Khulna University of Engineering & Technology
Department of Building Engineering and Construction Management
B. Sc. Engineering 2nd Year 1st Term Regular Examination, 2016
BECM 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)   What do you mean by HVAC? Briefly describe the terms involved in HVAC system.   (08)

      (b)   Define Psychometric. Show heating, cooling, humidifying and dehumidifying   (09)
            processes drawing psychometric chart.

      (c)   Define Clean room Performance Testing. Write down the different types of clean   (10)
            room tests.

      (d)   Write short notes on: i) TAB ii) MEP coordination.   (08)

2.   (a)   Define Air Conditioning System. Make a classification of Air Conditioning System.   (08)

      (b)   Describe Winter Air Conditioning System with suitable block diagram.   (12)

      (c)   An air conditioning plant is required to supply 40 m^3 of air per minute at a DBT   (15)
            27^{0}C and 75% RH. Determine the mass of water drained and capacity of the
            cooling coil.

3.   (a)   Define refrigerant. Mention various properties of a good refrigerant.   (07)

      (b)   Describe the functions of different components of a Vapor Compression   (10)
            Refrigeration System with a suitable block diagram.

      (c)   Write down the differences between VARS and VCRS.   (06)

      (d)   800 Kg of fruits are supplied to a cold storage at 20^{0}C. The cold storage is   (12)
            maintained at -3^{0}C and the fruits get cooled to the storage temperature in 8 hours.
            The latent heat of freezing is 105 KJ/Kg and specific heat of fruit is 1.26. Find the
            refrigeration capacity of the plant.

4.   (a)   Define air duct system. Describe different components of an air duct system with   (08)
            figure.

      (b)   Write down the general rules for air duct design.   (09)

      (c)   Describe air duct arrangement on the basis of number of ducts with figure.   (06)

      (d)   Determine the diameter and velocity pressure of the air duct system shown in   (12)
            figure below. Assume velocity in branch duct "CF" as 8 m/s.
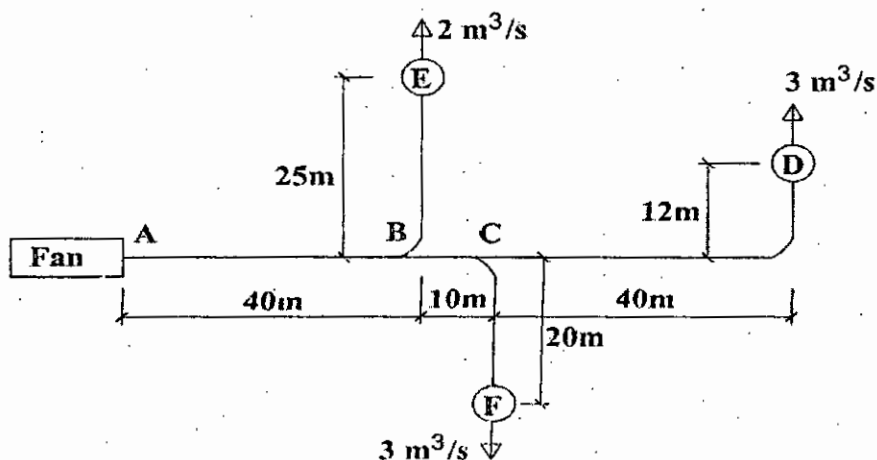
Section – B

5. (a) Define water supply system. Write down the objectives of water supply system. (06)

   (b) Describe the different water distribution methods in tall building with figure. (10)

   (c) Write short note on domestic under-ground storage tank. (05)

   (d) Water is to be supplied in nine storey low income group housing building having 2 (14) flats on each floor. Each flat is provided with a toilet and a kitchen and average number of persons living per flat is 6. The municipal water supply in the area is intermittent and irregular with supply restricted to 4 hours in the morning and 4 hours in the evening. Separate water meters are not to be provided in the flats. Design the pump capacity and the size of the 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/person. Consider the total length of rising pipe from the under-ground tank to the over-head tank including the length of all pipe fittings is 60 m and the diameter of pipe is 40 mm.

6. (a) Define sanitary drainage system. Write down the essential components of sanitary (07) drainage system.

   (b) What is trap? Classify the different types of trap based on shape, use and location. (08)

   (c) Describe the different types of building drainage system with figure. (12)

   (d) If the soil is sandy loam with a long term infiltration rate of about 50 l/m^2 day, (08) design a soakage pit for the disposal of effluent from the septic tank to serve a household of ten persons who produce 100 lpcd of waste water.

7. (a) Write down the principles governing in planning and design of house drainage. (07)

   (b) Write down the functions of septic tank. Draw a figure to show the functional zones (08) in a septic tank.

   (c) Define plumbing fixtures. Write short note on soak pit. (07)

   (d) Design a septic tank to serve a household of eight persons who produce 80 lpcd of (13) waste water. The tank is to be desludged every six years.

8. (a) Define ventilation. Describe the factors that affect ventilation. (08)

   (b) Write short note on rate of ventilation. (06)

   (c) Describe different types of ventilation. (09)

   (d) An assembly hall has a capacity of 800 seats and hall size is 50m x 15m x 8m. The (12) minimum recommended rate of fresh air supply is 2 air charges per hour. Calculate the required minimum ventilation rate and comment about the design.

Khulna University of Engineering & Technology
Department of Building Engineering & Construction Management
B. Sc. Engineering 2nd Year 1st Term Regular Examination, 2016
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)   Define aesthetics according to famous philosophers   10
   (b)   Justify the importance of aesthetics in the field of creativity.   20
   (c)   Write short note on modern aesthetics   05

2. (a)   Describe the phase of aesthetic activity level.   15
   (b)   What do you understand by the 'Law of Aysanck'?   10
   (c)   Write down the relation between creative activity and aesthetic pleasure.   10

3. (a)   What are the levels of individual's predisposition to creation?   15
   (b)   Discuss about the beginning of creation.   10
   (c)   Write short note on the psychological factors in creation.   10

4. (a)   Describe the interplay of sub conscious, conscious and super conscious mind in   20
         the process of creation.
   (b)   What are the functions of criticism?   10
   (c)   How beauty is an important branch of aesthetics?   05

Section – B

5. (a)   What is the definition of design in the context of Architecture?   10
   (b)   Explain the ideas of Design.   10
   (c)   Describe the evaluation phases of development of Design ideas.   15

6. (a)   Explain the Markus's views on future role of designer.   10
   (b)   What is rhythm? How to gain rhythm in design?   10
   (c)   Explain the steps of design process with necessary sketches.   15

7. (a)   What is line? Describe the different types of line.   10
   (b)   What are the basic design principles of building design? Explain with necessary   15
         sketches.
   (c)   Explain the various types of design criticism.   10

8. (a)   What is datum? How do you create different types of datum?   10
   (b)   What are the primary elements of design? Explain them with necessary examples.   15
   (c)   Explain the nature responsive design characters with sketches and examples.   10

Khulna University of Engineering & Technology
Department of Building Engineering & Construction Management
B. Sc. Engineering 2nd Year 1st Term Regular Examination, 2016
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   (10)
   the shear diagram of that interval.

   (b) Draw the shear force and bending moment diagrams for the structure as shown in figure   (15)
   below.
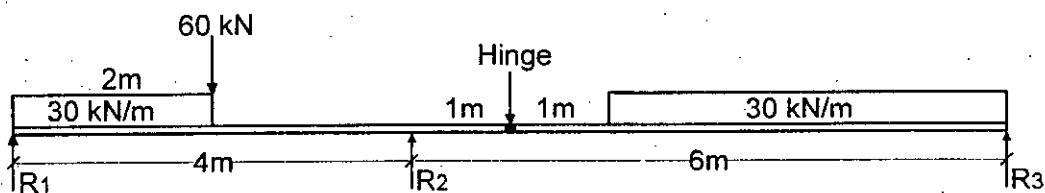
   (c) Draw the shear moment and load diagrams corresponding to the given shear diagram as   (10)
   shown in figure below.
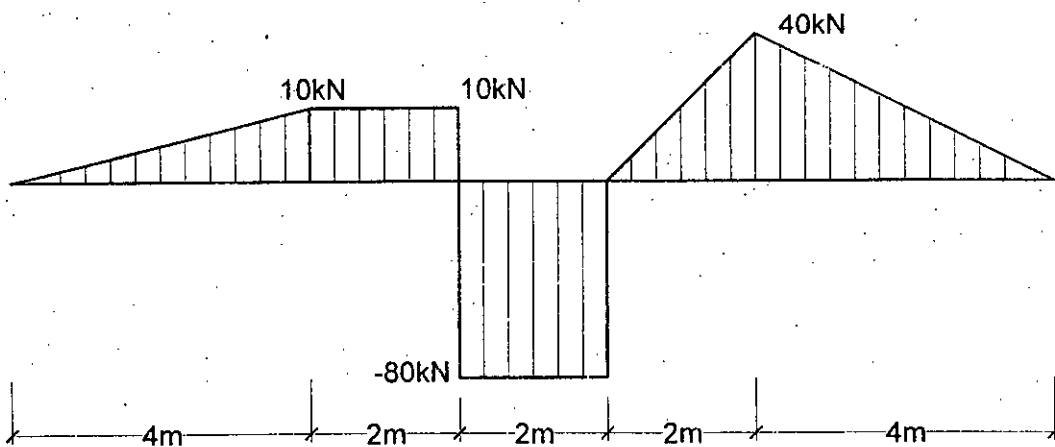

2. (a) Define the following terms: Point of contra-flexure, Dengerous section, Shear flow,   (10)
   Cantilever beam and Overhanging beam.

   (b) Draw the shear force and bending moment diagrams for the structure as shown in figure   (25)
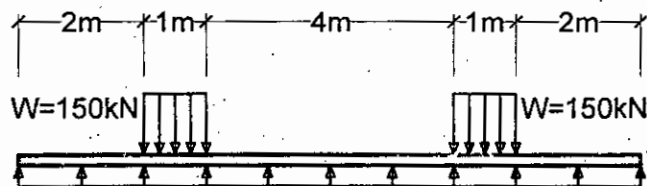   below.
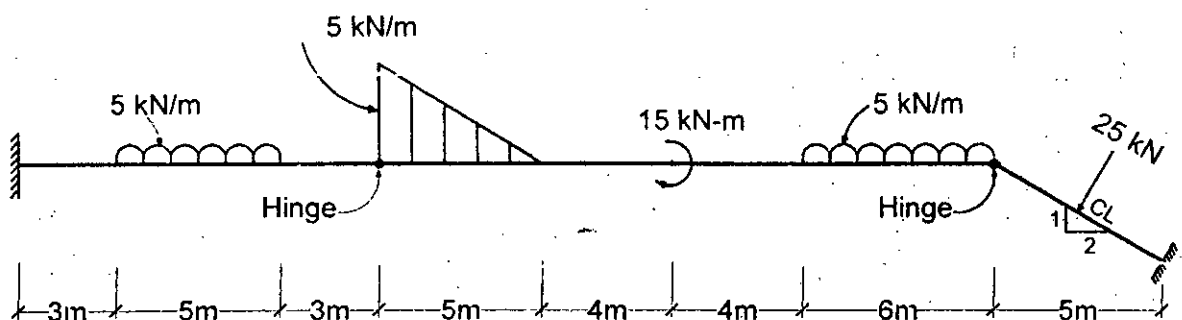
3. (a) What are the assumptions to derive the flexural stress formula? (05)

(b) A portion of the floor plan of a certain building is shown in figure below. The total loading (30) (including live and dead loads) in each bay is also shown. Determine the size of the section of the beam B-2 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.
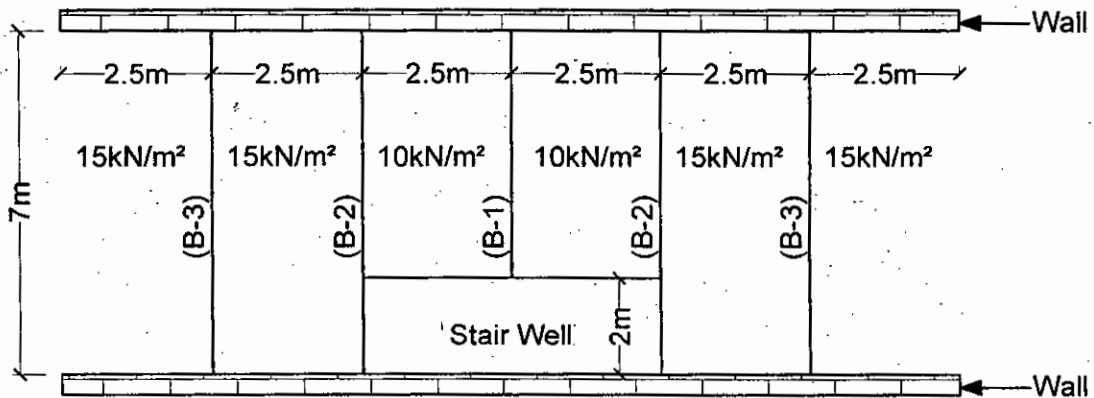

4. (a) Differentiate between statically determinate and statically indeterminate beam. (05)

(b) A square timber beam used as a railroad tie is supported by uniformly distributed reaction (15) and carries two uniformly distributed loads each totaling 150 kN as shown in figure below. Determine the size of the section if the maximum stress is limited to 15 Mpa.


(c) What safe value of W can be applied to the beam loaded as shown in figure below if (15) $\sigma_t \leq 80$ Mpa and $\sigma_c \leq 120$ Mpa.


$I_{NA} = 30 \times 10^6$ mm^4
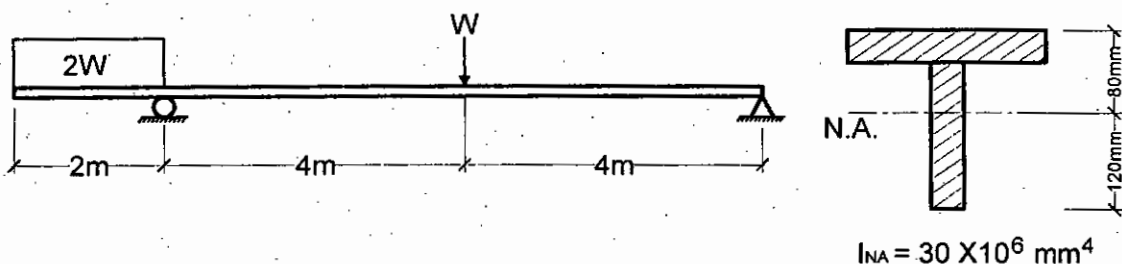
Section - B

5. (a) Analyze the internal forces system of a body define axial force; shear force; bending (07) moment and torque.

(b) An aluminium rod is rigidity attached between a steel and a copper rod as shown in figure (10) below. Axial loads are applied at the positions indicated. Find the minimum value of P that will not exceed a stress in steel of 140 Mpa, in aluminium of 86 Mpa and in copper of 95 Mpa.
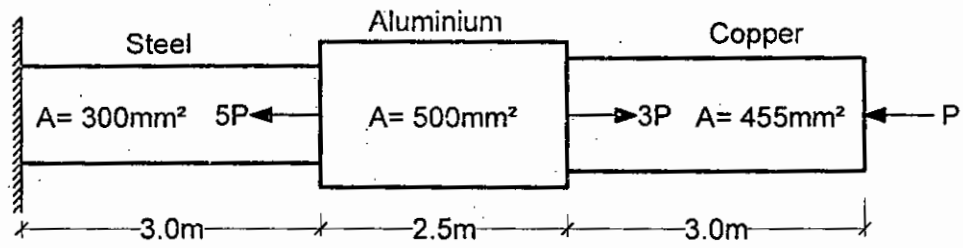
(c) Define normal stress, shearing stress and bearing stress. A 10 inch square steel bearing (18)
plate lies between an 6 inch diameter wooden post and a cement conctrete footing as
shown in figure below. Determine the safe value of the axial load F if the stress in wood is
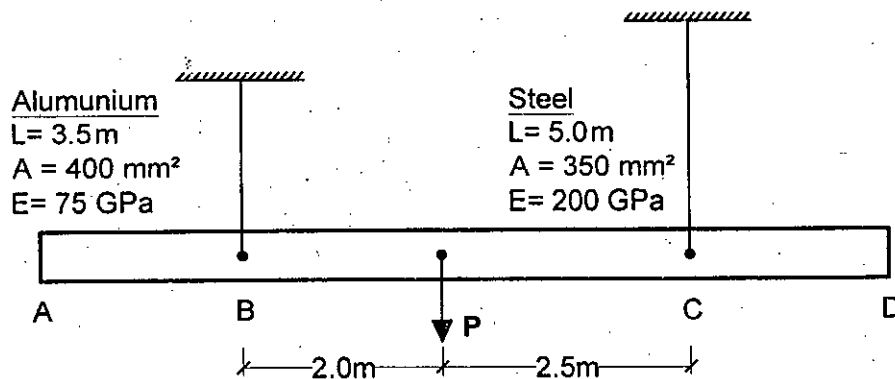limited to 1750 psi and that in cement concrete to 750 psi.
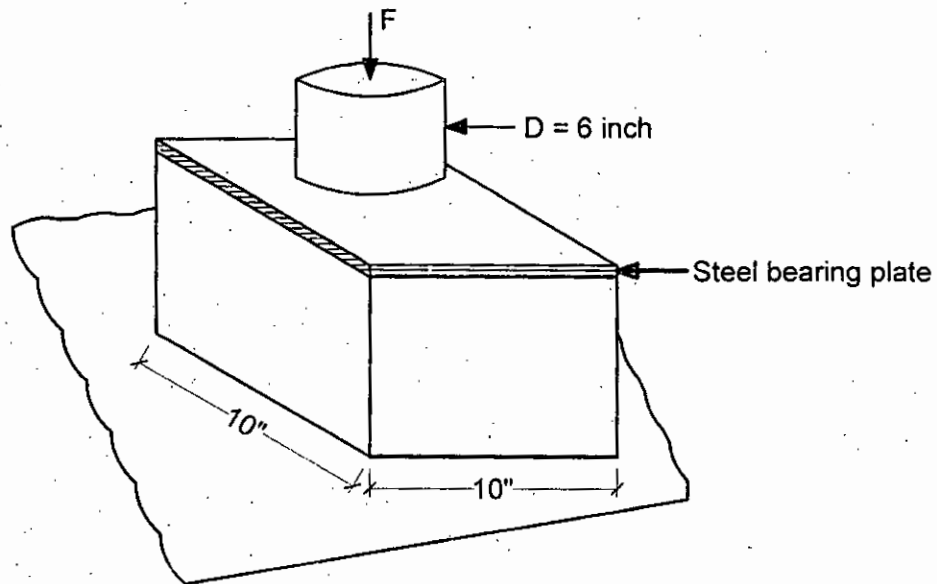
6. (a) Briefly describe the following terms: Ductility, Brittleness, Stiffness, Toughness and (10)
Permanet Set.

(b) Define the modulus of elasticity, modulus of resilience and modulus of rigidity. Derive the (10)
equation, $\delta = \dfrac{PL}{AE}$ where the symbols bear their usual meanings.

(c) The tank shown in figure below is fabricated from $\frac{1}{4}$" steel plate. Calculate girth stress and (15)
longitudinal stress caused by an internal pressure of 120 psi.
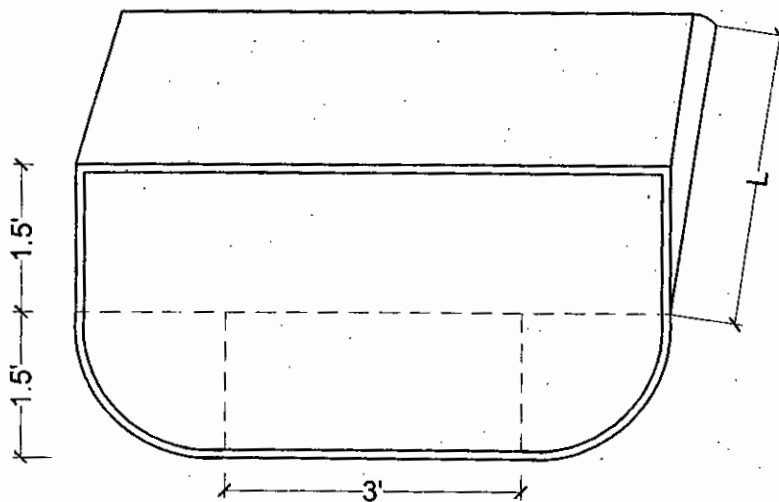
7. (a) Briefly describe the stress-strain diagram of mild steel. Write short note on 0.2% offset (15)
method to findout the yield strength of mild steel.

(b) Showed that $\delta = \frac{MgL}{2AE}$, where the symbols bear their usual meanings, The bar 'ABCD' (20)
attached to two vertical rods at points B and C as in figure below is horizontal before the
load is applied. Deterrmine the vertical movement of the bar 'ABCD' considering the
magnitude of P is 71 kN.

Alumunium
L= 3.5m
A = 400 mm²
E= 75 GPa

Steel
L= 5.0m
A = 350 mm²
E= 200 GPa

A   B   P   C   D

2.0m   2.5m

8. (a) Write short notes on poisson's ratio, biaxial deformation and triaxial deformation. (06)

(b) Two 300mm X 16mm plates are riveted together with 25 mm diameter rivets and quadruple (14)
riveted double cover butt joints as shown in figure below. Find the strength and efficiency of
the joint, if the thickness of the cover plates be 10 mm. The permissible stress are $T = 80$
MPa, $\delta t = 100$ MPa and $\delta c = 160$MPa.

t₁ =16 mm

① ② ③

300mm

P   P

① ② ③

t₂ =10 mm
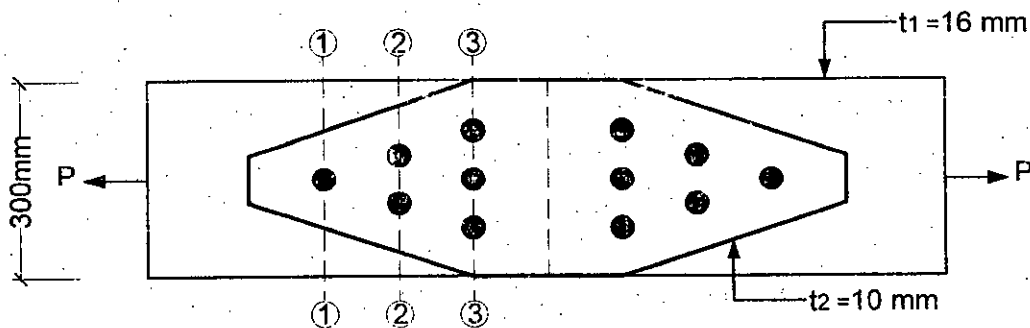
(c) A bracket consisting of an I - Section is connected to the flange of a vertical column as (15)
shown in figure below. The bracket carries a load of 100kN at an ecentricity of 150 mm.
Find the size of the weld required for the bracket, if the permissible stress in the weld is 100
MPa.

100kN
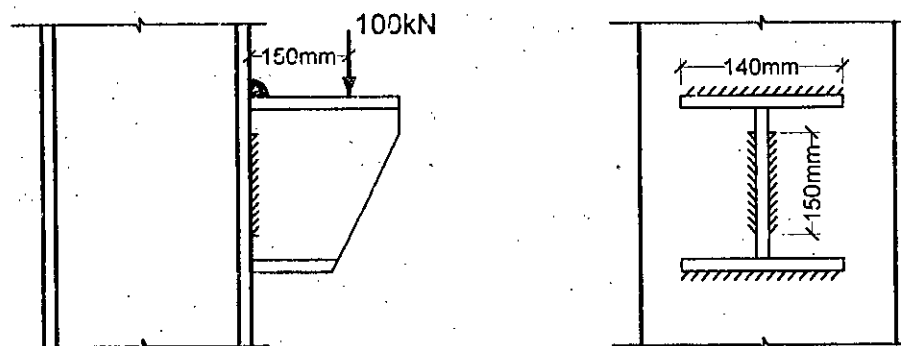
150mm

140mm

150mm

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 with example: (i) Matrix, (ii) Scalar matrix, (iii) Hermitian matrix and (iv)   (12)
         Trace of a matrix.

    (b) If A is a square matrix, express the matrix A as a sum of a Hermitian matrix   (10)
         and a skew-Hermitian matrix.

    (c)   (13)
    $$\text{If } A = \begin{bmatrix} 1 & 0 & 3 \\ 2 & 3 & -1 \\ -3 & 1 & 2 \end{bmatrix}$$

    and I is the unit matrix of order 3, evaluate $A^3 + 3A^2 - 7A + 9I$.

2. (a) Define inverse of a matrix. When does it exist? Write down the following   (17)
         system of equations in matrix form and find the inverse of coefficient matrix by
         using elementary (row) transformations. Hence solve the system using matrix
         method:
         $$x - 3y - 8z = -10$$
         $$3x + y = -4$$
         $$2x + 5y + 6z = 13$$

    (b) Discuss different types of elementary transformations which are valid on a   (05)
         matrix.

    (c) Find the row-reduced echelon form and hence the normal form of the matrix   (13)
         $$A = \begin{bmatrix} 2 & 3 & -1 & -1 \\ 1 & -1 & -2 & -4 \\ 3 & 1 & 3 & -2 \\ 6 & 3 & 0 & -7 \end{bmatrix}$$. What is its rank?

3. (a) For what value (s) of λ, the system of equations,   (15)
         $$3x - y + 4z = 3$$
         $$x + 2y - 3z = -2$$
         $$6x + 5y + \lambda z = -3$$
         Possesses (i) a unique solution? and (ii) infinitely many solutions?
         Determine the solution for case (ii).

    (b) Why a homogenous system is always consistent? What do we mean by trivial   (15)
         and non-trivial solution of a homogeneous system? Solve the system:
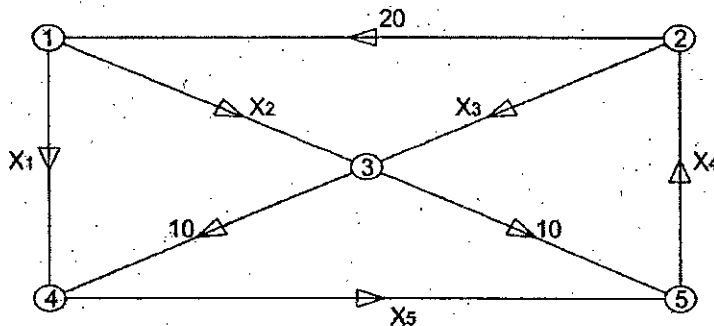 $$4x_1 - x_2 + 2x_3 + x_4 = 0$$
         $$2x_1 + 3x_2 - x_3 - 2x_4 = 0$$
         $$7x_2 - 4x_3 - 5x_4 = 0$$
         $$2x_1 - 11x_2 + 7x_3 + 8x_4 = 0$$

(c) Define orthogonal matrix. Is the matrix $\dfrac{1}{3}\begin{bmatrix} 2 & 2 & 1 \\ -2 & 1 & 2 \\ 1 & -2 & 2 \end{bmatrix}$ orthogonal? (05)

4. (a) Set up a system of linear equations to represent the network shown in the figure: (12)

What type of solution does the system possess?

(b) Define eigen values and eigen vectors. Determine the Eigen values and the corresponding eigen vectors of the matrix. (18)

$$A = \begin{bmatrix} 1 & 1 & 3 \\ 1 & 5 & 1 \\ 3 & 1 & 1 \end{bmatrix}.$$

(c) If a non-singular matrix A is symmetric show that A^{-1} is also symmetric. (05)

Section B

5. (a) Prove that $\underline{A} \times (\underline{B} \times \underline{C}) = \underline{B}(\underline{A}.\underline{C}) - \underline{C}(\underline{A}.\underline{B})$ for any three vectors $\underline{A}$, $\underline{B}$ and $\underline{C}$. Using this result, show that $\underline{A} \times (\underline{B} \times \underline{C}) + \underline{B} \times (\underline{C} \times \underline{A}) + \underline{C} \times (\underline{A} \times \underline{B}) = 0$. (12)

(b) The diagonal of a parallelogram are given by the vectors $\underline{A} = 3\hat{i} - 4\hat{j} - \hat{k}$ and $\underline{B} = 2\hat{i} + 3\hat{j} - 6\hat{k}$. Prove that the parallelogram is a rhombus and determine the length of its sides. (12)

(c) Determine whether the vectors are linearly independent or linearly dependent: (11)
$\underline{A} = 2\underline{i} + \underline{j} - 3\underline{k}$, $\underline{B} = \underline{i} - 4\underline{k}$, $\underline{C} = 4\underline{i} + 3\underline{j} - \underline{k}$.

6. (a) Find equations for the tangent plane and normal line to the surface $z = x^2 + y^2$ at the point $(2, -1, 5)$. (12)

(b) In what direction from the point $(2, 1, -1)$ in the directional derivative of $\varphi = x^2 y z^3$ a maximum? What is the magnitude of this maximum? (12)

(c) Evaluate (i) $\nabla^2(\ln r)$ (ii) $\underline{\nabla} f(r)$. (11)

7. (a) The acceleration $\underline{a}$ of an object at any time t is given by $\underline{a} = -g\hat{j}$, where g is a constant. At $t = 0$ the velocity is given by $\underline{V} = V_0 \cos\theta_0 \hat{i} + V_0 \sin\theta_0 \hat{j}$ and the displacement $\underline{r} = \underline{0}$. Find $\underline{V}$ and $\underline{r}$ at any time $t > 0$. (12)

(b) If $\underline{A} = (2y+3)\hat{i} + xz\hat{j} + (yz-x)\hat{k}$, evaluate $\int_c \underline{A}.d\underline{r}$ along the following paths C. (12)

(i) the straight lines from $(0,0,0)$ to $(0,0,1)$, then to $(0,1,1)$ and then to $(2,1,1)$.

(ii) the straight line joining $(0,0,0)$ and $(2,1,1)$.

(c) Evaluate $\iiint_v (2x+y)dV$, where V is the closed region bounded by the (11) cylinder $z = 4 - x^2$ and the planes $x = 0$, $y = 0$, $y = 2$ and $z = 0$.

8. (a) Find Laplace transforms of (i) $F''(t)$ (ii) $e^{4t} + 4t^3 - 2\sin 3t + 4\cos 5t$. (12)

(b) Evaluate $L^{-1}\{\dfrac{1}{s^3(s^2+4)}\}$. (11)

(c) Solve the differential equation using the Laplace transform: $Y'' + a^2Y = F(t)$; (12) $Y(0) = 1$, $Y'(0) = -2$.

Khulna University of Engineering & Technology
Department of Building Engineering & Construction Management
B. Sc. Engineering 2nd Year 1st Term Regular Examination, 2016

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 scripts (including question no. 8 from section B).
       ii)   Figures in the right margin indicate full marks.

Section – A

1. (a) Discuss the importance of the study of economics.   (10)

    (b) What is law of demand? Draw a demand curve from a hypothetical demand schedule.   (10)

    (c) What are the main factors that affect the supply of any goods or services?   (15)

2. The cost of stereo systems has fallen over the past several decades. Now,

    (a) Use a supply-and-demand diagram to show the effect of falling production cost on the price and quantity of stereos sold.   (15)

    (b) In your diagram, show what happens to consumer surplus and producer surplus.   (10)

    (c) Suppose the supply of stereos is very elastic. Who benefits most from falling production cost-consumers or producers of stereos? Explain.   (10)

3. (a) What do you mean by the word 'production' in engineering economics? Explain the different factors of production.   (15)

    (b) Draw and explain the idea of total cost, average cost, and marginal cost. How are they related?   (20)

4. (a) Define nominal GDP and real GDP. List and explain the four components of GDP with example.   (15)

    (b) What is national savings, private savings, and public savings? Suppose GDP is $8 trillion, taxes are $1.5 trillion, private savings is $0.5 trillion and public savings is $0.2 trillion. Assume this country is closed, calculate consumption, government purchase, national savings and investment.   (20)

Section – B

5. (a) What is accounting? Who uses accounting information?   (15)

    (b) How can you use accounting knowledge?   (10)

    (c) Write down various concept of accounting.   (10)

6. (a) Mr. Moon started his own delivery service "Moon Delivers" on January 2016. The following transactions occurred during the month of January.   (25)
    January -1: Mr. Moon invested Tk. 200,000 cash in the business.
    January -2: Purchased a van for deliveries for Tk. 10,000. Moon paid Tk. 2000 in cash and signed a note payable the remaining balance.
    January -5: Paid Tk. 5000 for office rent for the month.

January -7: Performed Tk. 2400 of service on account.
January -9: Withdrawn Tk. 2000 in cash for owner's personal use.
January -13: Purchased supplies for Tk. 500 on account.
January -17: Received cash Tk. 800 for services provided on January-7.
January -26: Made cash payment of Tk. 8000 on the note payable.
January -28: Received cash Tk. 1600 of remaining money for service provided
           on January-7.
January -31: Paid Tk. 1000 for employee salary.
Required: Journalise above the transactions.

(b) What is accounting equation? Show the elements of accounting equation.   (10)

7.   Jonh Robison opens her own law office on July 1, 2015. During the first month (35)
of operations, the following transactions occurred.
July - 1: Invested Tk. 10,000 in cash in the law practice.
July - 2: Paid Tk. 800 cash for rent on office space.
July - 3: Purchased office equipment on account Tk. 3000.
July - 4: Provided legal services to clients for cash Tk. 1500.
July - 5: Borrowed Tk. 17,000 cash from a bank on a note payable.
July - 6: Performed legal services for a client on account Tk. 2000.
July.- 7: Salaries paid to employee in cash Tk. 4000.
Required: Prepare necessary ledger accounts.

8.   The Lamisa Motel opened for business on May 1, 2015.   (35)
Its trial balance before adjustment on May 31 as follows:

Lamisa Motel Trial Balance May 31, 2015		
Particulars	Debit (Tk.)	Credit (Tk.)
Cash	2500	
Supplies	1900	
Prepared insurance	2400	
Land	85,000	
Furniture	16,800	
Accounts payable		5,300
Unearned rent		3,600
Mortgage payable		35,000
Lamis' capital		60,000
Rent revenue		9,200
Advertisement expense	500	
Salaries expense	3000	
Utilities expense	1000	
	1,13,100	1,13,100

Other data:
(1) Insurance expires at the rate of Tk. 200 per month.
(2) A count of supplies shows Tk. 900 of unused supplies on May 31.
(3) Annual depreciation is Tk. 3000 on furniture.
(4) Salaries unpaid for the month Tk. 800.
(5) Unearned rent of Tk. 2500 has been earned.

Required:
(a) Prepare a statement of comprehensive income for the month of May, 2015.
(b) Prepare owner's equity statement and
(c) Prepare statement of financial position as on May 31, 2015.