Khulna University of Engineering & Technology

Department of Building Engineering & Construction Management

B. Sc. Engineering 2nd Year 1st Term Regular Examination, 2015

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. (09)

   (b) Define mechanical room. What are the major mechanical equipments used in high rise buildings. (08)

   (c) Define different modes of heat transfer. Write the formula for determining heat transfer by conduction through a slab having their usual meaning. (10)

   (d) Define Psychrometry. Show heating, cooling, humidifying and dehumidifying process in Psychrometric chart. (08)

2. (a) Define human comfort according to ASHRAE. Describe the factors affecting comfort air conditioning. (08)

   (b) Describe the summer air conditioning with block diagram. (15)

   (c) In a winter air conditioning system 100 m^3 of air per minute at 15 ^{0}c dry bulb temperature and 80% RH is heated until its dry bulb temperature 22 ^{0}c. Find the heat added to the air per minute. (12)

3. (a) Define refrigeration system and refrigerant. Explain the term TOR and COP. (12)

   (b) What are the different types of refrigeration system? (05)

   (c) Draw the P-h and T-s diagram of a vapor compression refrigeration cycle. (06)

   (d) An ice plant produces 10 tons of ice per day at 0 ^{0}c using water at room temperature of 20 ^{0}c. Estimate the power rating of the compressor motor, if the COP of the plant is 2.5 and overall electro-mechanical efficiency is 90%. (12)

4. (a) What is meant by ventilation? Write down the purposes of ventilation. (07)

   (b) Define exhaust and plenum system for mechanical ventilation. (06)

   (c) Explain various types of natural ventilation in a space for human comfort with sketches. (12)

   (d) An auditorium has a capacity of 1000 seats and a volume of 6000 m^3. The recommended minimum rate of fresh air supply is 2 air charges per hour. Calculate the minimum required ventilation rate m^3/sec 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 air of 2 m^3/hr/person). (10)

Section – B

5. (a) What are the objectives of water supply? Explain briefly the importance of water supply. (07)

   (b) Discuss briefly the elements of water supply. (10)

   (c) Enumerate the general considerations for planning and design of a water supply system. (08)

   (d) Describe briefly the domestic overhead storage tanks. (10)

6. (a) What are the common sanitary fittings for a standard toilet? (05)

   (b) Explain the system of plumbing with proper sketches. (12)

   (c) Draw a drainage scheme for a house. (12)

   (d) What are the general requirements of underground water reservoir. (06)

7. (a) What is trap? (05)

   (b) What is the meaning of 'Drainage' for a building? (05)

   (c) Explain various types of drainage system. (10)

   (d) Explain various types of water closet with proper sketches. (15)

8. (a) What are the general requirements of domestic overhead water storage tanks? (09)

   (b) Write short notes on: (i) Stop cocks, (ii) Bib Cocks. (06)

   (c) Water is to be supplied in nine storey low income group housing building having 4 flats on each floor. Each flat is provided with a toilet and a kitchen and average number of person living per flat is 5. The municipal water supply in the area is intermitted 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 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 160 L/d/person. (20)

Khulna University of Engineering & Technology
Department of Building Engineering & Construction Management
B. Sc. Engineering 2nd Year 1st Term Regular Examination, 2015
CE 2101
(Engineering Mechanics)

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.
iii) Assume reasonable value for any missing data.
iv) All figures are not drawn in scale.

Section – A

1. (a) Define transmissibility of force, free body diagram and two force members. (18)
Draw the free body diagram of different members as shown in figure.

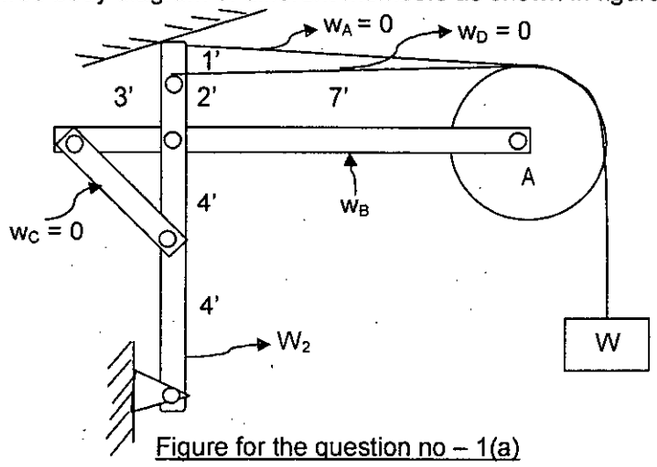


Figure for the question no – 1(a)

(b) The wheel shown in figure given below in on the point of rolling over the block. (17)
If W = 800 lb, what is the magnitude and sense of the least force F that will produce this condition.

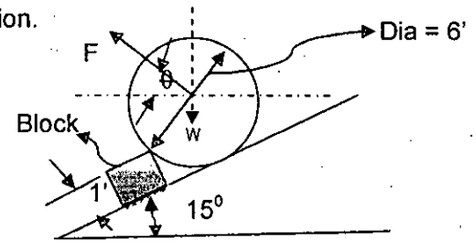
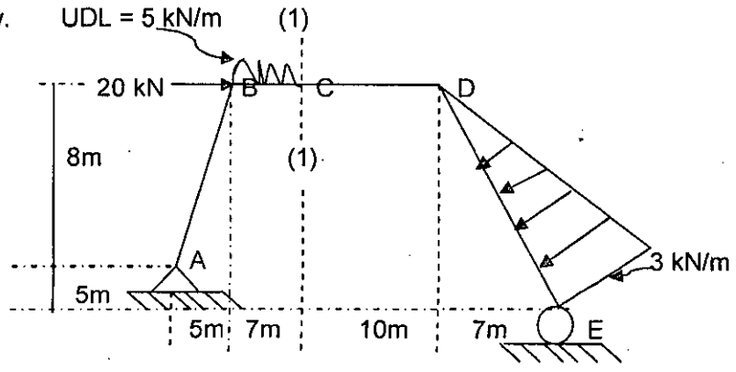


Figure for the question no – 1(b)

2. (a) Define shear force and bending moment. Calculate the shear force at the left (18)
of section (1)-(1) and bending moment at the right of section (1)-(1) as shown in figure.below.



(b) Draw the shapes of typical ideal form of trusses: crescent, whipple and parker trusses. Determine the force in members indicated in the truss as shown in figure. (17)

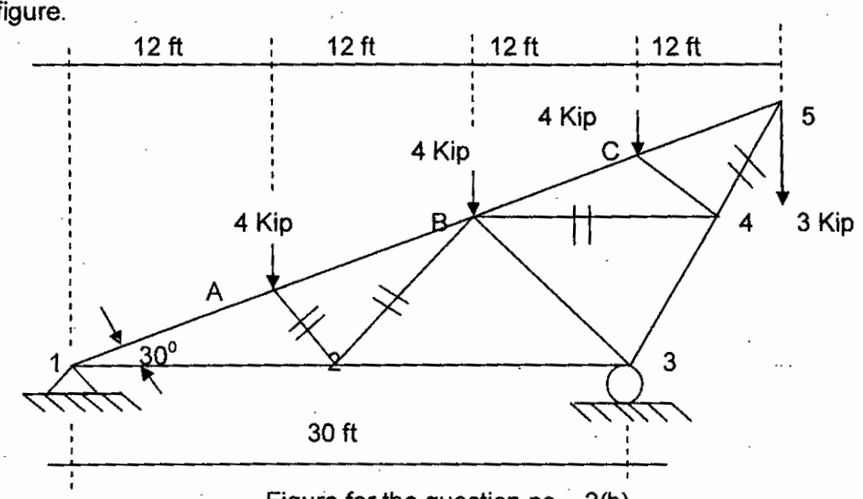


Figure for the question no – 2(b)

3. (a) Deduce $T_1 = T_2 e^{j\theta}$, where the symbols bear their usual meaning. (07)

(b) A motorcycle rider passes point A at a speed of 30 mph. What is the maximum value of 'h' if the motorcycle (considered as a particle) is to jump the 30 ft ditch? Neglect air resistance and somersaults. (07)

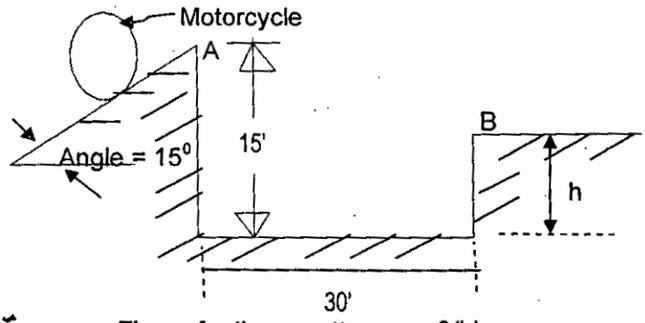


Figure for the question no – 3(b)

(c) Find the weight acting at the figure below. (Figure need not to draw in answer script) (07)

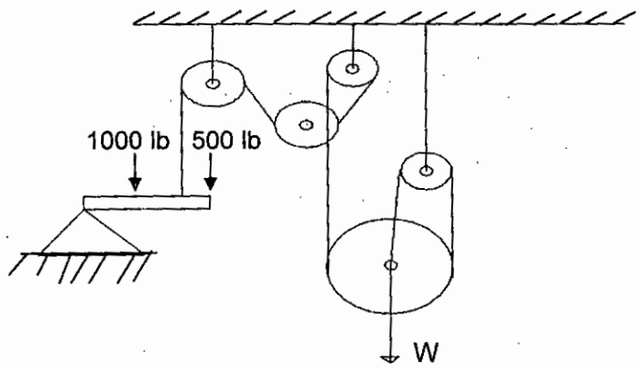


Figure for the question no - 3(c)

(d) . A refrigerator weighs 500 lb. The height h = 6 ft and b = 28 inch. The co-efficient of static friction at A and B is $\mu_s = 0.25$. Find (i) what force F is necessary for impending slip (ii) will the refrigerator tip before it slips? (14)

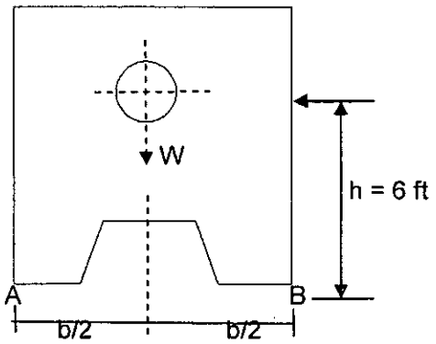


Figure for the question no – 3(d)

4. (a) Define: Angle of friction, angle of repose and wedge. The following figure represents a boom that support is a load W = 1 Kip. If AB = BC = BD = 8 ft and BE = 10 ft, find tension in the cable and force in each member. (20)

(b) In the following figure shown below, W_A = 50 lb, β = 300, f_A = 0.3 and f_C = 0.2. For the movement of the body A, find (i) tension in the cables (ii) what is the speed of bodies after the movement of 20 ft from rest. (15)

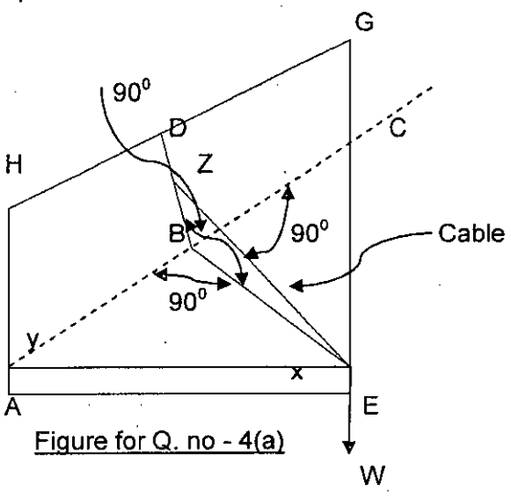


Figure for Q. no - 4(a)

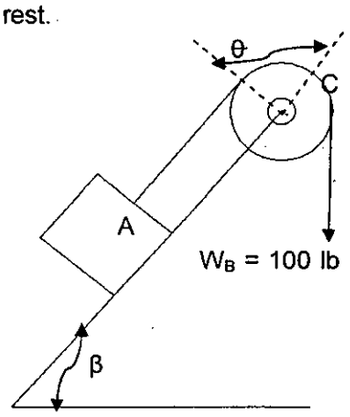


Figure for Q. no – 4(b)

Section – B

5. (a) Write down the principle of symmetry. Fine the centroid of a right circular cone, whose altitude is h and bas has a radius r. (15)

(b) Determine the co-ordinates of the centroid of the composite section shown in figure below. (20)

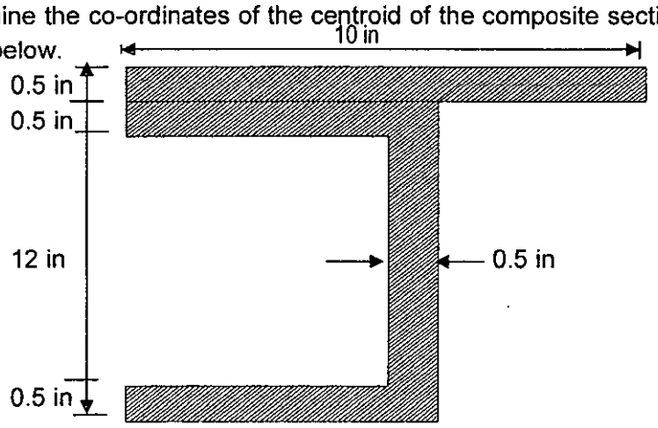


Figure for the question no – 5(b)

6. (a) What do you mean by polar moment of inertial? Prove that $I_x = \overline{I_x} + Ad^2$, where the symbols bear their usual meanings. (13)

(b) Determine the moment of inertia about the horizontal axis passing through the centroid of the following figure as shown in below. (22)

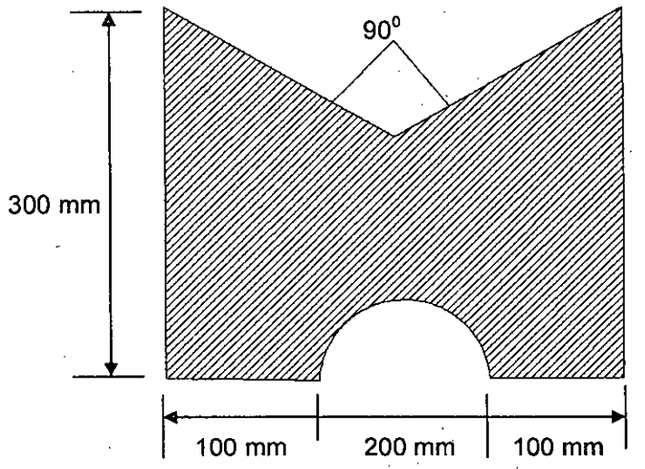


Figure for the question no – 6(b)

7. (a) State the theorem of Pappus and Guldinus. (06)

(b) The wood hande of the mallet as shown in figure below, is L = 44 ft long, weighs 3 lb and has an uniform cross section. The load weighing 14.2 lb, is a wood cylinder of diameter, D = 8 inch. Find the radius of gyration of the body with respect to the Y-axis. (16)

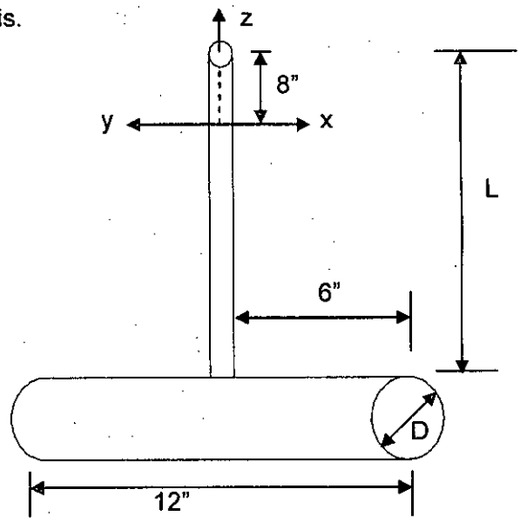


Figure for the question no – 7(b)

(c) A jet of water A, whose velocity is V_A = 60 fps, strikes a blade B which is moving at V_B = 30 fps in the same direction as A, shown in figure below. Eight pounds per second of water strike the blade, two-third passing without friction along the lower part, the rest across the upper. Determine the horizontal and vertical components of the force on the blade. (13)

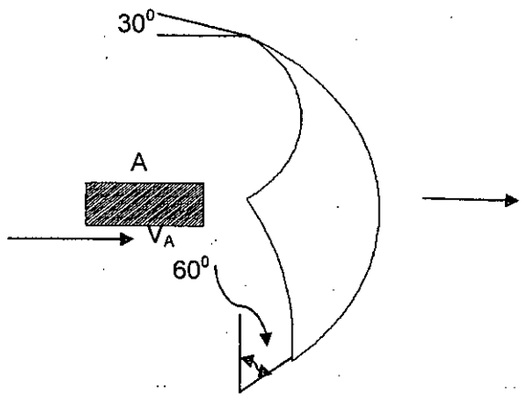


Figure for the question no – 7(c)

8. (a) Under what conditions, a flexible chord is curved to form either a parabola or a catenary? (05)

(b) What is the corresponding sag and length of wire between poles for a power line weighing 0.3 lb per ft which is to be subjected to a maximum tension of 2000 lb? The poles are 180 ft apart. Consider the supports are in a horizontal plane and the weight is uniformly distributed horizontally. (10)

(c) Two smooth spheres A and B with velocities of V_{A1} = 10 fps and V_{B1} = 12 fps, collide when these velocities are directed at angles of 30^0 and 60^0 with the line centers as shown. The spheres are equal size but A weighs w_A = 6 lb and B weighs w_B = 3 lb. The co-efficient of restitution is 0.7. (i) What are the absolute velocities of these spheres immediate after impact? (ii) what is the loss of kinetic energy? (20)

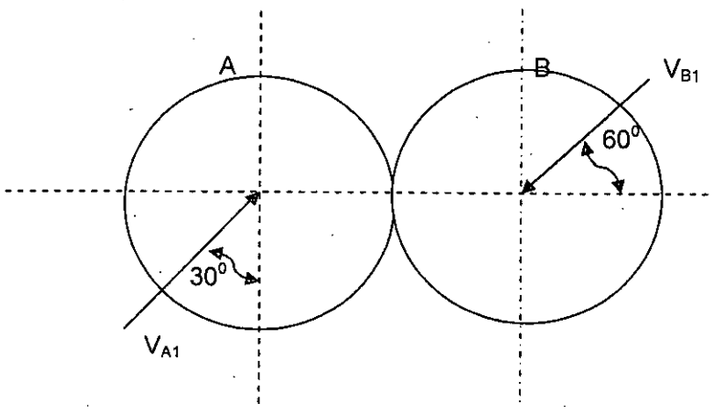


Figure for the question no – 8(c)

Khulna University of Engineering & Technology
Department of Building Engineering & Construction Management
B. Sc. Engineering 2nd Year 1st Term Regular Examination, 2015
CE 2111
(Mechanics of Solids - I)

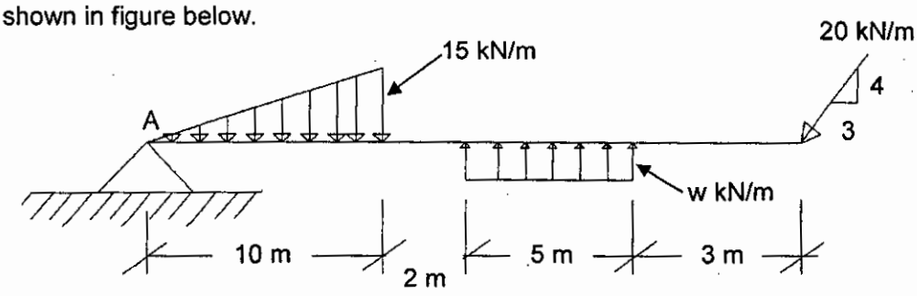
Full Marks: 210 Time: 3 hrs

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

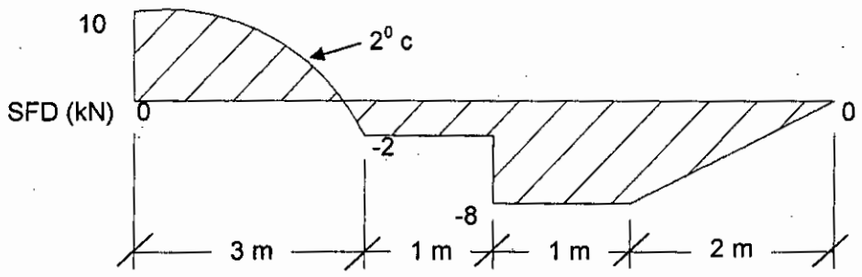
Section – A

1. (a) Show that the change in bending moment between any two sections is equal to the area of the shear diagram of that interval. (10)

(b) Draw the shear force and bending moment diagrams for the structure as shown in figure below. (15)

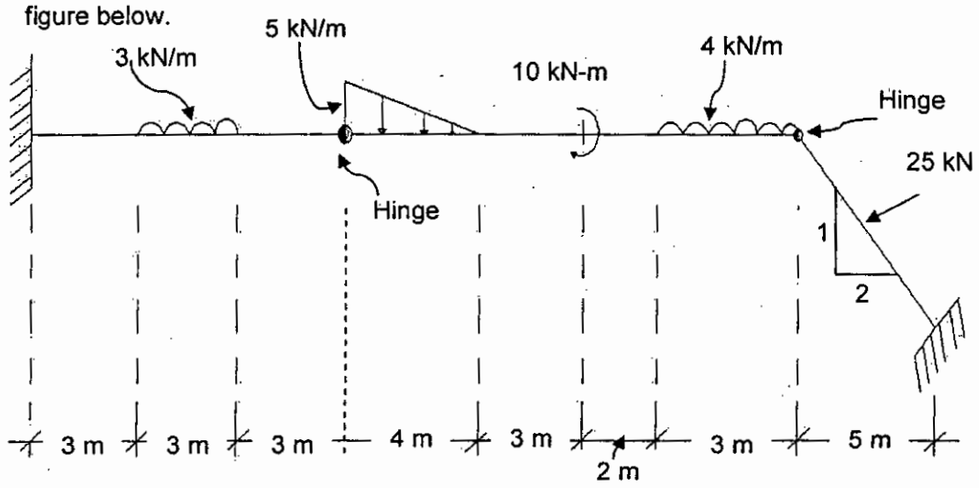


(c) Draw the load diagrams corresponding to the given shear diagram as shown in figure below. (10)



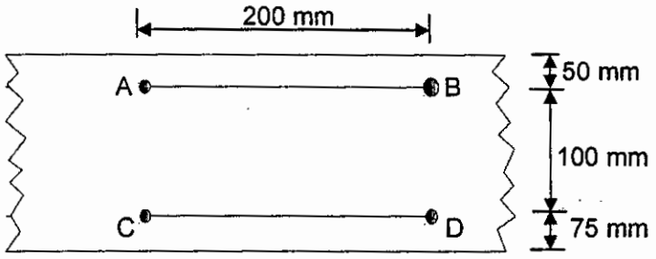
2. (a) Define the following terms: Point of contra-flexure, dangerous section, shear flow, point of inflection, and engineering stress. (10)

(b) Draw shear force and bending moment diagram for the structure as shown in figure below. (25)

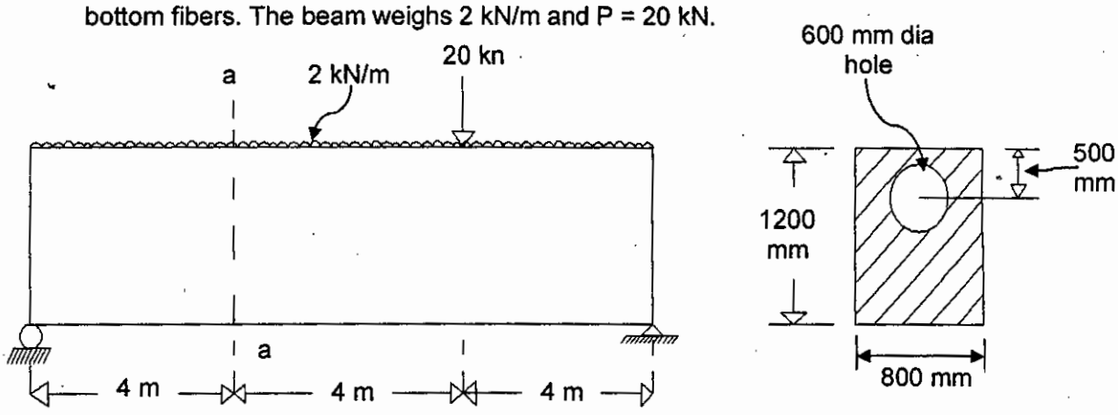


3. (a) What are the assumptions to derive the flexural stress formula? (05)

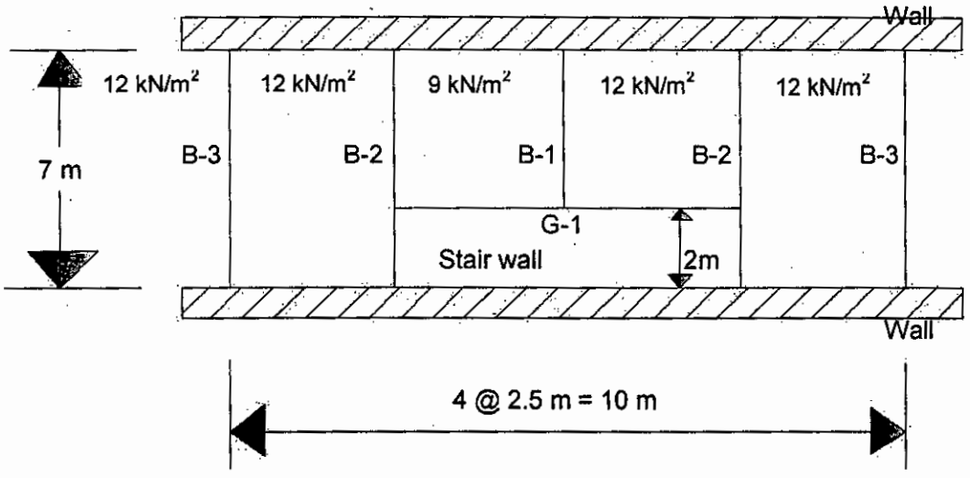
(b) In a laboratory test of a beam loaded by end couples, the fibers at layer AB in following figure are found to increase 30 x 10^{-3} mm while those at CD decrease 90 x 10^{-3} mm in the 200 mm gage length. Using E = 70 GPa determine the flexural stress in the top and bottom fiber. (15)



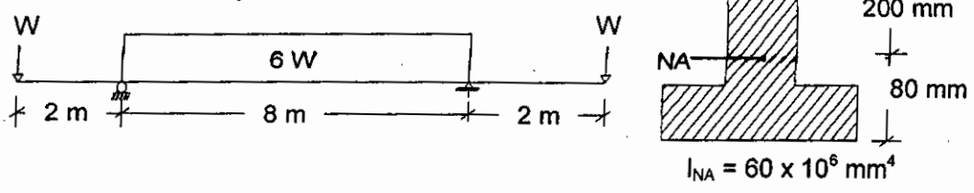
(c) At section a-a for the beam, loaded as shown in the figure. Find (a) the maximum normal stress (b) the normal stress midway between the top and the bottom fibers. The beam weighs 2 kN/m and P = 20 kN. (15)



4. (a) 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 beam B-2 if the allowable flexural stress is 120 MPa. Assume the beams are adequately braced and the depth of the cross-section is 1.5 times of the width. (20)



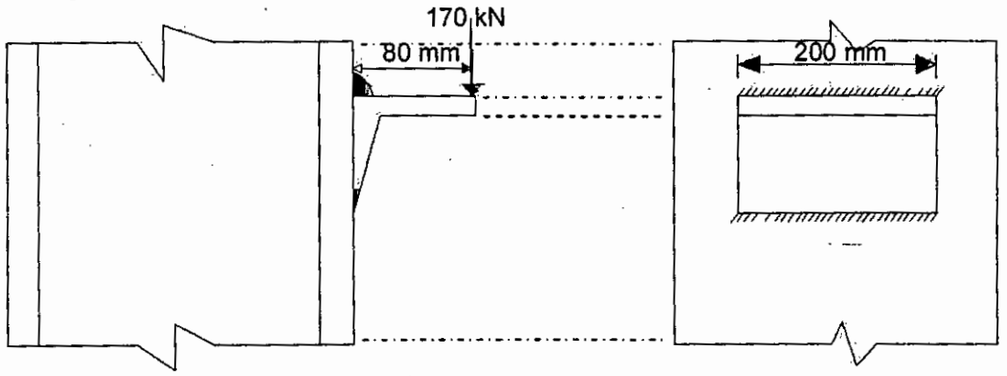
(b) Determine the maximum safe value of W that can be carried by the beam shown in figure. If $\sigma_c \leq 60 Mpa$. (15)



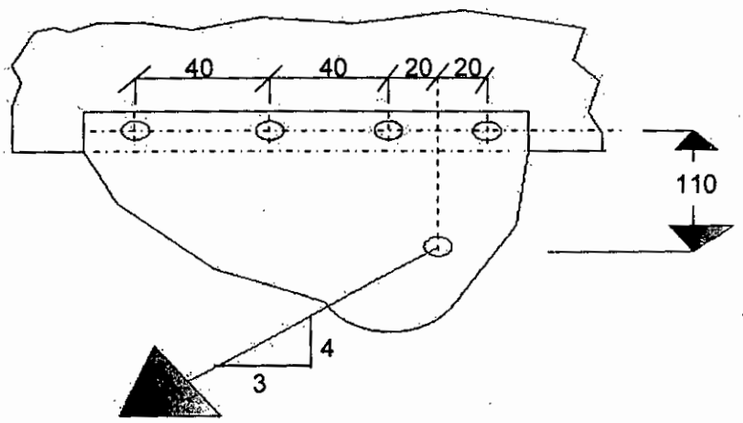
I_{NA} = 60 x 10^6 mm^4

Section – B

5. (a) Write down the disadvantages of welding over riveting. A bracket is welded to a column carrying a load of 170 kN at an eccentricity of 80 mm as shown in figure. Find the maximum stress developed in the weld per mm length. (18)



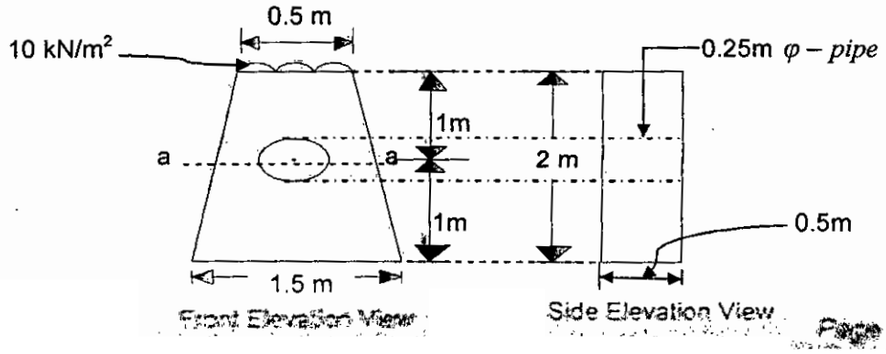
(b) Draw the failures of rivets and gussets plates. A gusset plate is riveted to a larger plate by four - 22 mm rivets arranged as loaded as shown in figure. Determine the maximum and minimum shear stress developed in the rivets. (N.B. all dimensions are in mm). (17)



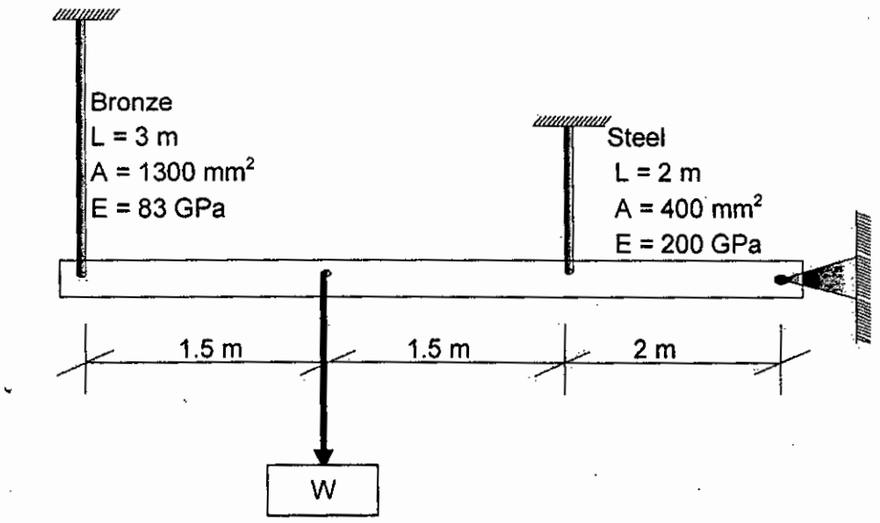
6. (a) Distinguish between the following terms: (i) Isotropic, anisotropic and orthotropic material; (ii) Modulus of elasticity and modulus of rigidity; (iii) Modulus of resilience and modulus of toughness. (19)

The undersea research vehicle Alvin has a spherical pressure hull 4 ft in radius and shell thickness of $1\frac{1}{8}$". The pressure hull is steel having yield point of 95 ksi. Determine depth of submergence that would set up the yield point stress in the spherical shell. Consider sea water to have a specific weight of 10 kN/m^3.

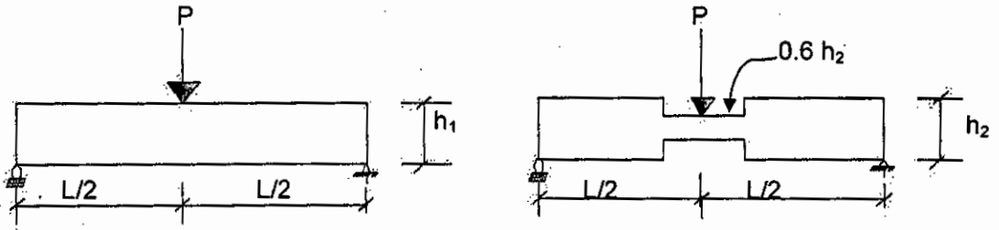
(b) The concrete pier as shown in figure is loaded at the top with uniformly distributed load of 10 kN/m^2. Investigate the state of stress at a level of 1.0 m above the base. Concrete weighs approximately 25 kN/m^3. (16)



7. (a) Draw the stress-strain diagram of mild steel and locate its different points. A rigid bar of negligible weigh is supported as shown in figure below. If W = 80 kN, compute the temperature change that will cause the stress in steel rod to be 60 MPa. Assume the co-efficient of linear expansion are 11.7 $\frac{\mu m}{m.^{o}c}$ steel and 18.9 $\frac{\mu m}{m.^{o}c}$ for bronze. (20)

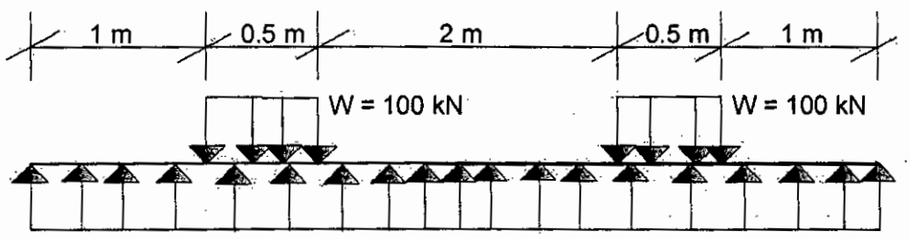


(b) For $\sigma - \varepsilon$ diagram of mild steel, after reaching yield limit, an increase of strain shows stress to be unchanged" – Justify the statement. Find the ratio of internal strain energy as shown in figure. (15)



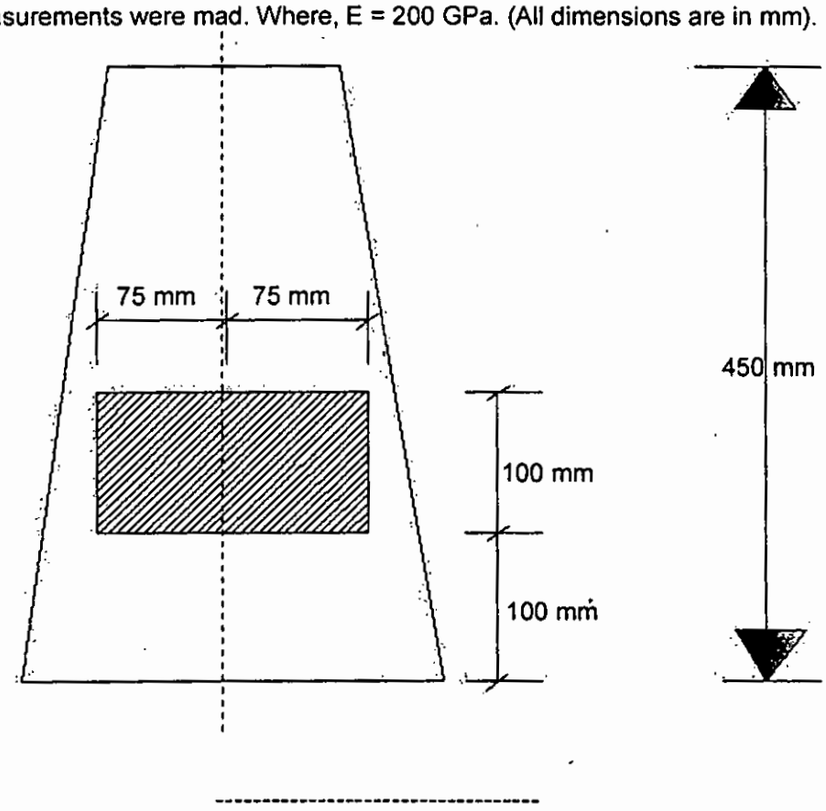
8. (a) Differentiate between (i) Statically determinate beam and statically indeterminate beam. (05)

(b) A square timber beam used as a railroad tie is supported by uniformly distributed reaction and carries two uniformly distributed loads each totaling 100 kN as shown in figure below. Determine the size of the section if the maximum stress is limited to 10 MPa. (15)



(c) A solid steel beam having the cross sectional dimensions partially shown in the figure below was loaded in the laboratory in pure bending. Bending took place around a horizontal neutral axis. Strain measurements showed that the top fiber contracted 0.0003 m/m longitudinally; the bottom fiber elongated 0.0006 m/m longitudinally. Determine the total normal force in pounds which (15)

acted on the shaded area indicated in the figure at the time of strain measurements were mad. Where, E = 200 GPa. (All dimensions are in mm).



Khulna University of Engineering & Technology
Department of Building Engineering & Construction Management
B. Sc. Engineering 2nd Year 1st Term Regular Examination, 2015
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 with example (any three): (12)
(i) Equivalent matrix, (ii) Singular matrix, (iii) Trace, (iv) Symmetric matrix.

(b) Point out three cases with example that matrices do not follows arithmetic operations as real numbers. (09)

(c) Test linear dependence and independence of the following vectors. If possible express the vectors as a linear combinations. Hence verify the linear combination (if exist); where, [0, 1, 2, 3], [2, 8, 9, 1], [2, 6, 5, -5]. (14)

2. (a) Reduce the following matrix to echelon form, canonical form and normal form. (17)
Hence find its rank, $\begin{bmatrix} 0 & 0 & 1 & 0 \\ 2 & 1 & 2 & 1 \\ 4 & 2 & 0 & 2 \end{bmatrix}$.

(b) Is the following matrices are invertible, why? $\begin{bmatrix} 0 & 1 \\ 1 & 0 \end{bmatrix}, \begin{bmatrix} 1 & 2 \\ 2 & 4 \end{bmatrix}, \begin{bmatrix} 0 & 2 & 0 \\ 1 & 0 & 2 \end{bmatrix}$. (06)

(c) If possible find the inverse of A. Hence express A as well as A^{-1} (if possible) as a product of elementary matrices; where, $A = \begin{bmatrix} 0 & 1 \\ 2 & 4 \end{bmatrix}$. (12)

3. (a) What is the value of λ so that the following system of linear equations has (i) Unique solution, (ii) Many solution, (iii) No solution? where, $\begin{matrix} \lambda x + y = 2 \\ x + \lambda y = 2\lambda \end{matrix}$. (17)

(b) Find the largest Eigen value and corresponding Eigen vector of the Markov matrix, $A = \begin{bmatrix} 0.8 & 0.3 \\ 0.2 & 0.7 \end{bmatrix}$. Hence verify. Also find the largest Eigen value of A^{10} and corresponding Eigen vectors (by using property). (18)

4. (a) Write down three properties of Eigen value. (06)

(b) Using Laby-Hamelton theorem find the value of A^2 and A^{-2} (if possible) of the matrix, $A = \begin{bmatrix} 2 & 3 \\ 4 & 6 \end{bmatrix}$. (09)

(c) Define trivial and non-trivial solution of a set of homogeneous equations. Find the non-trivial solutions of $4x_1 - x_2 + 2x_3 + x_4 = 0$, $2x_1 + 3x_2 - x_3 - 2x_4 = 0$, $7x_2 - 4x_3 - 5x_4 = 0$, $2x_1 - 11x_2 + 7x_3 + 8x_4 = 0$. (20)

Section – B

5. (a) Find the velocity and acceleration of a particle which moves along the curve, $x = 2\sin 3t$, $y = 2\cos 3t$, $z = 8t$ at any time $t > 0$. Also find the magnitude of the velocity and acceleration along x axis at $t = \frac{\Pi}{6}$. (13)

(b) If $\frac{d^2\bar{q}}{dt^2} = 12t\hat{i} + 24t^2\hat{j} + \sin t\hat{k}$ such that $\bar{q}(0) = \hat{i} + \hat{j}$ and $\frac{d\bar{q}}{dt} = 2\hat{i} + 3\hat{j}$, $t = 0$. Then, find the value of $\bar{q}$ at any t, and at $t = 5$. (16)

(c) What are the physical meaning of ∇f and $\nabla \cdot \bar{F}$? (06)

6. (a) Find the angle between the surfaces $x^2 + y^2 + z^2 = 9$ and $z = x^2 + y^2 - 3$ at the point $(2,-1,2)$. (11)

(b) Show that $\vec{F} = (y^2 + 2xz^2)\hat{i} + (2xy - z)\hat{j} + (2x^2z - y + 2z)\hat{k}$ is irrotational and hence find its scalar potential. (13)

(c) Calculate $\int_C \vec{F}.d\vec{r}$, where C is the port of the spiral $\vec{r} = < a\cos\theta,\ a\sin\theta,\ a\theta >$ corresponding to $0 \le \theta \le \frac{\Pi}{2}$ and $\vec{F} = r^2\hat{i}$. (11)

7. (a) Evaluate $\iint_S \vec{F}.\hat{\eta}ds$, where $\vec{F} = yz\hat{i} + zx\hat{j} + xy\hat{k}$ over the surface of $x^2 + y^2 + z^2 = 1$ which lies in the first octant. (12)

(b) For Laplace transform, write following properties: First shifting, Second shifting, Scaling, Multiplication by powers of t, Division by t. Also state the convolution theorem for inverse Laplace transform. (10)

(c) Find the Laplace transform of $\frac{\sin at}{t}$. Does the transform of $\frac{\cos at}{t}$ exist? Justify. (13)

8. (a) Find Laplace transforms of: (i) $t^2\sin 2t$, (ii) $e^{-4t}\frac{\sin 3t}{t}$, (iii) Unit step function. (11)

(b) Find the inverse Laplace transforms of: (i) $\frac{s^2+3}{s(s^2+9)}$, (ii) $\frac{s}{s^2+4s+13}$, (iii) $\log\frac{s^2-1}{s^2}$. (15)

(c) Using the convolution theorem, find $L^{-1}\{\frac{s^2}{(s^2+1)(s^2+2)}\}$. (09)

Khulna University of Engineering & Technology
Department of Building Engineering & Construction Management
B. Sc. Engineering 2nd Year 1st Term Regular Examination, 2015
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, microeconomics and macroeconomics. (15)
   (b) What are the different ways that a society can answer the basic questions of an economics system? (10)
   (c) Discuss the importance of studying economics as a student of Building Engineering & Construction Management department. (10)

2. (a) What is demand elasticity? What are the determinants of demand elasticity? (13)
   (b) What is supply? Why is supplying curve upward to the right? (10)
   (c) What is supply function? Show the difference between supply schedule and supply curve. (12)

3. (a) What is indifference curve? Discuss the characteristics of indifference curve. (10)
   (b) Draw the cost curves for a typical farm for a given price. Explain how the competitive farm chooses the level of output that maximizes profit. (15)
   (c) Under what conditions will a farm shutdown temporarily? Explain. (10)

4. (a) Why it is desirable for a country to have large GDP? List four components of GDP. Give an example of each. (15)
   (b) Explain low higher saving leads to a higher standard of living. (10)
   (c) Explain the idea of demand pull and cost push inflation. (10)

Section – B

5. (a) What is accounting? Who uses accounting information? (10)
   (b) Describe the rules of debit and credit of accounts. (10)
   (c) Write down the various concepts of accounting. (15)

6. (a) How can use your accounting knowledge as a student of BECM? (10)
   (b) Luna Syed opened her own consulting farm, Syed consulting on May 1, 2015. The following transaction occurred during the month of May. (25)
   May 1, Luna invested Tk 80,000 cash in his farm.
   May 2, Paid Tk 8,000 for office rent for the month.
   May 3, Purchased Tk 5,000 of supplies on account.
   May 5, Paid Tk 500 to advertise in the country news.
   May 9, Received Tk 30,000 cash for services provided.
   May 12, Withdraw Tk 7,000 cash for personal use.
   May 15, Performed Tk 33,000 of services on account.
   May 17, Paid Tk 30,000 for employee salaries.

May 20, Paid for the supplies purchased on account on May 3.
May 23, Received a cash payment of Tk 20,000 for services provided on account on May 15.
May 26, Borrowed Tk 50,000 from the bank on a note payable.
May 29, Purchase office equipment for Tk 24,000 on account.
May 30, Paid Tk 1,500 for utilities.
Instructions: Journalize above the transactions in the book of Luna Syed.

7. (a) Define ledger. Describe the importance of ledger. (10)

(b) Fantasy Park was started on April 1, 2013 by C.J. Arman. The following transactions occurred during the month: (25)
2013 April 1, Arman invested Tk 5,00,000 cash in business.
April 4, Purchased land costing Tk 3,00,000 for cash.
April 8, Incurred advertising expense of Tk 18,000 on account.
April 11, Paid salaries to employee Tk 15,000.
April 12, Hired park manager at a salary of Tk 40,000 per month effective May 1.
April 13, Paid Tk 15,000 cash for one year insurance policy.
April 17, Withdraw Tk 6,000 cash for personal use.
April 20, Received Tk 57,000 in cash for admission fees.
April 30, Paid Tk 9,000 on balance owned for advertising incurred on April 8.
Instructions: Prepare necessary ledger accounts.

8. The trial balance of Kajals's construction service for the year ended April 30, 2015 is giving below: (35)

Kajal's Construction Service
Trial Balance as on 30 April, 2015

Account Titles	Debit (Tk)	Credit (Tk)
Cash	20,000	
Account Receivable	36,000	
Parts and Supplies	1,82,000	
Prepaid Insurance	10,800	
Lab Equipment	4,80,000	
Accumulated Depreciation Lab Equipment		1,20,000
Accounts Payable		40,000
Notes Payable		80,000
Kajol, Capital		4,11,200
Kajol, Drawing	4,34,000	
Service Revenue Earned		8,70,000
Wages Expense	2,07,600	
Rent Expense	96,000	
Utilities Expense	4,3,400	
Advertising Expense	9,800	
Miscellaneous Expense	1,600	
	15,21,400	15,21,400

Additional data: i) Parts and supplies on hand at April 30, 2015, amount to Tk 32,000.
ii) Wages payable for the period amount to Tk 6,400.
iii) Depreciation on equipment for the year amount to Tk. 30,000.
Instructions: a) Prepare a statement of comprehensive income for the year ending April 30, 2015.
b) Prepare an owner's equity statement for the year ending April 30, 2015.
c) Prepare a statement of financial position as at April 30, 2015.
