

Khulna University of Engineering & Technology
Department of Industrial Engineering and Management

B.Sc. Engineering 2nd Year 1st Term Regular Examination, 2019

ME 2111

Engineering Mechanics and Theory of Machines

Full Marks: 210

Time: 3 hrs

N.B: i) Answer any **THREE** questions from each section in separate scripts.
 ii) Figures in the right margin indicate full marks.
 iii) Assume reasonable data if missing any.

SECTION-A

1. (a) A crate is supported by three cables as shown in figure 1(a). Determine the weight W of the crate, knowing that the tension in cable AB is 1378 lb. 17

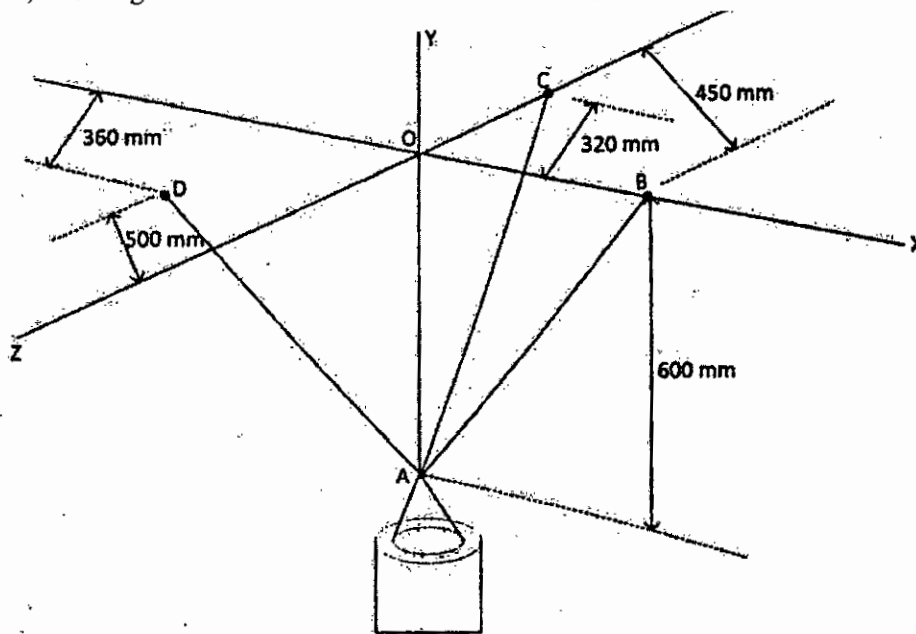


Figure 1(a)

- (b) The light bar AD is suspended from a cable BE and supports a 20 kg block at C. The extremities A and D of the bar are in contact with frictionless vertical walls. Determine the tension in cable BE and the reactions at A and D. 18

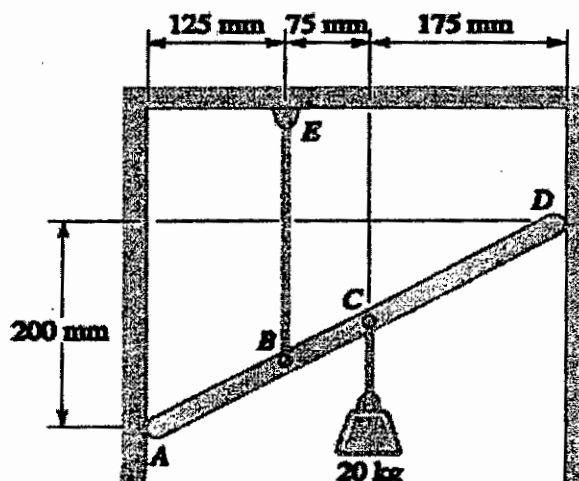


Figure 1(b)

2. (a) Determine the centroids of the area shown by integration

17

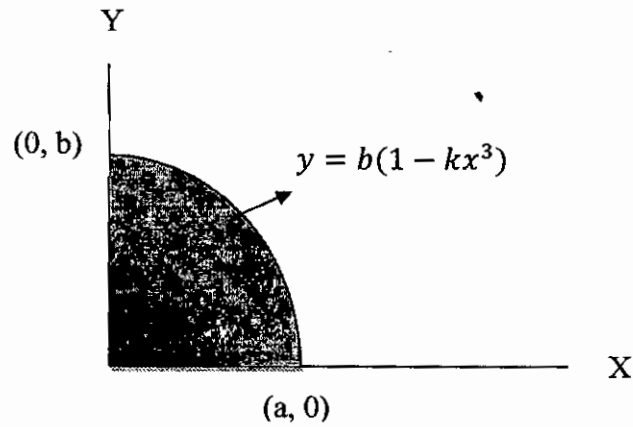


Figure 2(a)

- (b) State parallel axis theorem. Determine the moments of inertia of the shaded area shown in figure 2(b) with respect to X and Y axes when $a=20\text{mm}$.

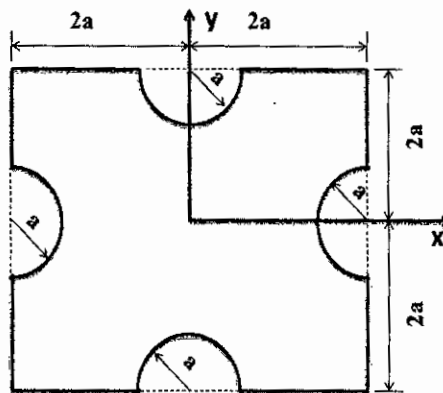


Figure 2 (b)

3. (a) Determine the components of all forces acting on member ABD of the frame shown in figure 3(a).

18

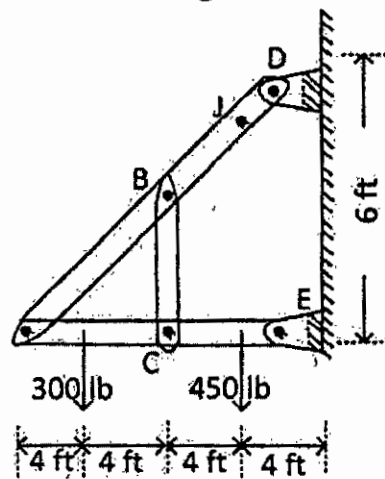


Figure 3(a)

- (b) Determine the force in members CE and DE of the truss shown in figure 3(b).

17

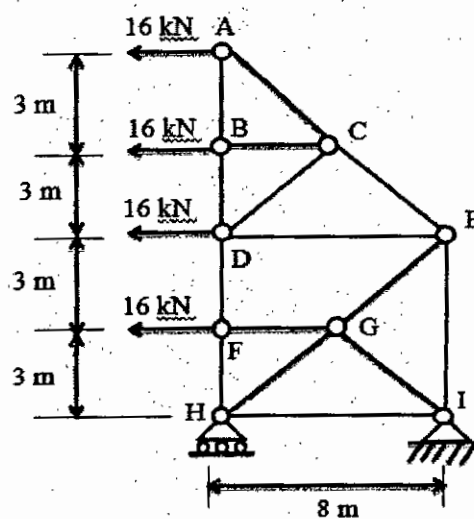


Figure 3(b)

4. (a) Two blocks are connected by a cable as shown in figure 4 (a). Determine the force Q 18
required to move the body towards left.

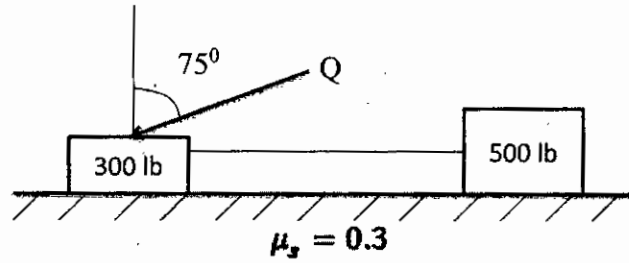


Figure 4(a)

- (b) A flat belt connects pulley A, which drives a machine tool, to pulley B, which is attached 17
to the shaft of an electric motor. The co-efficients of friction are $\mu_s=0.25$, $\mu_k=0.2$,
between both pulleys and the belt. Knowing that the maximum allowable tension in the
belt is 600-lb. Determine the largest torque which can be exerted by the belt on pulley A.

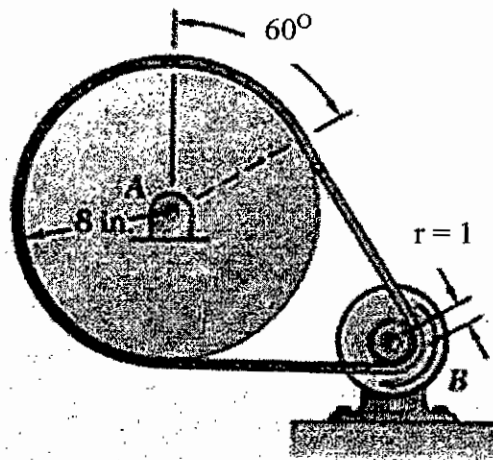


Figure 4(b)

SECTION-B

- 5 (a) The coefficients of friction between blocks A and C and the horizontal surfaces are $\mu_s=$ 18
 $=0.24$ and $\mu_k = 0.20$. Knowing that $m_A = 5$ kg, $m_B = 10$ kg, and $m_C = 10$ kg, determine i)
the tension in the cord, ii) the acceleration of each block.

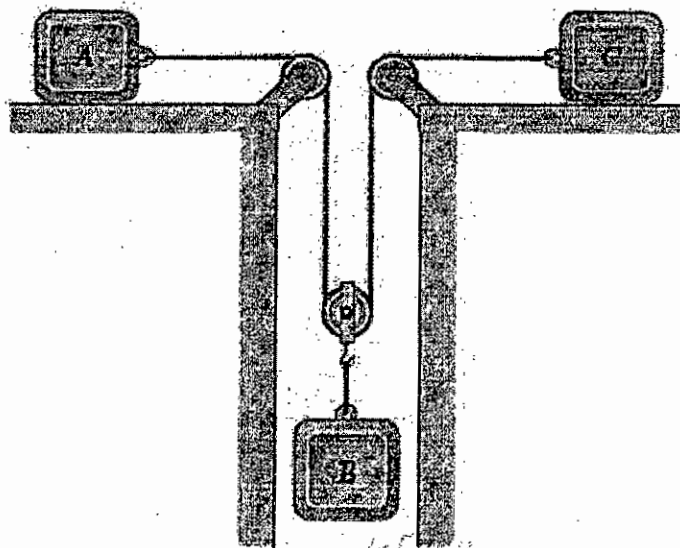


Figure 5(a)

- (b) A 20-lb collar slides without friction along a vertical rod as shown in figure 5 (b). The 17
spring attached to the collar has an undeformed length of 4 in. and a constant of 3 lb/in. If
the collar is released from the rest in position 1, determine its velocity after it has moved 6
in. to position 2.

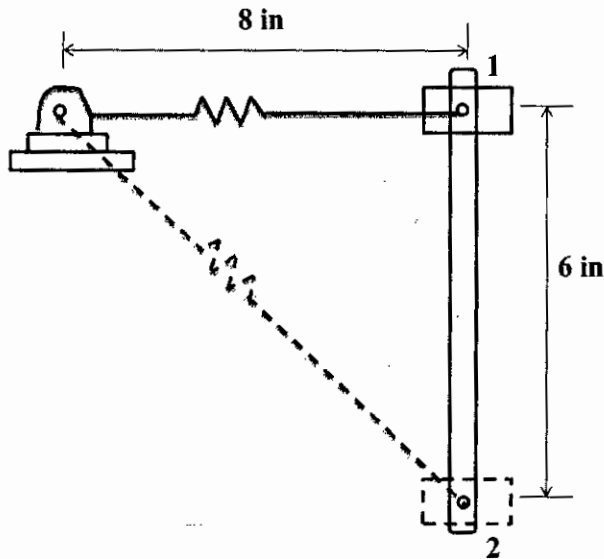


Figure 5 (b)

6. (a) Two small spheres A and B are made of different materials and have the weights indicated in figure 6(a). They are moving on a frictionless, horizontal surface with the velocities shown when they hit each other. Knowing that the coefficient of restitution between the spheres is $e=0.80$, determine i) The velocity of each sphere after impact. ii) The energy loss due to the impact. 17

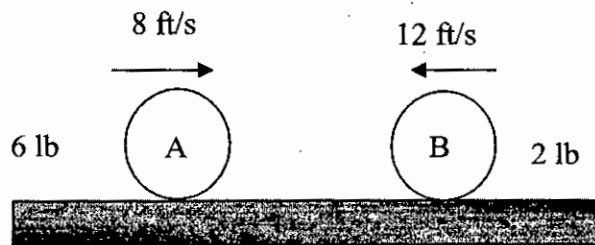


Figure 6(a)

- (b) A drum of 80-mm radius is attached to a disk of 160-mm radius. The disk and drum have a combined mass of 5 kg and combined radius of gyration of 120 mm. A cord is attached as shown in figure 6(b) and pulled with a force P of magnitude 18 N. Knowing $\mu_s=0.20$ and $\mu_k=0.15$, determine i) Whether or not the disk slides, ii) The angular acceleration of the disk and the acceleration of G . 18

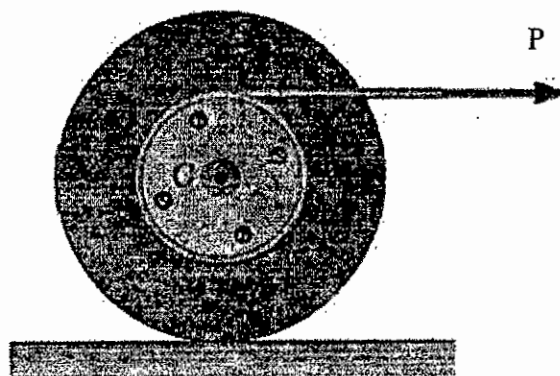


Figure 6(b)

7. (a) The 10 lb slender rod AB is welded to the 6 lb uniform disk which rotates about a pivot at A. A spring of constant 0.625 lb/in is attached to the disk and is unstretched when rod AB is horizontal. Determine the required angular velocity of the assembly when it is in the position shown in the following figure 7(a), if its angular velocity is to be 8 rad/s, after it has rotated through 90° clockwise. 17

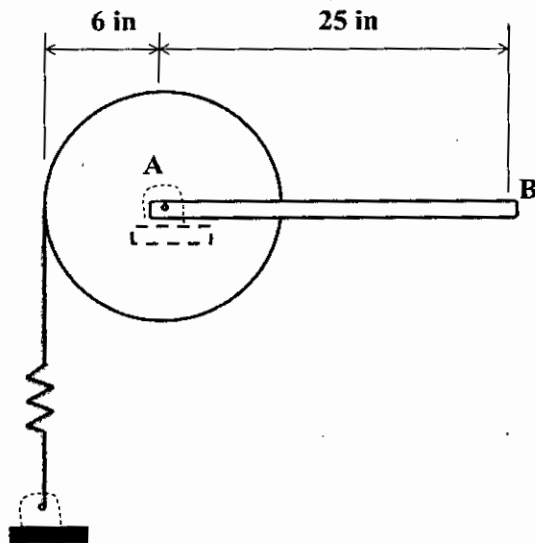


Fig. 7 (a)

- (b) A shaft carries four masses A, B, C and D of magnitude 200 kg, 300 kg, 400 kg and 200 kg respectively and revolving at radii 80 mm, 70 mm, 60 mm and 80 mm in planes measured from A at 300 mm, 400 mm and 700 mm. The angles between the cranks measured anticlockwise are A to B 45° , B to C 70° and C to D 120° . The balancing masses are to be placed in planes X and Y. The distance between the planes A and X is 100 mm, between X and Y is 400 mm and between Y and D is 200 mm. If the balancing masses revolve at a radius of 100 mm, find their magnitudes and angular positions. 18
8. (a) Define: Critical Speed, Viscous Damping, Damping Ratio, and Logarithmic Decrement. 08
- (b) Show that the critical speed of a shaft is same as the natural frequency of free transverse vibration. 15
- (c) The moments on a mechanical vibrating system show that it has a mass of 8 kg and that the springs can be combined to give an equivalent spring of stiffness 5.4 N/m. if the vibrating system has dashpot attached which exerts a force of 40 N when the mass has a velocity of 1 m/s, find i) Critical damping co-efficient ii) Damping factor iii) Logarithmic decrement, and iv) Ratio of two consecutive amplitudes. 12

Khulna University of Engineering & Technology
Department of Industrial Engineering and Management
 B.Sc. Engineering 2nd Year 1st Term Regular Examination, 2019
MATH 2111
 Mathematics-III

Full Marks: 210

Time: 3 hrs

N.B: i) Answer any **THREE** questions from each section in separate scripts.
 ii) Figures in the right margin indicate full marks.
 iii) Assume reasonable data if missing any.

SECTION-A

1. (a) Define with examples: i) Order and degree of a differential equation ii) Linear and non linear differential equations and iii) General solution and particular solution of a differential equation. 12
- (b) Formulate the differential equation from the relation $y = c_1 e^{2x} + c_2 e^{-x} + x^2$ by eliminating arbitrary constants c_1 and c_2 . 10
- (c) Solve the initial value problem (IVP): $x^2 \frac{dy}{dx} - 2xy = 3y^4$; $y(1) = \frac{1}{2}$ 13
2. Solve the following differential equations:
 - (a) $\frac{dy}{dx} = \cos(x + y)$; $y(0) = \frac{\pi}{4}$ 11
 - (b) $(x^3 + y^2 \sqrt{x^2 + y^2}) dx - xy \sqrt{x^2 + y^2} dy = 0$ 12
 - (c) $(3x^2 y^4 + 2xy) dx + (2x^3 y^3 - x^2) dy = 0$ 12
3. (a) Solve $(D^2 - 2D + 10)y = e^{-x} \cos 3x + x^2$ 12
- (b) Solve $(D^2 - 1)y = x \sin x + (1 + x^2)e^x$ 11
- (c) Solve $(D^2 - 2D + 1)y = e^x \log x$ by the method of variation of parameters. 12
4. (a) Find Laplace transform of i) $e^{-t} \sin \pi t$ and ii) $f(t) = \begin{cases} \cos t, & 0 \leq t < \pi \\ 0, & t > \pi \end{cases}$. 12
- (b) Find inverse Laplace transform: $G(s) = \left\{ \frac{2s-4}{(s^2+s)(s^2+1)} \right\}$ and $\left\{ \frac{e^{-s}}{s(s+1)} \right\}$. 10
- (c) Solve the IVP using Laplace transforms: $y'' + 4y' + 6y = 1 + e^{-t}$ 13
- Subject to $y(0) = 0, y'(0) = 0$

SECTION-B

5. (a) Define single valued and multiple valued functions with examples. Find all the values of z which satisfy $z - \frac{1}{z} = 2i$. 10
- (b) Show that $\lim_{z \rightarrow 0} \frac{z}{z}$ does not exist. Also use C-R equations show that $f(z) = \frac{1}{z}, z \neq 0$ is analytic at all points except at the point $z = 0$. 12
- (c) State Laurent's theorem and obtain the Laurent's series expansion of the function $f(z) = \frac{1}{z(z-2)^2}$ in the region valid for $0 < |z| < 2$. 13
6. (a) Obtain Taylor's series of $\ln(2 + iz)$ about $z = i$. 10
- (b) State Cauchy's integral formula and evaluate $\int_C \frac{dz}{z}$, where C is the semi-circular arc of $|z| = 3$ above the real axis. 12
- (c) Evaluate $\oint_C \frac{z^2 - z - 2}{z(z^2 + 1)} dz$, where C is a rectangle with vertices at $\pm 2 + 2i, \pm 2 - \frac{i}{2}$. 13
7. (a) Graphically represents $3 < |z - 3 + 4i| \leq 4$ in the argand diagram. 07
- (b) Using Cauchy's residue theorem compute $\oint_C \frac{\cos z}{z^2(z-\pi)^3} dz$, where C is the circle $|z| = 5$. 15
- (c) Verify that $v(x, y) = e^{x^2 - y^2} \cos 2xy$ is harmonic in an appropriate domain D . Also find its harmonic conjugate v and find analytic function $f(z) = u + iv$ satisfying $f(0) = 1$. 13
8. (a) Define contour with an example. 05
- (b) Evaluate the integrals using contour integration: 30

- i) $\int_{-\infty}^{\infty} \frac{dx}{(x^4 + 5x^2 + 4)^2}$
- ii) $\int_0^{2\pi} \frac{\cos^2 2\theta}{5 + 4 \cos 2\theta} d\theta$

Khulna University of Engineering & Technology
Department of Industrial Engineering and Management

B.Sc. Engineering 2nd Year 1st Term Examination, 2019

CSE 2111

Data Structures and Algorithms

Full Marks: 210

Time: 03 hrs

- N.B:** i) Answer any **THREE** questions from each section in separate scripts.
ii) Figures in the right margin indicate full marks.
iii) Assume reasonable data if missing any.

SECTION-A

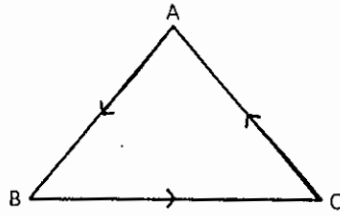
1. (a) What is meant by data structure? Explain the purposes of learning data structure. 10
(b) What are the basic differences between dynamic and static memory allocation? 08
(c) How can you represent a linear array in terms of memory? Explain. 07
(d) Write an algorithm to insert an element into a specific position in an array. 10
2. (a) Why sorting is used? Explain the space and time complexity of sorting algorithms? 08
(b) Perform quick sort operation for the following data items. 15
12, 7, 25, 18, 3, 10, 30, 5, 17
(c) Write down the binary search algorithm and calculate its complexity. 12
3. (a) Explain priority queue and tree. 08
(b) Define garbage collection, overflow and underflow with example. 11
(c) Using bubble sort algorithm, find out the number of comparisons (C) and the number of interchanges (D) which alphabetize the n=6 letters in "PEOPLE". 16
4. (a) What is linked list? "Insertion and deletion in array is more costly than linked list"- justify the statement. 10
(b) What is the difference between one-way and two-way linked list? Write an algorithm to delete an element from any position of a one-way linked list. 15
(c) Briefly describe the concept of circular linked list with proper example. 10

SECTION-B

5. (a) Between insertion sort and selection sort algorithm which one can take the advantages of having sorted sub-array into the array to be sorted? Explain with example. 12
(b) Explain the linked representation of binary tree with figure. 12
(c) Construct a binary search tree by using the following items: 11
45, 80, 40, 15, 50, 75, 20, 12, 27, 38, 55, 65, 23, 82
6. (a) Draw the tree from the following traversing. 12
Pre-order: A B D E F C G H J L K
In-order: D B F E A G C L J H K
(b) What is meant by heap? Differentiate between max heap and min heap with proper example(s). 10
(c) What is recursion? What are the basic properties of a recursive function? Explain with the help of factorial function. 13

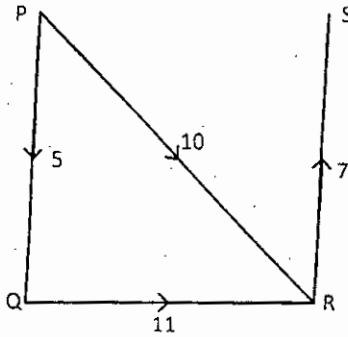
7. (a) Define graph. How a graph is maintained in the memory using adjacency matrix?
 (b) Find the path matrix.

11
12



- (c) Find the shortest path.

13



8. (a) What is hashing? What are the principle criteria for selecting hash function?
 (b) Keys: 1010, 1011,, 1049.
 Addresses: 25000, 25001,, 25050.
 Find the hash function and test the function with some keys.
 (c) What is collision? Mention the collision resolution tolls. Discuss chaining.

10
12
13

Khulna University of Engineering & Technology
Department of Industrial Engineering and Management

B.Sc. Engineering 2nd Year 1st Term Examination, 2019

HUM 2111

Financial, Cost and Management Accounting

Full Marks: 210

Time: 3hrs

- N.B:** i) Answer any *THREE* questions from each section in separate scripts.
ii) Figures in the right margin indicate full marks.
iii) Assume reasonable data if missing any.

SECTION-A

- | | | |
|----|--|----|
| 1. | (a) Define is Accounting? Discuss the objectives of Accounting. | 10 |
| | (b) Who are the users of accounting information? What are the information needs of the different types of users? | 10 |
| | (c) Define transaction. Discuss the characteristics of transaction. | 10 |
| | (d) Describe the rules for determining Debit and by using Accounting equation and golden rules. | 05 |

2. On April 1, 2018, Mr. Haque established HAQUE TRAVEL AGENCY. The following transactions were completed during the month: 35

- | | |
|-----------------|---|
| 2018, April -1 | Invested Tk. 1,00,000 cash to start the agency. |
| 2018, April -2 | Paid Tk. 4,000 cash for April office rent. |
| 2018, April -3 | Purchased office equipment for Tk. 25,000 cash. |
| 2018, April- 4 | Incurred the Tk. 3,000 of advertising cost in the Daily Ittefaq on account. |
| 2018, April -5 | Paid Tk. 6,000 cash for office supplies. |
| 2018, April- 6 | Earned Tk. 75,000 for services rendered Tk. 10,000 cash is received from customers and the balance of Tk. 65,000 is billed to customers on account. |
| 2018, April -7 | Withdraw Tk. 2,000 cash for personal use. |
| 2018, April -8 | Paid Daily Ittefaq amount due in transaction (4). |
| 2018, April -9 | Paid employees salaries Tk. 22,000. |
| 2018, April -10 | Received Tk. 50,000 in cash from customers who have previously been billed in transaction (6). |

Instructions: i) Prepare a tabular analysis of the transactions using the following column headings: Cash; Account Receivable; Supplies; Office Equipment; Account Payable; Mr. Haque Capital.

ii) Journalise above the transactions in the book of Mr. Haque.

3. (a) Khulna park was started on July 1, 2015 by Mr. C.J. Arman. The following selected events and transactions occurred during the month: 25

- | | |
|---------------|--|
| 2015, July-1 | Arman invested Tk. 500,000 cash to start the park. |
| 2015, July-2 | Purchased land costing Tk. 3,00,000 for cash. |
| 2015, July-8 | Incurred advertising expense of Tk. 18,000 on account. |
| 2015, July-10 | Hired park manager at a salary of Tk. 25,000 per month, effective, August-1. |
| 2015, July-15 | Paid Tk. 15,000 cash for one year insurance policy. |
| 2015, July-20 | Received Tk. 57,000 in cash for entrance fees. |
| 2015, July-25 | Paid Tk. 18,000 on balance owed for advertising incurred on July 8. |

Required: Prepare necessary ledger accounts (Arman uses the following accounts: Cash; Prepaid Insurance; Land; Accounts Payable; Entrance fees; Advertisement; Arman, Capital).

- (b) Define adjustment entries. Describe the objectives of adjustment entries. 10

4. The following particulars are extracted from the book of M/s. Moon services relating to the year ended December 31, 2018: 35

M/s MOON SERVICES		
Trial Balance as on December 31, 2018		
Account Titles	Debit(Tk.)	Credit(Tk.)
Cash	1,00,000	
Account receivable	55,000	
Prepaid Insurance	45,000	
Supplies	30,000	
Office furniture	1,00,000	
Advertisement expense	20,000	
Accumulated depreciation furniture		10,000
Accounts payable		15,000
Moon's Capital		200,000
Drawings	40,000	
Services revenue		3,30,000
Salaries expense	1,20,000	
Rent expense	45,000	
Miscellaneous expense	20,000	
	5,75,000	5,75,000

Additional Information:

- Supplies on hand on 31st December, 2018 Tk. 7,500.
- The balance in the prepaid insurance account represents the cost of a five years policy from 1st January 2018 through December 31, 2022.
- Salaries unpaid Tk. 5,000.
- Depreciation expense for the year on the office furniture is Tk. 7,500.

Required:

- Prepare a statement of comprehensive income for the year ended December 31, 2018.
- Prepare owner's equity statement and
- Prepare a statement of financial position as on December 31, 2018

SECTION-B

5. (a) What is statement of cost? Why and how is it prepared? 10
 (b) From the flowing information of Padma manufacturing, you are required to prepare a cost sheet. Showing cost of raw materials used; Prime cost; Works cost; Cost of goods manufactured; Cost of goods sold; Total cost and sales: 25

	Inventories at beginning	Inventories at end
	Tk.	Tk.
Raw materials	48,400	36,000
Work-in -progress	40,800	30,400
Finished goods	52,000	60,000
Direct wages.....Tk.	76,800	
Raw materials purchased ... Tk.	1,25,600	
Factory overhead: 2/3 rd of direct wages.		
Administrative overhead: 20% works cost.		
Selling and distribution overhead: 5% of sales.		
Profit: 15% of sales.		

6. (a) What are materials? Show the difference between FIFO and LIFO methods. 08
 (b) Sun flower manufacturing Co. follows the FIFO method. The following particulars are available in respect of raw materials during the month of July: 27

July 01: Balance 3,400 units @ Tk. 10.40

Purchases during the month:

- July 04: 2,300 units @ 10.00;
 July 14: 2,000 units @ 11.00;
 July 21: 2,200 units @ 10.60;

July 24: 2,400 units @ 10.80

The same quantity of raw materials was issued at the end of each week. The first issue during the month was made on the 2nd July. The stock on hand at the end of the month was 3,000 units. There was no loss in storage.

Required: Prepare Store ledger account. (Necessary workings be must shown)

7. (a) Describe the elements of gross earning and deduction of payroll register. 10
 (b) Following information for three office assistants of Eastern Enterprise relating salaries for the month of November, 2018: 25

Particulars	Name of the employees		
	Alam	Bashir	John
Basic Salaries (Tk.)	15,000	12,000	10,000
House rent (% of basic salaries)	50%	50%	50%
Medical allowance (Tk.)	1,000	1,000	1,000
Charge allowance (Tk.)	2,000	-	-
Conveyance allowance (Tk.)	800	800	800
Employees contribution to provident fund	10%	10%	10%
Subscription to joint life policy	2%	2%	2%
Subscription to welfare fund (Tk.)	200	100	100
Overtime (hours)	20	25	30

During the month, normal working hours were 200 hours. Overtime allowance was $1\frac{1}{2}$ of the basic salary per hour. Deduct from Mr. John for computer loan yearly amount Tk. 4,800 and Mr. Bashir enjoy 2 days leave without salary.

Instruction: i) Prepare payroll register for the month of November, 2018. ii) Give payroll journal entries.

8. (a) What do you mean by budget? 03
 (b) Show the various types of budget. 08
 (c) The following information of Meghna Company Ltd. for the month of January to March, 2019. Expected purchase and sales are given below: 24

Months	Purchases, Tk.	Sales, Tk.
December, 2018	96,000	1,20,000
January, 2019	1,40,000	80,000
February, 2019	1,50,000	90,000
March, 2019	1,70,000	1,00,000

40% of the sales are on credit. Cash on 50% of the credit sales will be collected in the month of sales and other 50% will be collected in the next month. Purchases are all for cash. Salaries to be paid are Tk. 10,000 per month. Balance at bank on January 01, are Tk. 16,000. It has been decided by the management that in case of deficit of funds in any month within the limit of Tk. 60,000, the deficiency can be met by making arrangement of overdrawing the account in the bank. But if the deficiency exceeds Tk. 60,000, long term loan will be arranged.

Instruction: Prepare a cash budget for the month of January to March, 2019 under Receipts and Payments method.

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 B.Sc. Engineering 2nd Year 1st Term Regular Examination, 2019
EEE 2111
 Electrical Circuits and Machines

Full Marks: 210

Time: 3 hrs

N.B: i) Answer any *THREE* questions from each section in separate scripts.
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SECTION-A

1. (a) State and explain Ohm's law, KVL and KCL. Define Branch, node and Mesh. 12
- (b) Deduce the condition for which maximum power will be transformed from source to load. 10
- (c) State and explain superposition theorem. Using the theorem, find the current through $10\ \Omega$ resistance of the circuit shown in figure 1(c). 13

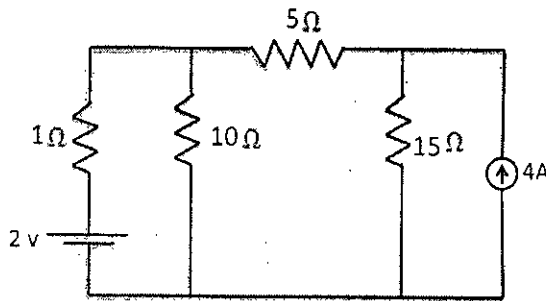


Figure 1(c)

2. (a) Find all branch currents using nodal analysis of figure 2(a) 13

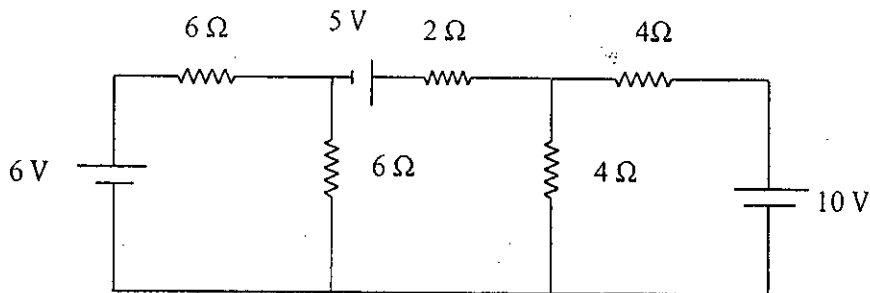


Figure 2(a)

- (b) State and explain Thevenin's theorem. Find Thevenin's equivalent circuit for the network shown in figure 2(b) for the terminal AB. 12

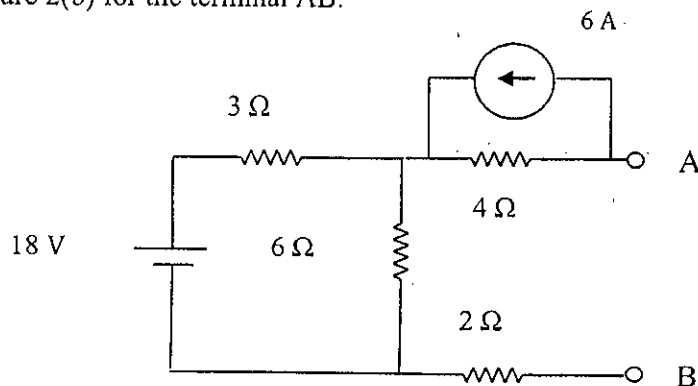


Figure 2(b)

- (c) Find the current I_0 of the network shown in figure 2 (c) by using Y/Δ conversion. 10

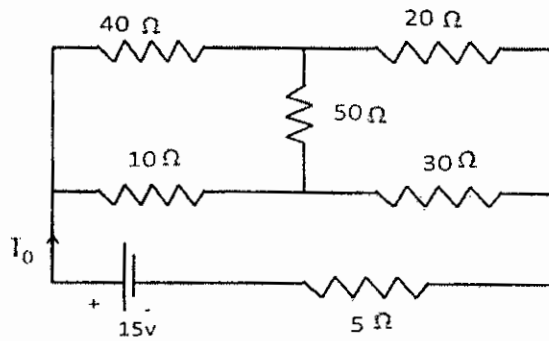


Figure 2(c)

3. (a) Write down generator action. Classify DC generators according to the way in which their fields are excited. 05
- (b) Why does the terminal voltage of a DC shunt generator decrease with the increase of the load applied to it? 10
- (c) Illustrate various power stages of DC generator. Prove that the overall efficiency of a DC generator is the product of mechanical efficiency and electrical efficiency. 10
- (d) A shunt generator delivers 195 A at terminal voltage of 250 V. The armature, and shunt field resistances are 0.02Ω and 50Ω respectively. The iron and friction losses are equal to 950 W. Find i) e.m.f generated ii) Cu losses iii) Output of the prime mover iv) Commercial, mechanical and electrical efficiencies. 10
4. (a) What is back e.m.f? Write down its significance. 10
- (b) Show that speed of a DC motor depends on flux/pole, resistance of the armature and applied voltage. How can you control the speed of a DC shunt motor with flux control method? 15
- (c) A 25 KW, 250 V DC shunt machine has armature, and field resistances of 0.06Ω and 100Ω respectively. Determine the total armature power developed when i) working as a generator delivering 25 KW output ii) working as a motor taking 25 KW input. 10

SECTION-B

5. (a) What is phase? Find the angle of phase difference between $v = 100 \cos(\omega t - 30^\circ)$ and $i = -10 \sin(\omega t - 60^\circ)$. Which wave lags? 05
- (b) Define impedance. Find the impedance of an L branch from its dynamic equilibrium equation. 10
- (c) A voltage $v = -150 \sin^{377t}$ is applied to a particular circuit element and it is found $i = 10 \cos^{377t}$ amp. Make sketch of v and i waves. Find the method and magnitude of the circuit parameter. 10
- (d) Define phasor. Write the significance of j. Express as a single number of the expression $\sqrt[3]{4.5 - j7.79 + \log_e 10} < 172$ 10
6. (a) Find the equation for energy delivered to an inductor and to a capacitor during a quarter cycle. 12
- (b) Deduce the value of crest factor and form factor of sinusoidal waves. 07
- (c) Calculate real power and reactive power employing complex forms. 07
- (d) Find the equation of instantaneous power delivered to R-L branch and from the equation define real power and reactive power. Represent the power graphically. 09
7. (a) Derive the e.m.f equation of a transformer and prove that e.m.f/turn is same in both primary and secondary windings of a transformer. 10
- (b) Draw the vector diagrams for a loaded transformer when the load is inductive, capacitive and resistive. 10
- (c) Describe short circuit and open circuit test of a single phase transformer. 15
8. (a) Show that a rotating magnetic flux of constant magnitude is produced when three phase windings of stator of an induction motor is fed by three phase currents? 15
- (b) Why does rotor of an induction motor rotate? 10
- (c) A 4-pole 3-phase induction motor operates from a supply whose frequency is 50 Hz. Calculate i) The speed at which the magnetic field of the stator is rotating. 10
ii) The speed of the rotor when slip is 0.04.
iii) The frequency of the rotor currents when the slip is 0.03.
iv) The frequency of the rotor currents at stand still.

