

Khulna University of Engineering & Technology
Department of Building Engineering and Construction Management
 B. Sc. Engineering 2nd Year 1st Term Regular Examination, 2017
BECM 2101
 (Building Engineering System)

Full Marks: 210

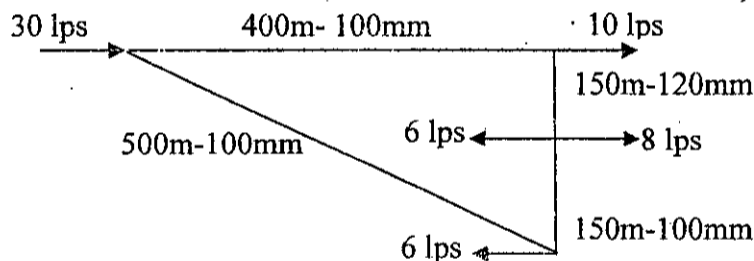
Time: 3 hrs

- N.B.** i) Answer any three questions from each section in separate script.
 ii) Figures in the right margin indicate full marks.

Section – A

Consideration

- 1 (a) What are the objectives of water supply? Discuss the planning and design of a water supply project in Bangladesh. (07)
- (b) Define aquiclude and artesian aquifer. Draw the hydrological cycle with neat sketch. A 150mm ϕ tube well is sunk to withdraw water from a 10m thick confined aquifer having $K=0.88$ lps/m². The depth of water below the piezometric level is 41m and it falls 40m in the tube well while pumping. Calculate the discharge of the tube well when the radius of the circle of influences is 41m. (10)
- (c) Write down the problems of ground water development in Bangladesh. Write down the main purposes of water transmission and distribution. Distinguish between branched and looped network on the basis of disadvantages. (18)
- Calculate the flow in each pipe in the following looped pipe network by Hardy-Cross method.



- 2 (a) Define septic tank and soak pit. Describe the process in septic tank with neat sketch. If the soil is sandy loam with a long-term infiltration rate of about 30 l/m²-day; design a soak pit for the disposal of effluent from the septic tank. Consider ten persons dwell who produce 90 lpcd of waste water. (13)
- (b) Name the performance parameters of a septic tank. Deduce, (22)

$$Q = \frac{A_2}{\sqrt{1 - \frac{A_2^2}{A_1^2}}} \cdot \sqrt{2g(h_1^* - h_2^*)}$$

where the symbols bear usual meaning. Design a septic tank to serve a household of 28 persons who produce 150 lpcd of waste water. The tank to be desludged every four years.

- 3 (a) What do you mean by plumbing test? Water is to be supplied in a nine storey low income group housing building having 2 flats on each floor. Each flat is provided with a toilet and a kitchen, and the average number of persons living per flat is 4. The municipal water supply in the area is intermittent and irregular with supply restricted to 4 hours in the morning and 5 hours in the evening. Separate water meters are not provided in flats. Design the pump capacity and the size of various units that are to be installed to ensure continuous tank supply. The living standards do require average per capita daily demand of 150 L/d /persons. Consider the total length of rising pipe from the under- ground tank to the overhead tank including the length of all pipe fittings is 60m. and the diameter of pipe is 40mm. Equivalent length of elbows and gate valve are 4m and 5m respectively. Minimum residual head=4m. (15)
- (b) Water supply is being provided in an eight storey building through an overhead tank installed on the terrace @1m height. The height of each floor is 3m. and water taps are installed @1m height in each floor. One down take pipe from the tank is serving two flats on each floor, and each flat is provided with the following water supply fixtures, @ mentioned distance from the down take: (20)
1. W.C. – flushing tank type @8m
 2. W.B. – @5m
 3. Bath taps with showers @4.5m
 4. Kitchen sink @1.5m

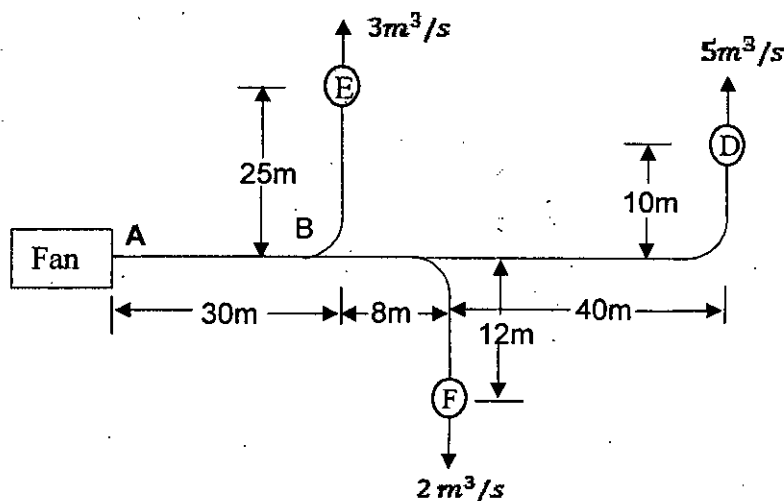
Design the pipe dia. For the main (down take) as well as the top floor branch line only. The probable simultaneous demand may be worked out from Table-2. Suitable values of F.U. and Discharge rates for fixtures may be assumed from tables.

Table-1		Table-2	
Fixtures	Fixture Unit F.U.	Load in FU	Probable Flow in lps
WC	1	1	0.12
WB	1	2	0.24
Bath with taps	4	6	0.3
Kitchen	2	8	0.3
		16	0.4
		32	0.5
		48	0.6
		64	0.9
		80	1.0
		96	1.25
		112	1.30
		200	2.3
		500	4.2
Table-3			
Pipe Fittings	Equivalent length of pipe in pipe diameter		
90° Elbow	30		
Tee	40		
Gate valve	20		
Globe Valve, bib taps	300		
Table-4			
15 mm Q	100%		
20 mm Q	100%		
25 mm Q	50%		
50 mm Q	25%		

- 4 (a) Write down the general requirements of domestic water storage tank. Describe the water supply system of tall buildings with neat sketch. (10)
- (b) Discuss in brief domestic underground water storage tanks with neat sketch. Draw the following figure with neat sketch and proper notations. (any four) (25)
- (i) The water connection (ii) Stop Cock (iii) Bib Cock
- (iv) Reducing Elbow, Tee, Wye and Cross (v) Saddle flange, Increaser, ordinary plug and 1/4 bend with single hub.

Section – B

- 5 (a) What are meant by HVAC? Briefly describe the terms involved in HVAC system. (06)
- (b) What are the necessities of studying Heat Transfer? Describe in-brief different modes of heat transfer (09)
- (c) Show different processes in a psychrometric chart. (12)
- (d) Write short notes on (i) TAB (ii) MEP. (08)
- 6 (a) Define Air Conditioning system. Describe four important factors that affects comfort air conditioning. (12)
- (b) Describe Summer Air Conditioning system with suitable block diagram. (13)
- (c) In a winter air conditioning system, 80m^3 of air per minute at 15°C DBT and 75% RH is heated until its dry bulb temperature is 22°C . Find the heat added to the air per minute. (10)
- 7 (a) Define Refrigeration system. Mention various types of refrigeration system. (07)
- (b) Briefly describe primary and secondary refrigerants with examples (08)
- (c) Describe the functions of different components of a Vapor Compression Refrigeration system with a suitable block diagram. (10)
- (d) An ice plant produces 10 tons of ice per day at 0°C using water at room temperature of 25°C . Estimate the power rating of the compressor motor if the COP of the plant is 3.5 and overall electro mechanical efficiency is 85% (10)
- 8 (a) Define air duct system. Describe different components of an air duct system with figure. (18)
- (b) Determine the cross section of the air duct system in figure below. Assume velocity in main duct AB is 10 m/s. Use the formula $\frac{\Delta P_f}{L} = \frac{2.268 \times 10^{-3} Q^{1.873}}{D^{4.94}}$ (17)



Khulna University of Engineering & Technology
Department of Building Engineering and Construction Management
B. Sc. Engineering 2nd Year 1st Term, Regular Examination, 2017
BECM 2151
(Aesthetics and Design)

Full Marks: 210

Time: 3 hrs

- N.B.** i) Answer any three questions from each section in separate script.
ii) Figures in the right margin indicate full marks.

Section – A

1. (a) How do the arts relate to spirituality and religion? (15)
(b) Discuss the central ideas of Abstractionism and Cubism. (10)
(c) Critically evaluate the statement of Plato "Art is an imitation of the imitation". (10)
2. (a) Describe the historical concept of Indian Classical music. (10)
(b) How architecture and music are similar even being two different forms of aesthetic activity? (15)
(c) Classify different types of classical column with sketches. (10)
3. (a) Explain - "Art is a social phenomenon". (10)
(b) Illustrate music as an element of aesthetics to expand architectural ideas. (15)
(c) Evaluate the inner meaning of the quote of ancient Sumerians - "The more useful is more beautiful". (10)
4. Write short notes on: (5x7)
(a) Romanticism
(b) Pre historic ideas in Art
(c) Cubism and Picasso
(d) Renaissance Period
(e) Leonardo Da Vinci

Section – B

5. (a) What is the difference between art and architecture? (5)
(b) What is context in design? How context affects the building form in designing? (10)
(c) Differentiate among vernacular, traditional and professional design ideas. (5)
(d) What does it mean by design by drawing and design by science? Write down the advantages and disadvantages of design by drawing. (15)
6. (a) Illustrate the five principles of design with necessary sketches, (15)
(b) Broadly discuss about the properties of line and it's uses with necessary sketches. (10)
(c) Explain the external outline, physical dimension, surface quality, position of a form. (10)
7. (a) Describe the elements of unity. (10)
(b) Briefly discuss about the analogies in Architecture. (20)
(c) All criticism is not just the negative one - explain this statement. (5)
8. (a) Differentiate between mechanical and visual scale. (5)
(b) Discuss about the medium of criticism. (10)
(c) What does it mean by design in nature? How a designer can be inspired by the nature and adopt the man made design element in harmony? (10)
(d) Describe how a building designer can emphasize an element of design through dominance? (10)

Khulna University of Engineering & Technology
Department of Building Engineering and Construction Management
 B. Sc. Engineering 2nd Year 1st Term Regular Examination, 2017
CE 2111
 (Mechanics of Solids - I)

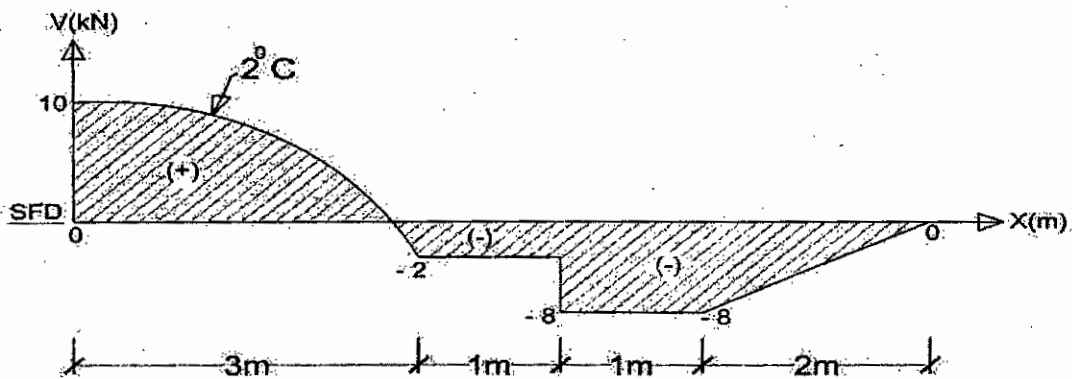
Full Marks: 210

Time: 3 hrs

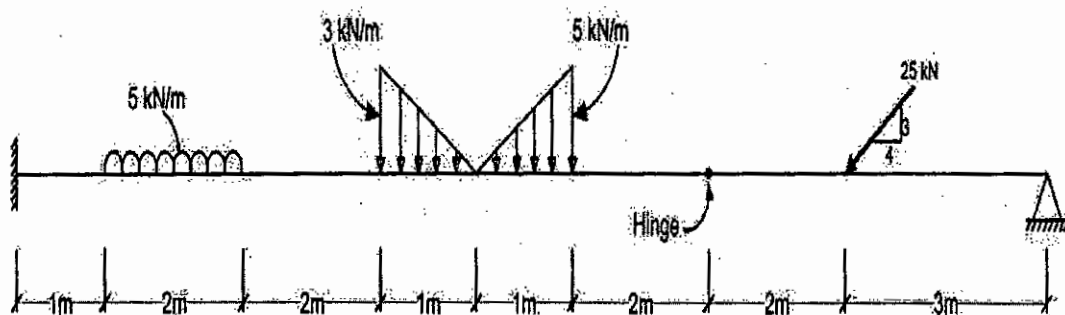
- N.B.** i) Answer any three questions from each section in separate script.
 ii) Figures in the right margin indicate full marks.

Section – A

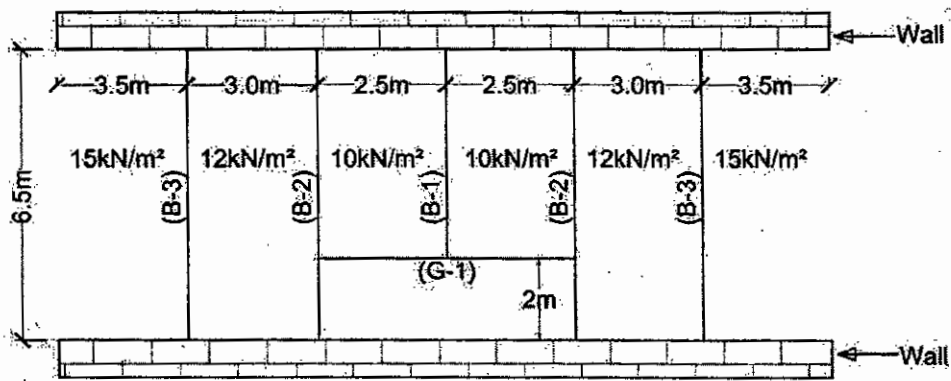
- 1 (a) Show that the change in bending moment between any two sections is equal to the area of the shear diagram of the interval. (10)
- (b) Draw stress-strain diagram of a mild steel specimen. From the diagram briefly describe: Proportional limit, Elastic limit, Yield point, Ultimate strength and Rupture strength. (12)
- (c) Draw the moment and load diagrams corresponding to the given shear diagram as shown in figure below. (13)



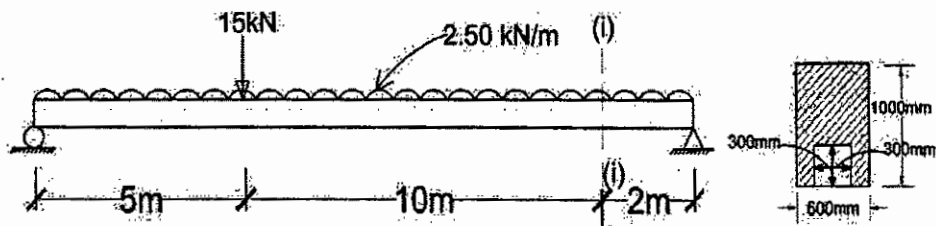
- 2 (a) Briefly describe 0.2% offset yield method. Define the following terms: Point of contra-flexure, Dangerous section, Working stress, Cantilever beam and Overhang beam. (12)
- (b) Draw the shear force and bending moment diagrams for the structure as shown in figure below. (23)



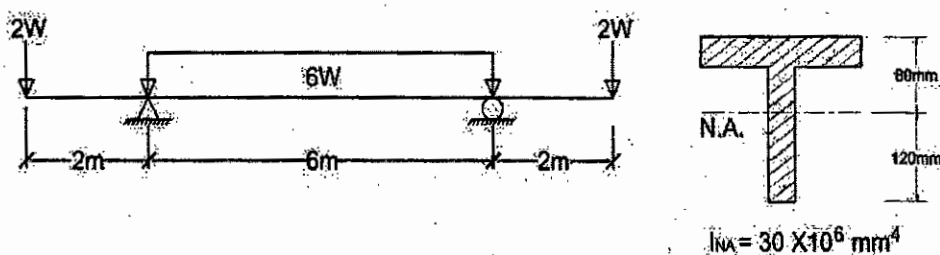
- 3 (a) What are the assumptions to derive flexural stress formula? (05)
- (b) A portion of the floor plan of a certain building is shown in figure below. The total loading (including live and dead load) in each bay is shown in figure. Determine the size of the section of the beam B-2 if the allowable flexural stress is 160MPa. Assume the beams are adequately braced and the depth of the cross-section is 1.50 times of the width. (30)



- 4 (a) Differentiate between statically determinate and statically indeterminate beam. (05)
- (b) At section (i) - (i) for the beam, loaded as shown in figure, Find (a) the maximum normal stress at (i) - (i), (b) the normal stress midway between the top and the bottom fibers. (15)

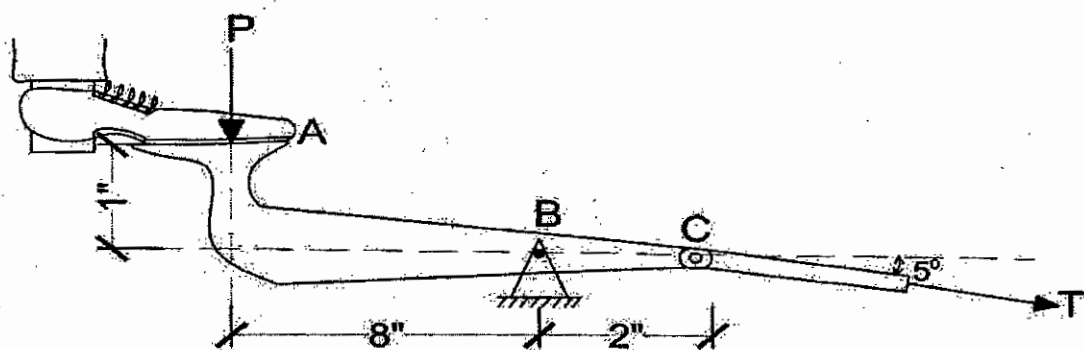


- (c) Determine the maximum safe value of W that can be carried by the beam shown in figure. If $\sigma_t \leq 80 \text{ MPa}$ and $\sigma_c \leq 100 \text{ MPa}$. (15)

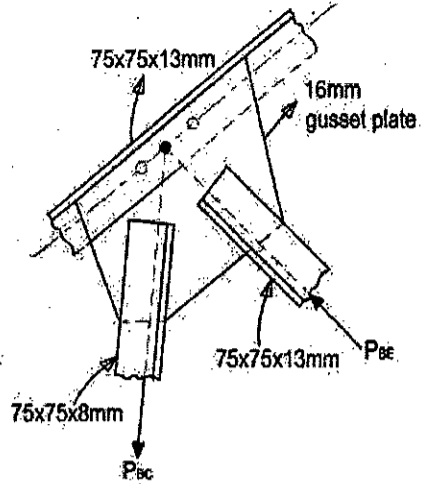
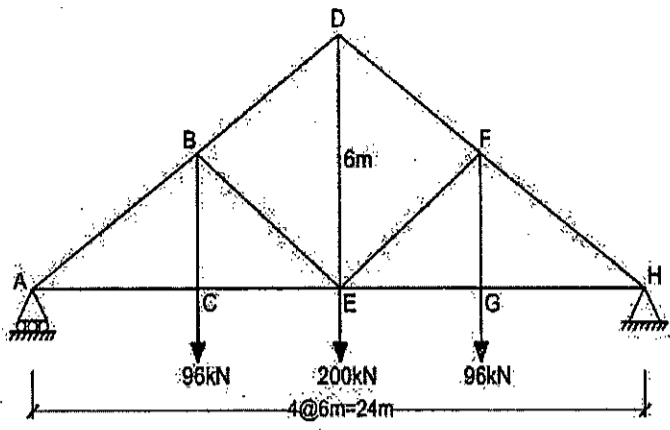


Section - B

- 5 (a) Distinguish between pressure, stress and strength. Compute the maximum force P that can be applied by the machine operator if the shearing stress in the pin at B and axial stress in the control rod at C are limited to 10 ksi and 14 ksi, respectively. The diameters are $\frac{1}{4}$ in for the pin and $\frac{1}{7}$ in for the control rod. Assume double shear for pin at B. (18)

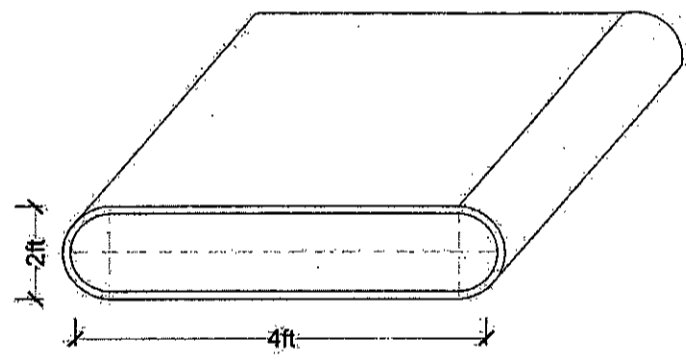


- (b) A roof truss and the detail of the riveted connection at joint B. Using allowable stress of $\tau = 70 \text{ MPa}$ and $\sigma_b = 160 \text{ MPa}$, how many 19 mm- ϕ rivets are required to fasten member BC to gusset plate? Member BE? What is the largest average tensile or compressive stress in BC and BE? (17)



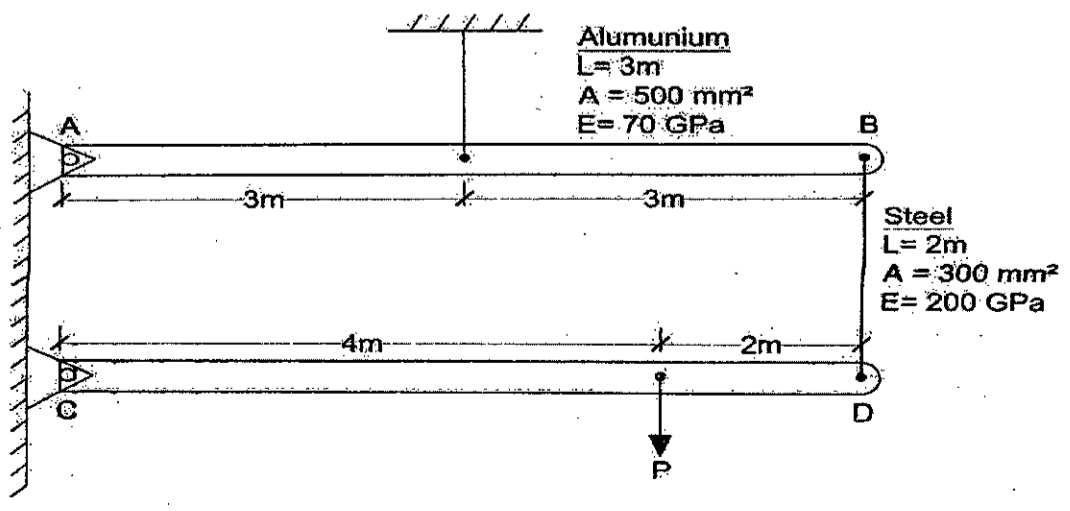
Size and Thickness	Area (mm ²)	I (10 ⁶ x mm ⁴)
75x75x13	1780	0.892
x10	1400	0.725
x8	1140	0.602
x6	864	0.469
x5	725	0.398

6 (a) Distinguish between isotropic, anisotropic and orthotropic materials. Draw the stress-strain diagram of mild-steel with proper notations. The tank shown in figure is fabricated from 1/8 in steel plate. Calculate the maximum longitudinal and circumferential stress caused by an internal pressure of 330 psi. (20)

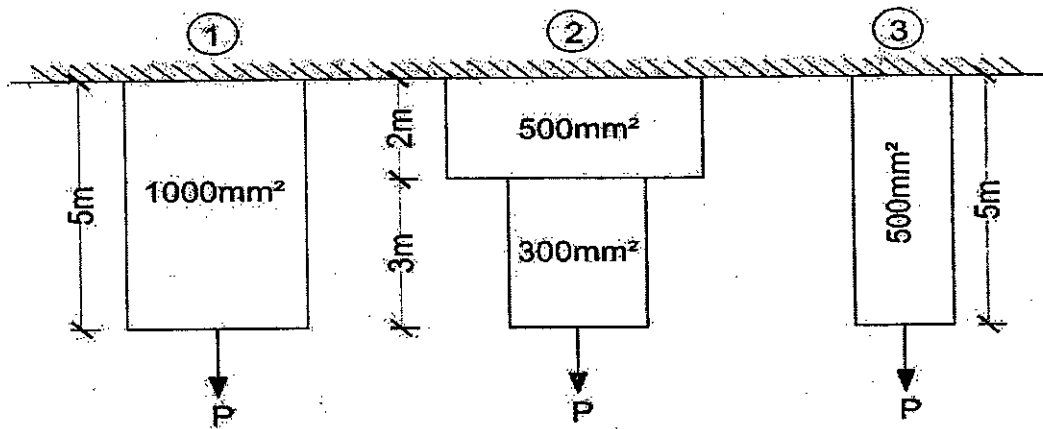


(b) Define: (i) Proportional limit (ii) Modulus of resilience (iii) Permanent set (iv) Tangent modulus (v) Strain hardening. Deduce, $G = \frac{mE}{2(m+1)}$ Where the symbols bear usual meaning. (15)

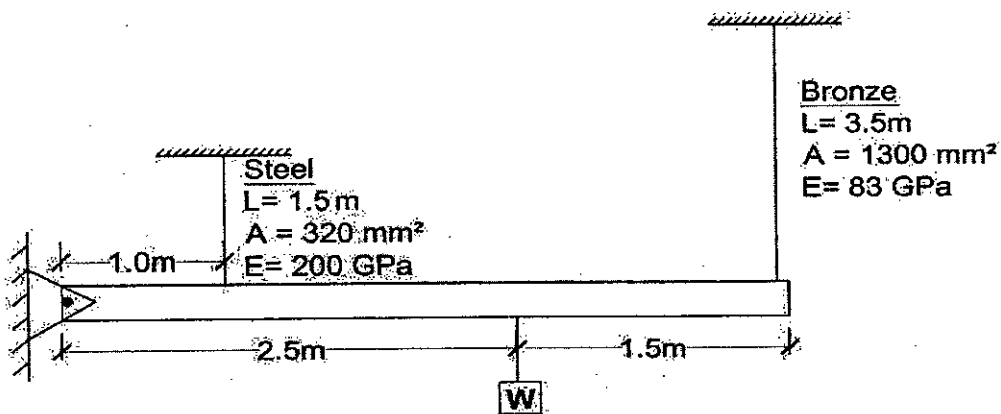
7 (a) Define cyclic loading. The rigid bar AB and CD as shown in figure are supported by pins at A and C and the two rods. Determine the maximum force P that can be applied as shown if its vertical movement is limited to 5mm. Neglect the weights of all members. (17)



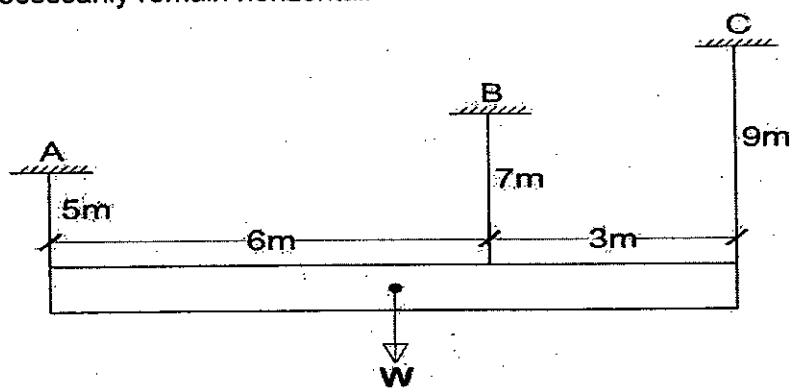
- (b) Define stiffness and modulus of rigidity. Compare the strain energy stored in each of the three steel bars shown in figure below, subjected to the condition that, the axial stress in the lower portion of the 2nd bar is equal to that in the 1st and 3rd bars, namely 450MPa. (18)



- 8 (a) State Castigliano's theorem. A rigid bar of negligible weight is supported as shown in figure. If $W = 100\text{kg}$; Compute the temperature change that will cause the stress in the steel rod to be 55MPa. Assume $\alpha_{steel} = 11.7 \mu\text{m}/(\text{m} \cdot ^\circ\text{C})$ and $\alpha_{Bronze} = 18.9 \mu\text{m}/(\text{m} \cdot ^\circ\text{C})$. (16)



- (b) Define ductility and fatigue. The figure as shown is the section through a balcony. (19)
The total uniform load of 1MN is supported by three rods of the same area and material. Compute the load in each rod. Assume the floor to be rigid, but note that it does not necessarily remain horizontal.



Khulna University of Engineering & Technology
Department of Building Engineering and Construction Management
 B. Sc. Engineering 2nd Year 1st Term Regular Examination, 2017
Math 2123
 (Mathematics-III)

Full Marks: 210

Time: 3 hrs

- N.B.** i) Answer any three questions from each section in separate script.
 ii) Figures in the right margin indicate full marks.

Section – A

1. (a) Define integral transform and kernel of transform. Also find the kernel of Laplace transform. (10)
- (b) Find the Laplace transform of $te^{2t} \sin 3t$ (10)
- (c) Solve the following I.V. P. by Laplace transform (15)

$$Y'' + 9Y = \cos 2t, \quad Y(0) = 1, \quad Y(\pi/2) = -1$$

2. (a) Find the inverse Laplace transform of $\frac{11S^2 - 2S + 5}{(S-2)(2S-1)(S+1)}$ Using Heaviside expansion formula. (10)

- (b) A cantilever beam is clamped at the end $x = 0$ and is free at the end $x = l$. It carries a load per unit length given by (15)

$$W(x) = \begin{cases} w_0, & 0 < x < l/2 \\ 0, & l/2 < x < l \end{cases}$$

Find the deflection. Using Laplace transform

- (c) In each determine whether the vectors are linearly independent or linearly dependent (10)

$$\underline{A} = 2\underline{i} + \underline{j} - 3\underline{k}, \quad \underline{B} = \underline{i} - 4\underline{k}, \quad \underline{C} = 4\underline{i} + 3\underline{j} - \underline{k}$$

$$\underline{A} = \underline{i} - 3\underline{j} + 2\underline{k}, \quad \underline{B} = 2\underline{i} - 4\underline{j} - \underline{k}, \quad \underline{C} = 3\underline{i} + 2\underline{j} - \underline{k}$$

3. (a) If $\underline{A} = \frac{\underline{r}}{|\underline{r}|}$ find $\text{grad div } \underline{A}$ (08)

- (b) Find an equation for the tangent plane to the surface $2xz^2 - 3xy - 4x = 7$ at the point $(1, -1, 2)$ (12)

- (c) A particle moves along a curve whose parametric equations are (15)
 $x = e^{-t}, \quad y = 2 \cos 3t, \quad z = 2 \sin 3t$, where t is the time. Find the magnitudes of the velocity and acceleration at time, $t = 0$.

4. (a) Test the vector $\underline{A} = (6xy + z^3)\underline{i} + (3x^2 - z)\underline{j} + (3xz^2 - 4)\underline{k}$, is irrotational or not. (13)
 If the vector is irrotational find its scalar potential.

- (b) Find the Directional derivative of $P = 4e^{2x-y+z}$ at the point $(1, 1, -1)$ in a direction toward the point $(-3, 5, 6)$. (10)

- (c) If $\underline{A} = (2y + 3)\underline{i} + xz\underline{j} + (yz - x)\underline{k}$, evaluate $\int_C \underline{A} \cdot d\underline{r}$ along the following path C: the straight lines from $(0, 0, 0)$ to $(0, 0, 1)$ then to $(0, 1, 1)$, and then to $(2, 1, 1)$. (12)

Section – B

- 5 (a) Define with example (i) skew- symmetric matrix, (ii) principal sub matrix, (iii) elementary matrix, (iv) diagonal matrix. (12)

- (b) Express the matrix A in the form P+Q, where P is a symmetric matrix and Q is a skew- symmetric matrix; (08)

$$A = \begin{bmatrix} 3 & 3 & -1 \\ 0 & 3 & -2 \\ -1 & 2 & 2 \end{bmatrix}$$

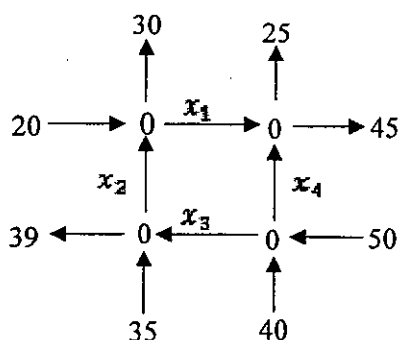
- (c) Reduce the matrix to its echelon form then to its canonical form then to its normal form. And also find its rank where (15)

$$A = \begin{bmatrix} 2 & 1 & 5 & 1 & 5 \\ 1 & 1 & -3 & -4 & -1 \\ 3 & 6 & -2 & 1 & 8 \\ 2 & 2 & 2 & -3 & 2 \end{bmatrix}$$

- 6 (a) Find the inverse of the matrix $A = \begin{bmatrix} 0 & 2 & 1 & 3 \\ 1 & 1 & -1 & -3 \\ 1 & 2 & 0 & 1 \\ -1 & 1 & 2 & 6 \end{bmatrix}$ using elementary transformation. (15)

- (b) What do you mean by a consistent system of linear equations? What are the different method of solving non- homogenous system of linear equations? Investigate for consistency of the following equations and if possible find the solutions of $4x - 2y + 6z = 8$, $x + y - 3z = -1$, $15x - 3y + 9z = 21$ by using matrix. (20)

- 7 (a) Find the traffic flow in the adjoining network of one way streets. Is the solution unique? (13)



- (b) Define eigen value and eigen vector of a matrix. Find all eigen values and associated eigen vectors of the following matrix: $A = \begin{bmatrix} 1 & 0 & -2 \\ 0 & 0 & 0 \\ -2 & 0 & 4 \end{bmatrix}$ (22)

- 8 (a) Find adj A and hence A^{-1} , where $A = \begin{bmatrix} 1 & 0 & 1 \\ -1 & 1 & 1 \\ 0 & 1 & 0 \end{bmatrix}$ (10)

- (b) Verify the Cayley- Hamilton theorem for the matrix $\begin{pmatrix} 1 & 1 \\ 1 & 2 \end{pmatrix}$ (10)

- (c) Find the nonsingular matrices P & Q such that PAQ is normal form where, (15)

$$A = \begin{bmatrix} 1 & 2 & 3 \\ 3 & 2 & 1 \\ 1 & 3 & 2 \\ 2 & 1 & 3 \end{bmatrix}$$

Khulna University of Engineering & Technology
Department of Building Engineering and Construction Management
B. Sc. Engineering 2nd Year 1st Term Regular Examination, 2017
Hum - 2123
(Engineering Economics and Financial Accounting)

Full Marks: 210

Time: 3 hrs

- N.B.** i) Answer any three questions from each section in separate script.
ii) Figures in the right margin indicate full marks.

Section – A

1. (a) How is Economics like a science? What are the two subfields into which Economics is divided? Explain what each subfield studies. (15)
- (b) Distinguish between Micro and Macro Economics mentioning their relationship. (05)
- (c) What do you mean by the word "Tradeoff" in Economics? Use a production possibilities frontier to illustrate society's tradeoff between clean environment and high incomes. Show what happens to the frontier if engineers develop an automobile engine with almost no emission. (15)
2. Pharmaceutical drugs have an inelastic demand, and computers have an elastic demand. Suppose technological advance doubles the supply of both products (That is, the quantity supplied at each price is twice what it was).
 - (a) What happens to the equilibrium price and quantity in each market? (15)
 - (b) Which product experiences a larger change in price and which in quantity? Explain. (10)
 - (c) What happen to consumer spending and consumer's surplus on each product? Explain. (10)
3. (a) What do you mean by the word "production" in engineering Economics? Explain the different factors of production. (15)
- (b) Explain the laws of variable returns. (20)
4. (a) Distinguish between perfect and imperfect competition. (05)
- (b) Define Monopoly. Draw the demand, marginal-revenue, and marginal cost curves for a monopolist. Show the profit maximizing level of output. Show the profit maximizing price and the "deadweight loss" from the monopoly. (20)
- (c) Define the idea of GDP, nominal GDP and the real GDP. List and explain the four components of GDP with example. (10)

Section – B

5. (a) What is journal? How does journalizing differ from ledger? (10)
- (b) Mr. Hasan Foyez starts his law practice and established a law firm. The following transactions were completed during the month of March, 2017: (25)

March 01: He investigated Tk. 1,60,000 cash and law books Tk. 25,000 in the law firm.

03: Paid rent for five months in advance Tk. 20,000.

05: Purchased office supplies on account Tk. 9,000.

- 08: Completed legal works for cash Tk. 24,000.
 12: Purchased office equipment Tk. 48,000 of which paid Tk. 22,000 in cash and balance on account.
 15: Service of legal work performed on credit Tk. 35,000.
 20: Cash withdrew by owner for his personal use Tk. 10,000.
 23: Cash received from account receivable Tk. 18,000.
 25: Utilities expenses paid Tk. 4,500.
 30: Supplies used during the month Tk. 6,500.
 31: Recognized that one month's rent has been expired.

Required: Journalise above the transactions.

6. (a) What is cash book? Why cash book is called both journal and ledger? (10)
 (b) The transactions of M/S Rupsha & Co. are as follows: (25)

2017

- April 01: Opening balance of cash Tk. 27,000 and balance of bank Tk. 19,500.
 02: Goods purchase for cash Tk. 8,000 and goods sales for cash Tk. 12,000.
 05: Received a cheque Tk. 6,000 from M/S Arif & Sons and deposited the same immediately in to the bank.
 09: Drawing cash from bank Tk. 7,500 for office.
 13: Materials purchase from Kajol Enterprise amount of Tk. 8,500 on credit.
 16: Purchase furniture for cash Tk. 5,800.
 20: Deposited cash Tk. 4,600 in to the bank.
 24: Paid to Kajol Enterprise by cheque Tk. 8,500.
 27: Rent expense paid in cash Tk. 4,500.
 28: Bank interest credited Tk. 200 and bank charge debited Tk. 100.
 30: Salaries paid by cheque Tk. 6,200.

Required: Double column cash book in the books of M/S Rupsha & Co.

7. (a) What is meant by Trial balance? (05)
 (b) Distinguish between Trial balance and Balance sheet. (08)
 (c) From the following ledger balances of M/S Shapla & Co. Prepare a trial balance as on December 31, 2016: (22)

	Amount Taka		Amount Taka
Capital	3,75,000	Discount	7,100
Building	1,05,000	Insurance exp.	3,000
Drawing	35,000	Cash	55,500
Purchases	3,06,000	Beginning inventory	12,000
Sales	4,65,000	Notes receivable	24,000
Accounts receivable	30,000	Irrecoverable debts	1,000
Sales return	3,500	Carriage inward	10,300

8. (a) The trial balance of Sonali Enterprise are as follows for the year ended (35) December 31, 2016:

Account title	Debit Taka	Credit Taka
Cash	32,100	
Account receivable	36,000	
Supplies	7,000	
Prepaid insurance	14,500	
Equipment	81,000	
Accumulated depreciation - Equipment		4,500
Building	2,00,000	
Accumulated depreciation - Building		15,000
Account payable		25,500
Notes payable		35,000
Unearned service revenue		20,000
Capital		1,70,000
Drawing	15,900	
Service revenue		1,35,000
Salaries expense	6,500	
Advertisement expense	4,000	
Utilities expense	8,000	
	4,05,000	4,05,000

Adjustments:

- (i) Supplies unused at the end of the year Tk. 2,500.
- (ii) Prepaid insurance expired during the year Tk. 3,000.
- (iii) Service revenue earned but not receive Tk. 12,500.
- (iv) Two months salaries not yet paid.