

Khulna University of Engineering & Technology
 Department of Building Engineering and Construction Management
 B. Sc. Engineering 2nd Year 1st Term Regular Examination, 2019
BECEM 2101
 (Building Engineering Systems)

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) Write down the learning objectives of Building Engineering Systems. Enumerate the general considerations for planning and designing of a water supply project in Bangladesh. (10)
- (b) Write down the main purposes of water transmission and distribution of water supply. Distinguish between branched and looped network on the basis of disadvantages. (10)
- (c) Draw the house water connection system with proper labeling. Solve the following looped network by Hardy Cross method. (15)

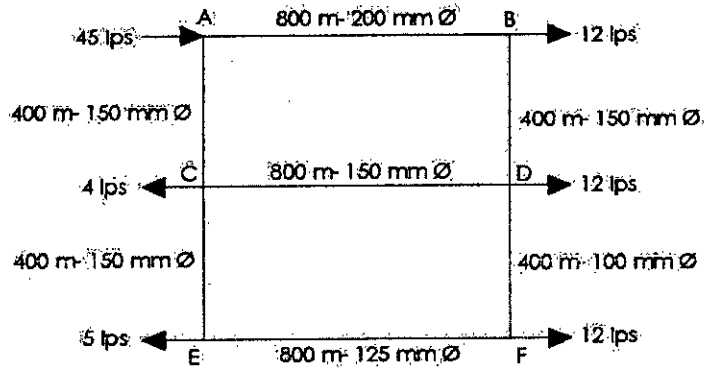


Figure: Question – 1(c)

2. (a) What are the factors considered in the designing of plumbing systems to supply water in a house? (05)
- (b) Explain the Hydro-Pneumatic water piping system that may be employed in buildings (neat sketch required). (08)
- (c) Name the process in a septic tank. Water is to be supplied in a seven storey low income group housing building having five flats on each floor. Each flat is provided with a toilet and a kitchen, and average number of persons living per flat is 5. The municipal water supply in the area is intermittent and irregular with supply restricted to 3 hours in the morning and 3 hours in the evening. Separate water meters are not to be provided in flats. Design the sizes of the various units that are to be installed to ensure continuous tank supply. The living standard does require average per capita daily demands of 200 l/d/p. (22)
3. (a) Define facilities management. Write down the areas covered under the facility management. (08)
- (b) Define drainage system. Classify the different types of trap based on shape, use and location. (09)
- (c) Write short notes on: (i) CAFM, (ii) BMS, (iii) Stop Cocks, (iv) Soak Pit, (v) Shaddle Flange, (vi) 1/32 Bend, and (vii) Ordinary Plug (Any Six) (18)
4. (a) Enumerate different causes of breaking water seal of a trap. (05)
- (b) Water is to be supplied in a 5 storied building with 3 flats at each level. (17)

Each flat is having a toilet and a kitchen. Average number of dwellers is 6/flat. The municipal water supply in that area is irregular with supply restricted to 3 hrs in the morning and 4 hrs in the evening. Separate water meters are not to be provided in each flats. Design a pump capacity to be installed. The living standard does require average per capita daily demands of 160 liter.

- (c) Name the performance parameters of septic tank. Draw a septic tank with proper labeling. Design a septic tank to serve a household of ten persons who produce 110 lpcd of waste water. The tank is to be desludged every three years. (13)

Section – B

5. (a) What do you mean by HVAC? Briefly describe the components of HVAC system. (14)
- (b) Draw the schematic diagram of hot water heating used in HVAC system. (10)
- (c) Define human comfort. Describe the factors affecting human comfort. (11)
6. (a) Describe the equipment used in air conditioning system. (06)
- (b) Describe winter air conditioning system with suitable diagram. (12)
- (c) Mention the benefits of using mechanical ventilation. (05)
- (d) An auditorium has a capacity of 1000 seats and a volume of 6000 m³. The recommended minimum rate of fresh air supply is 2 air charges per hour. Calculate the minimum required ventilation rate and compare this rate with the specification that fresh air supply rate should be at least 4 to 5 times higher than the actual rate of inhalation. (Assume an inhalation rate of 2m³/hr/person) (12)
7. (a) Explain the mechanism of a simple vapor compression refrigeration system with suitable diagram. (15)
- (b) Determine the dimensions of AB, BC, and CD using equal friction method for an air duct system as shown in figure. Choose a friction rate of 0.08 mm H₂O/m length of duct. Use the following formula, (20)

$$\frac{\Delta P_f}{L} = 2.268 \times 10^{-3} \frac{Q_v^{1.852}}{D^{4.973}} \text{ mm H}_2\text{O/m,}$$

where, Q_v is in m³/s and D is in meter.

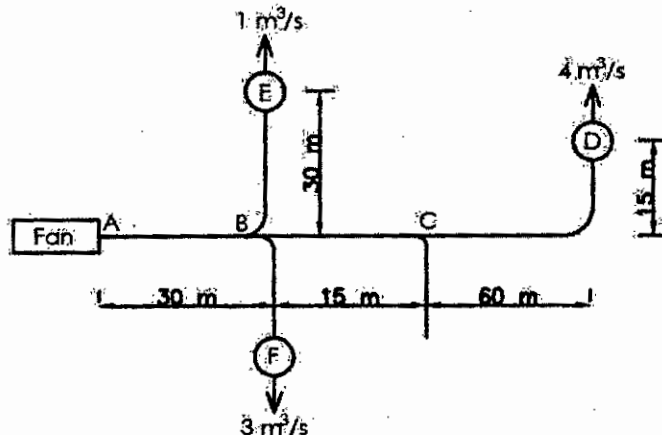


Figure: Question 7 (b)

8. (a) Show that, $\phi = \frac{\mu}{1 - (1 - \mu) \frac{P_s}{P}}$, where the symbols have usual meaning. (10)
- (b) What are the characteristic features of building control system? (13)
- (c) Define: (i) Dew point, (ii) Relative humidity, (iii) Wet bulb depression, (iv) Psychrometric chart, (v) CPT, and (vi) TAB (12)

Khulna University of Engineering & Technology
Department of Building Engineering and Construction Management
B. Sc. Engineering 2nd Year 1st Term Regular Examination, 2019
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) What is Aesthetics? What are the primary questions of Aesthetics? (10)
(b) Draw the table and show the position of Aesthetics in the field of knowledge. (10)
(c) Aesthetics for whom? Designer or public? Explain your point of views with example. (15)
2. (a) What are the Aesthetic Activities? Show the Aesthetic Activity levels. (10)
(b) What are the two extreme traditions of the laws of Aesthetic perception? (10)
(c) Explain the aspects of Aesthetic perception according to the Law of Birkhoff. (15)
3. (a) What is modern Aesthetic? Explain the paradigms of theoretical perception of "Beauty" with example. (20)
(b) Is Sublime beautiful? Explain your point of view with examples. (15)
4. (a) Explain the Hierarchy of levels of individual's predisposition to creation. (10)
(b) What are the psychological mechanisms of creation? Also explain the psychological factors in creation. (10)
(c) Show the psychological mechanism of perception and creation. (10)
(d) What is the critical method and structure of criticism? (05)

Section – B

- 5 (a) What differences exist between color and texture? Do you think Discernment, rather than Judgement, is the key feature of criticism? Why? (4+5=9)
(b) How can you achieve visual dominance in designing a building? Show it with necessary sketches. Differentiate among Vernacular, Traditional and Professional design ideas. (5+6=11)
(c) Show the differences between scale and proportion. (05)
(d) Discuss about the mathematical, mechanical, linguistic, problem-solving and adhocist analogies in architecture. (10)

- 6 (a) Distinguish between art and architecture. Discuss about the thinking processes of an Architect, an Urban designer and a planner. (15)
- (b) What does it mean by Indigenous Material and Indigenous Technology in the context of building design? How homogenous society is reformed by vernacular design idea? Illustrate it with necessary sketches. (5+10=15)
- (c) Illustrate the 'forceful', 'easily understandable' and 'superficial' design ideas. (05)
- 7 (a) Suppose, you are assigned to design a student residential accommodation building of KUET. How you can apply the five steps of design process in designing the building? (10)
- (b) What does it mean by idea of design? Describe the idea of design with necessary sketches. (15)
- (c) Show the advantages and disadvantages of design by drawings and design by science. (10)
- 8 (a) How elements of design together make a building with their own properties? Illustrate it. (15)
- (b) "Perception of space differs with the variation of scale in architectural design." Explain it with necessary sketches. (10)
- (c) Differentiate among Normative, Interpretive and Descriptive criticism. (10)
-

Khulna University of Engineering & Technology
Department of Building Engineering and Construction Management
 B. Sc. Engineering 2nd Year 1st Term Regular Examination, 2019
CE 2111
 (Mechanics of Solids-I)

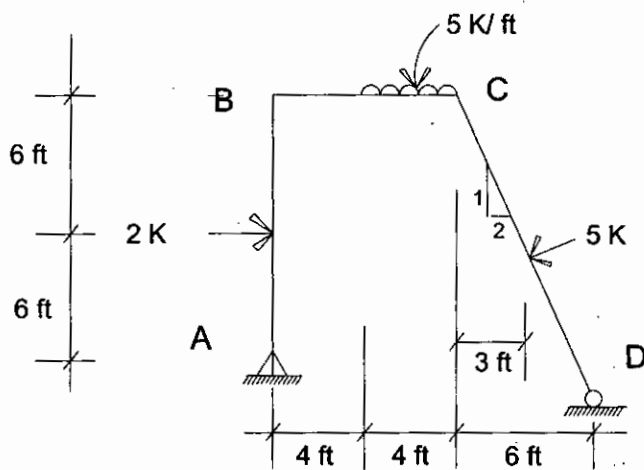
Full Marks: 210

Time: 3 hrs

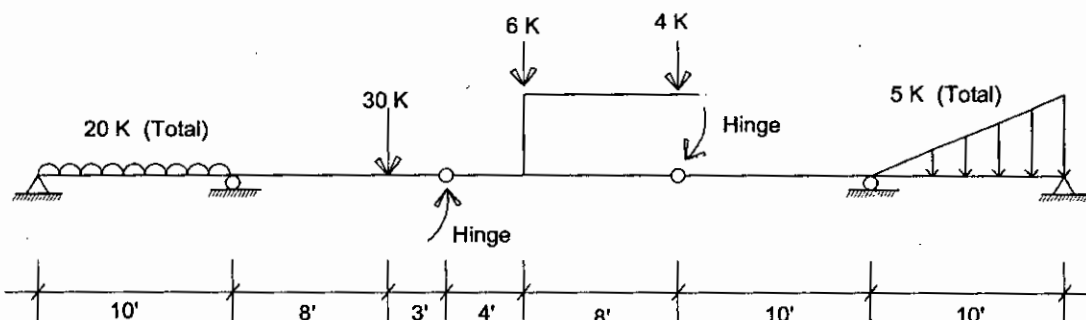
- N.B.** i) Answer any three questions from each section in separate script.
 ii) Figures in the right margin indicate full marks.

Section – A

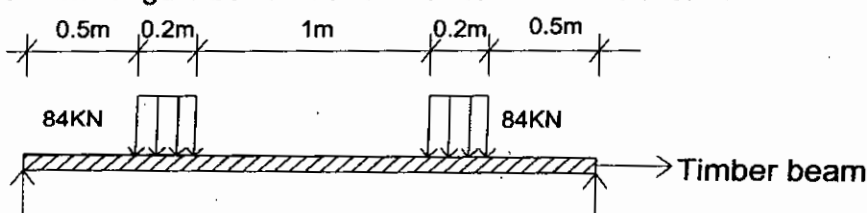
1. (a) Why strength of materials study is so significant in construction engineering and management sector? (05)
 (b) Proof that the change of bending moment between any two sections is equal to the area of the shear diagram of the interval. (10)
 (c) Draw the SFD and BMD of the figure shown. (20)



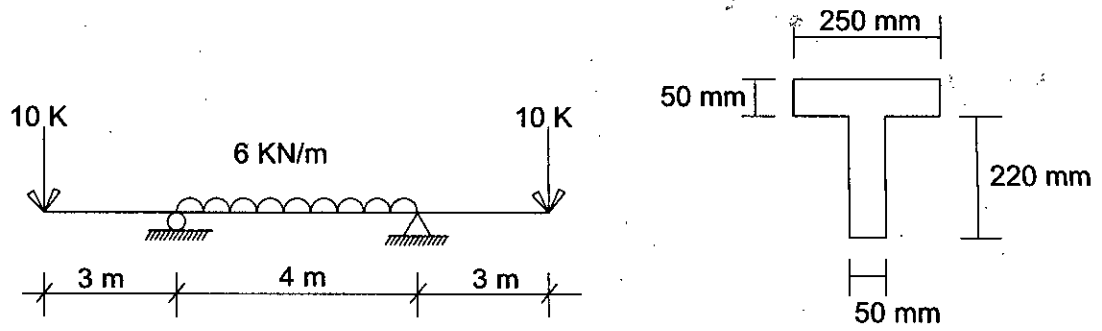
2. (a) Distinguish statically determinate and statically indeterminate beam. Write short notes on: Dangerous section, Inflection points and Point of contra-flexure. (10)
 (b) Draw the SFD and BMD for the beam shown in figure below. (25)



3. (a) Define flexural stress. What are the assumptions taken into consideration to derive flexural stress formula? (08)
 (b) A square timber beam used as a railroad tie is supported by uniformly distributed reaction and carries two uniformly distributed loads each of totaling 84 KN as shown in figure below. Determine the size of the section if $\sigma_{max} \leq 25 \text{ MPa}$. (12)

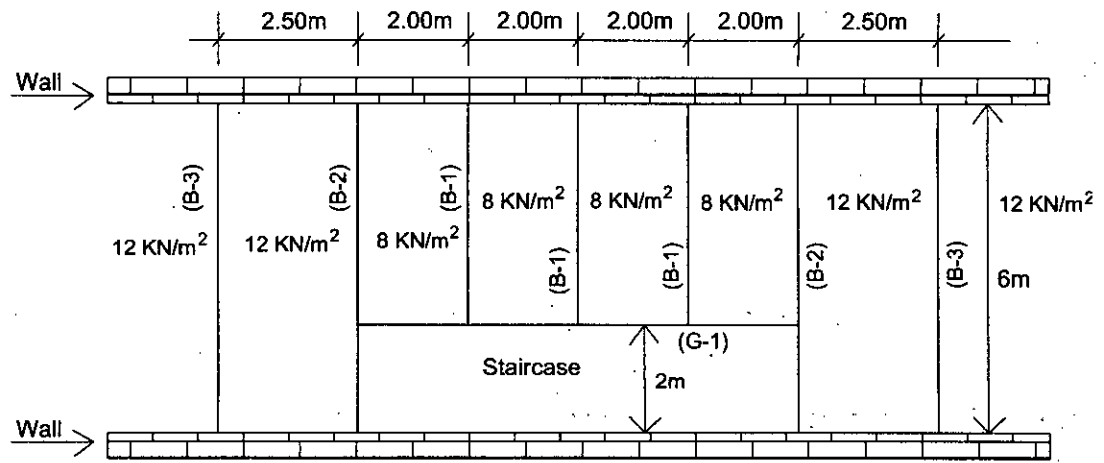


(c) Determine the maximum flexural stress for the beam shown below. (15)



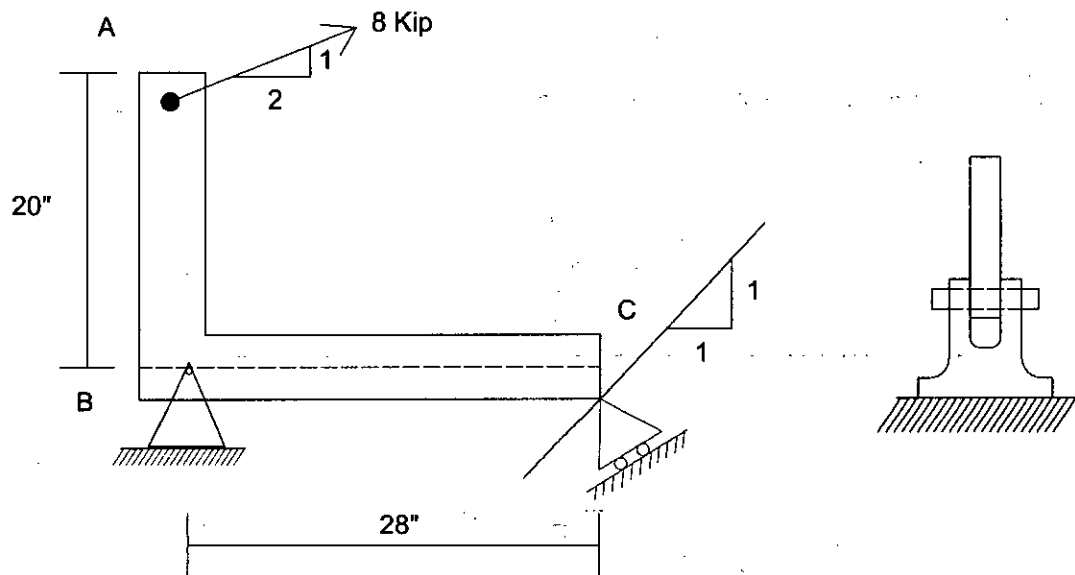
4. (a) Proof, $\sigma_{max} = \frac{MC}{I}$ where the symbols bear their usual meaning. (08)

(b) A portion of the floor plan of a certain building is shown in figure below. The total loading (including live and dead loads) in each bay is also shown. Determine the size of the section of the beams B-2 and B-3, if the allowable flexural stress is 150 MPa. Assume the beams are adequately braced and the depth of the cross section is 1.5 times of the width. (27)

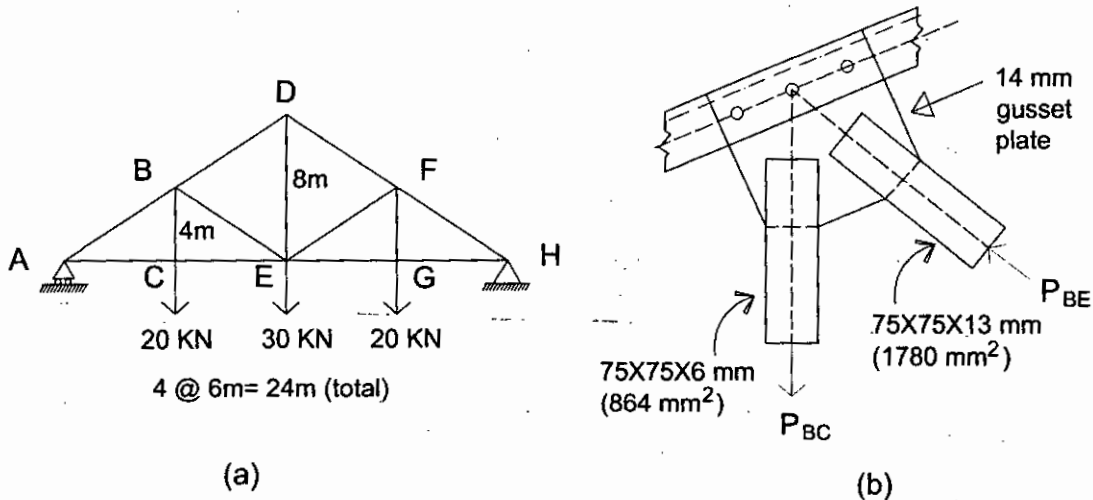


Section – B

5. (a) Distinguish between shearing and bearing stress. Compute the shearing stress in the pin B for the member shown in figure below. The pin diameter is 3/4". (14)



- (b) Figure shows a roof truss and the detail of riveted connection at joint B. Consider $e \leq 110 \text{ MPa}$, and $\sigma \leq 160 \text{ MPa}$, how many 12 mm ϕ rivets are required to fasten member BC to the gusset plate? Member BE? What is the largest average tensile/compressive stress in BC and BE? (21)



6. (a) The undersea research vehicle Alvin has spherical vessel hull 2.5m its radius and shell thickness 12 mm. It is having yield point of 750 MPa. Find submergence that would set up the yield point stress in spherical shell. Consider sea water have specific gravity of 10.09 KN/m^3 (14)

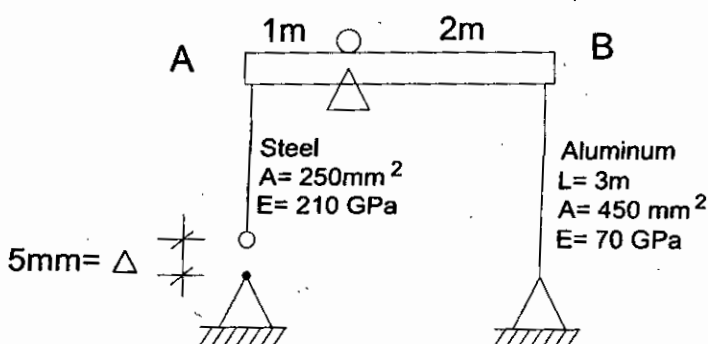
- (c) Distinguish anisotropic and orthotropic materials. Define: (i) strain hardening (ii) modulus of resilience (iii) Toughness (iv) Relaxation. Draw typical stress-strain diagram for low and high carbon steel, cast iron, concrete and rubber. (21)

- 7 (a) Prove that, $G = \frac{E}{2(1+\nu)}$, where symbols bear usual meaning. (10)

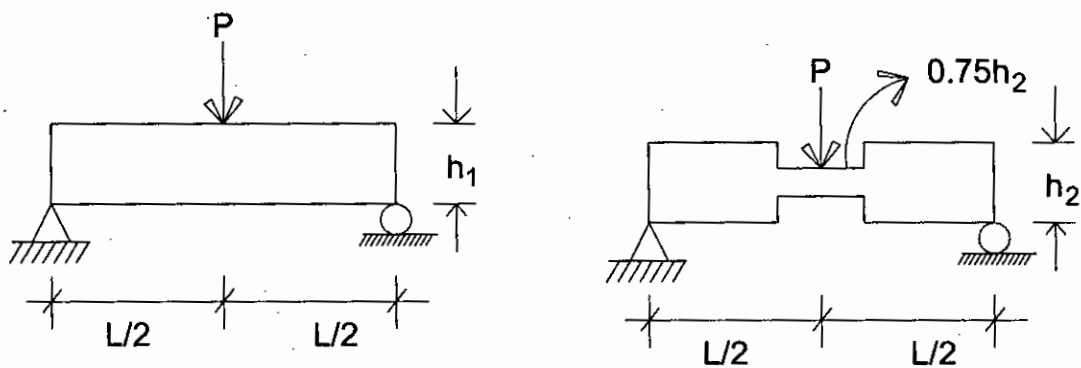
- (b) A solid aluminum shaft of 80 mm ϕ fits concentrically in a hollow steel tube. Compute minimum internal diameter of steel tube so that no contact pressure exists when the aluminum shaft carries an axial compressive load of 700 kN. Assume, $\nu = 1/4$ and $E_{al} = 70 \text{ GPa}$ (12)

- (c) The short concrete post carries 1450 kN in compression with dimension 700mmX700mm. The post is reinforced concentrically with six symmetrically placed steel bars, each 600 mm^2 in area. Compute the stress developed in each material. Use $E_{st} = 200 \text{ GPa}$ and $E_{co} = 14 \text{ GPa}$ (13)

- 8 (a) Compute the stress in the aluminum rod when the lower end of the steel rod will be attached to its support. (15)



- (b) State Castigliano's theorem. Find the ratio of internal strain energy from the following if both are of rectangular X- section and of equal depth and materials are identical. (2)



Khulna University of Engineering & Technology
 Department of Building Engineering and Construction Management
 B. Sc. Engineering 2nd Year 1st Term Regular Examination, 2019
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 homogeneous system of linear equations. Find a cubic polynomial $P(x) = a + bx + cx^2 + dx^3$ such that, $P(1) = 1, P'(1) = 5, P(-1) = 3$ and $P'(-1) = 1$. (13)

- (b) What is meant by orthogonal matrix? Determine whether the matrix A is orthogonal or not. (10)

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

- (c) Determine the values of 'a' for which the following system has no solutions, exactly one solution or infinitely many solutions. (12)

$$\begin{aligned} x + 2y + z &= 2 \\ 2x - 2y + 3z &= 1 \\ x + 2y + (a^2 - 3) &= a \end{aligned}$$

2. (a) Define rank of the matrix. Find the rank of the matrix B, where k is a real number. (10)

$$B = \begin{bmatrix} k & 1 & 2 \\ 1 & 1 & 1 \\ -1 & 1 & 1-k \end{bmatrix}$$

- (b) Using elementary row operations, find the inverse of the matrix: (12)

$$\begin{bmatrix} 1 & 3 & 3 \\ 1 & 4 & 3 \\ 1 & 3 & 4 \end{bmatrix}$$

- (c) If $M = \begin{pmatrix} 1 & 4 \\ 2 & 3 \end{pmatrix}$ then find all eigenvalues of M and the corresponding eigenvectors. Also evaluate an invertible matrix P such that $P^{-1}MP$ is diagonal. (13)

3. (a) What is symmetric matrix? Find all values of a, b and c for which matrix A is symmetric. (10)

$$A = \begin{bmatrix} 2 & a - 2b + 2c & 2a + b + c \\ 3 & 5 & a + c \\ 0 & -2 & 7 \end{bmatrix}$$

- (b) Define Laplace transform. Find Laplace transform of $t^2 e^{-t} \cos t + (t - 1)^2$ (12)

- (c) Define unit step function. Express the following function in terms of unit step. Hence find its Laplace transform. (13)

$$f(t) = \begin{cases} 2 & 0 \leq t < 3 \\ 2t & 3 \leq t < 5 \\ \frac{1}{7}t^2 & t \geq 5 \end{cases}$$

4. (a) State convolution theorem for inverse Laplace transform. Using partial fraction decompositions evaluate (12)

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

- (b) Using the concept of Laplace transform prove that (11)

$$\int_0^{\infty} \frac{\sin^2 t}{t^2} dt = \frac{\pi}{2}$$

- (c) Graph of a function $f(t)$ is given below. Find Laplace transform of $f(t)$. (12)

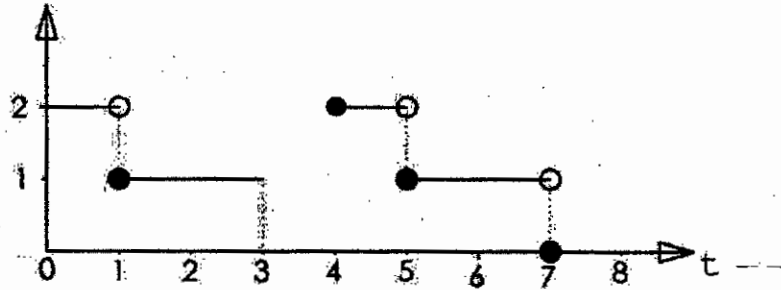


Figure – Question 4 (c)

Section – B

5. (a) The scalar triple product can be interpreted as the volume of a parallelepiped. Now you give the details about this interpretation and then find the volume of a parallelepiped determined by the vectors (12)

directional $2\hat{i} - 3\hat{j} + 4\hat{k}, \hat{i} + 2\hat{j} - \hat{k}, 3\hat{i} - \hat{j} + 2\hat{k}$

- (b) Find the derivative of the function $f(x, y, z) = yz + zx + xy$ at the point (1, -1, 2) in the direction of $\vec{A} = 3\hat{i} + 6\hat{j} - 2\hat{k}$. (10)

- (c) Show that $\vec{F} = (e^x \cos y + yz)\hat{i} + (xy - e^x \sin y)\hat{j} + (xy + z)\hat{k}$ is conservative and find a potential function for it. (13)

6. (a) Show that $\text{div}(\varphi \vec{A}) = (\text{grad } \varphi) \cdot \vec{A} + \varphi \text{div } \vec{A}$ and verify for $\varphi = e^{xyz}$ and $\vec{A} = ax\hat{i} - by\hat{j} + cz\hat{k}$. (10)

- (b) If $\vec{A} = (y^2 + 2x)\hat{i} + (3y - 4x)\hat{j}$ evaluate $\oint_C \vec{A} \cdot d\vec{r}$ around the triangle c of the following figure in the indicated direction. (11)

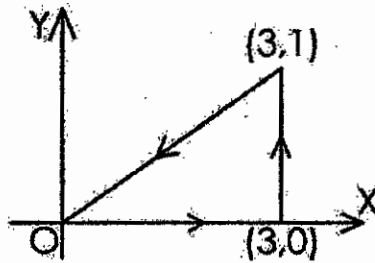


Figure: Question – 6 (b)

- (c) Evaluate (14)

$$\iint_s (\nabla \times \vec{F}) \cdot \hat{n} ds$$

where $\vec{F} = (x + 2y)\hat{i} - 3z\hat{j} + x\hat{k}$ and s is the surface of $2x + y + 2z = 6$ located in the first octant.

7. (a) Evaluate (15)

$$\iiint_v (\nabla \times \vec{F}) / dv$$

where v is the closed region bounded by the planes $x = 0, y = 0, z = 0$ and $2x + 2y + z = 4$ where $\vec{F} = xyz^2 + yz^2 + y^2z$

- (b) Find the *actual* angle between the surfaces $x^2 + y^2 + z^2 = 9$ and $z = x^2 + y^2 - 3$ at the point (2, -1, 2). (10)

- (c) For $\vec{A} = 2yz\hat{i} - x^2y\hat{j} + xz^2\hat{k}$ and $\varphi = 2x^2yz^3$ find $(\vec{A} \times \nabla)\varphi$ and $\vec{A} \times (\nabla\varphi)$. (10)

8. (a) A beam is embedded at its left end and simply supported at its right end. (20)
Find the deflection $y(x)$ when the load is given by

$$w(x) = \begin{cases} w_0; & 0 < x < \frac{L}{2} \\ 0; & \frac{L}{2} \leq x < L \end{cases}$$

- (b) Using Laplace transform solve the differential equation (15)

$$y'' + 2y' + 5y = e^{-t} \sin t$$

$$y(0) = 0 \quad y'(0) = 1$$

Khulna University of Engineering & Technology
Department of Building Engineering and Construction Management
B. Sc. Engineering 2nd Year 1st Term Regular Examination, 2019
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) Define Engineering Economics. Why is it necessary for an engineer to study Economics? Explain. (10)
- (b) What is meant by shift in demand curve? Explain the factors behind the demand curve to shift. (15)
- (c) How do government policy and technology effect the supply of any product? (10)

2. (a) Define market. Write down the forms of market. (05)
- (b) If there are 100 identical producers in the market of commodity X, each with a supply equation is given by $Q_{sx} = -40 + 20 P_x$ and 1000 identical individuals, each with a demand equation, is given by $Q_{dx} = 8 - P_x$. (15)
 - i. Determine the market equilibrium price and quantity.If the government decides to collect a sales tax of \$2 per unit sold, from each of the 100 sellers –
 - ii. What effect does this have on the equilibrium price and quantity?
 - iii. Who actually pays the tax?
- (c) What do you mean by the word 'production' in engineering economics? Explain the different factors of production. (15)

3. (a) Define price elasticity of demand. What factors govern the size of the coefficient of price elasticity of demand? (15)
- (b) Is the price elasticity of demand for "Basundhara Cement" greater than the price elasticity for cement in general? Why? What general rule can we infer from this? (10)
- (c) The market demand for playing card is given by the equation, $Q = 6000 - 1000 P$; for a price increase from \$2 to \$3 per deck, what is the price elasticity of demand? (10)

4. (a) Distinguish between perfect and imperfect competition. (05)
- (b) Define short-run. Explain the profit maximizing position of a firm in the short run under perfect competition. (15)
- (c) Identify the loss position and shut-down position of a firm in the short-run under perfect competition. (15)

Section – B

5. (a) Identify and describe the steps of accounting cycle. (10)
(b) Mr. Sagor started a travel agency name 'Eagle Travel Agency' on 1st May, 2018. He invested cash Tk. 2,75,000 and equipment Tk. 80,000 on May 01, 2018. Other transactions during the month are as follows: (25)

May 03: Purchase supplies for cash Tk. 9,000.
,, 05: Paid office rent for the month Tk. 10,000.
,, 08: Received cash Tk. 45,000 from customers for travels.
,, 11: Advertising incurred in the Daily newspaper on account Tk. 3,500.
,, 15: Purchase equipment Tk. 50,000 of which paid Tk. 30,000 in cash and balance on account.
,, 18: Withdraw cash for personal use Tk. 6,000.
,, 22: Paid to the Daily newspaper on May 11.
,, 26: Paid payroll for the month Tk. 15,000.
,, 31: Supplies used during the month Tk. 5,500.

Required: Show journal entries in the books of "Eagle Travel Agency".

6. (a) Describe the rules of Debit and Credit of accounting. (10)
(b) Mr. Farid started business by bringing cash Tk. 85,000 as his capital on January 01, 2018. Other transactions during the month are as follows: (25)

January 05: Purchased goods for cash Tk. 36,000.
,, 08: Goods sold for cash Tk. 15,000.
,, 12: Purchased furniture for cash Tk. 10,000.
,, 15: Cash deposited into the bank Tk. 13,000.
,, 18: Goods sold on credit Tk. 19,000.
,, 21: Withdraw goods for personal use Tk. 2,000.
,, 27: Rent expense paid by cheque Tk. 4,000.
,, 30: Cash received from Account receivable Tk. 14,000.

Required: Prepare necessary ledger accounts.

7. (a) What is Cash book? Why Cash book is called both journal and ledger? (15)
(b) The following transactions of M/S Turjo and Co. for the month of December, 2018: (20)

December 01: Opening balance of cash Tk. 28,000 and bank balance Tk. 16,500.
,, 04: Goods purchase for cash Tk. 7,000 and goods sales for cash Tk. 9,000.
,, 06: Received a cheque for Tk. 5,000 from Kajol & Sons and deposited the same into the bank immediately.
,, 11: Purchase furniture Tk. 6,000, its price is paid in cash Tk. 2,000 and by cheque Tk. 4,000.
,, 15: Paid cash Tk. 3,600 to Shapla Enterprise.
,, 18: Deposited cash Tk. 4,500 into bank.
,, 21: Bought goods Tk. 3,200 paid by cheque.
,, 24: Drew cash Tk. 4,300 from bank for owner's personal use.
,, 26: Advertisement expense paid by cheque Tk. 2,800.
,, 28: Notes receivable collected by bank Tk. 8,500.
,, 30: Bank interest credited Tk. 200 and bank charged debited Tk. 100.

Required: Prepare double column cash book in the books of Turjo & Co.

8. (a) Show the differences between trial balance and balance sheet. (05)
 (b) The following Trial balance are extracted from the books of Modhumoti Enterprise as on December 31, 2018. (30)

Trail Balance

Account title	Debit Taka	Credit Taka
Cash	34,000	
Prepaid insurance	9,000	
Account receivable	35,000	
Office supplies	6,000	
Equipment	80,000	
Accumulated depreciation - Equipment		10,000
Account payable		13,000
Notes payable		14,000
Loan		30,000
Capital		65,000
Drawing	12,000	
Service revenue		1,08,000
Wages expense	15,000	
Rent expense	16,000	
Salaries expenses	18,000	
Advertisement expenses	4,000	
Utilities expenses	8,000	
Internet expense	3,000	
	2,40,000	2,40,000

Adjustments:

- (i) Office supplies unused at the end of the year Tk. 1,200.
- (ii) Service revenue earned but not received Tk. 22,800.
- (iii) Two months salaries not yet paid.
- (iv) Expired insurance per month Tk. 200.
- (v) Charged depreciation on equipment @ 5% p.a.

Required:

- (a) Prepare a statement of comprehensive income (Income Statement);
- (b) Owner's equity Statement and
- (c) Statement of financial position (Balance Sheet) as on December 31, 2018.

