

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

B.Sc. Engineering 2nd Year 1st Term Examination, 2018

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) Explain external and internal forces acting on rigid bodies. 05
 (b) A light bar AD is suspended from a cable BE and supports a 20 kg block at C shown in figure 1 (b). 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. 14

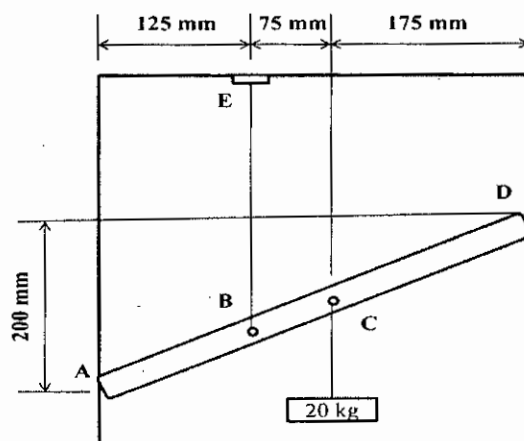


Fig. 1 (b)

- (c) A uniform rod AB of length $2R$ and weight W inside a hemispherical bowl of radius R as shown in figure 1 (c). Neglecting friction, determine the angle θ , corresponding to equilibrium. 16

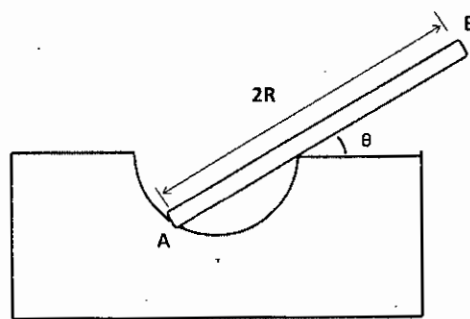


Fig. 1 (c)

2. (a) Determine by the direct integration the x co-ordinate and y coordinate of the centroid of the area shown in figure 2 (a). 18

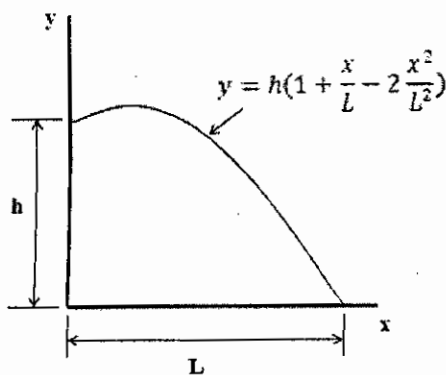
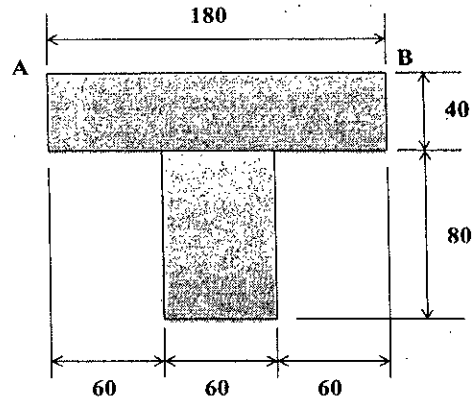


Fig. 2 (a)

- (b) Determine the moment of inertia \bar{I}_x and \bar{I}_y of the area shown in fig. 2 (b) with respect to centroidal axes respectively parallel and perpendicular to the side AB. 17



Dimensions are in mm.

Fig. 2 (b)

3. (a) Using the method of joints, determine the force in each member of the truss shown in figure 3 (a). 18

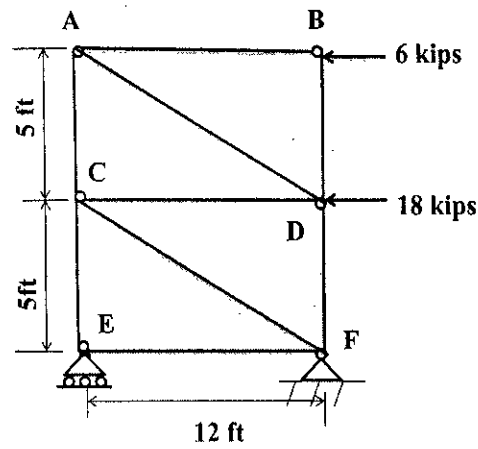


Fig. 3 (a)

- (b) Determine the components of the forces acting on each member of the frame shown in figure 3 (b). 17

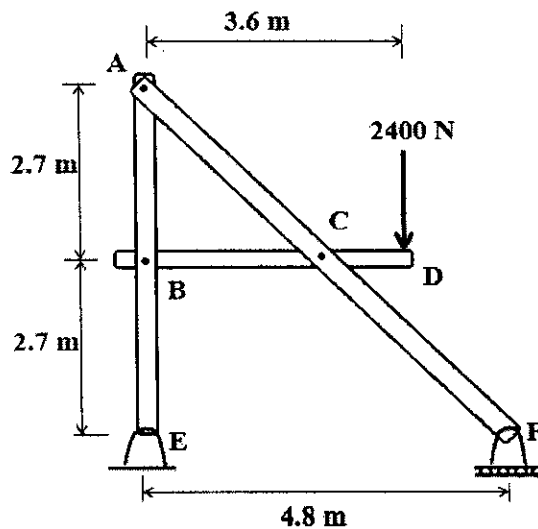


Fig. 3 (b)

4. (a) Two blocks are connected by a cable as shown in figure 4 (b). Determine the force Q required to move the body towards left. 17

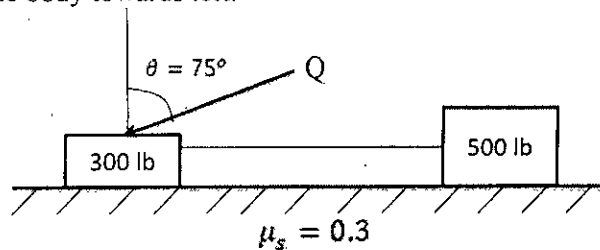


Fig. 4 (a)

- (b) A cam is to give the following motion to a knife-edged follower.
- Outstroke during 60° of cam rotation.
 - Dwell for the next 30°
 - Return stroke 60°
 - Dwell for the next 210°

18

Stroke of the follower 40mm and minimum radius of the cam is 50mm. Determine the axis of the follower passes through the axis of the cam shaft.

SECTION-B

5. (a) The two blocks shown in figure 5 (a) are originally at rest. Neglecting the masses of the pulleys and the effect of friction in the pulleys and between block A and the incline, determine (i) The acceleration of each block (ii) The tension in the cable. 17

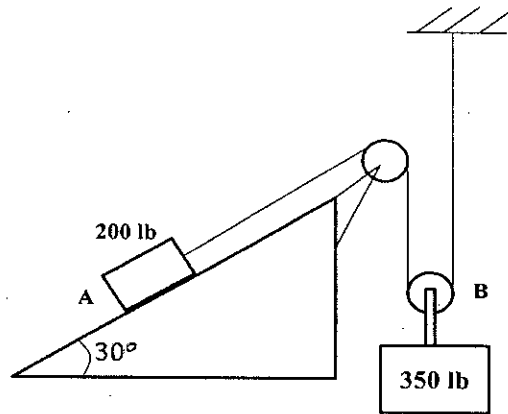


Fig. 5 (a)

- (b) Two blocks A and B of mass 5 kg and 6 kg respectively are connected by a cord which passes over pulleys as shown in figure 5 (b). A collar C of mass 4 kg is placed on block A and the system is released from rest. After the blocks have moved through 0.9 m collar C is removed and the blocks continue to move. Determine the velocity of block A just before it strikes the ground. 18

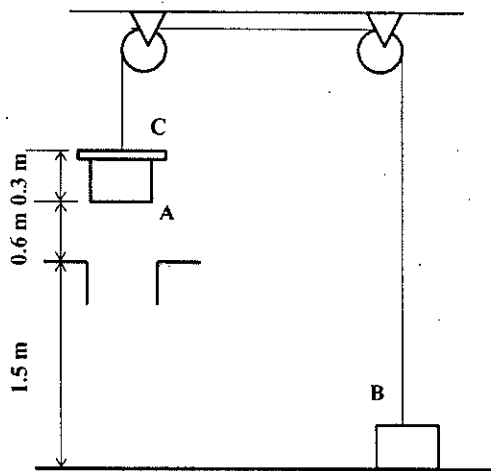


Fig. 5 (b)

6. (a) Define direct central impact. For perfectly plastic direct central impact, shows that the total kinetic energy of the system remained conserved. 18
- (b) The system shown in figure 6 (b) is initially at rest. Neglecting friction, determine (i) The force P required if the velocity of collar B is to be 5 m/s after 2s. (ii) The corresponding tension in the cable. 17

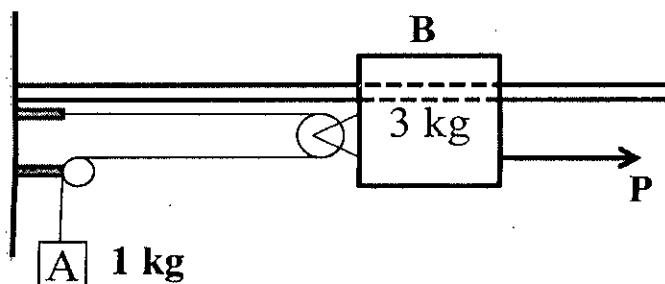


Fig. 6 (b)

7. (a) A uniform rod BC of mass 3 kg is connected to a collar A by a 0.2 m cord AB shown in figure 7 (a). Neglecting the mass of the collar and cord, determine (i) The smallest constant acceleration a_A , for which the cord and the rod lie in a straight line, (ii) The corresponding tension in the cord. 118

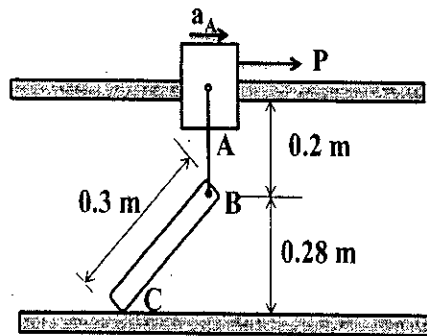


Fig. 7 (a)

- (b) A wheel of radius r and centroidal radius of gyration \bar{k} is placed on an incline and released from rest at time $t = 0$. Assuming that the wheel rolls without slipping, determine, (i) The velocity of the center at time t (ii) The co-efficient of static friction required to prevent slipping. 117

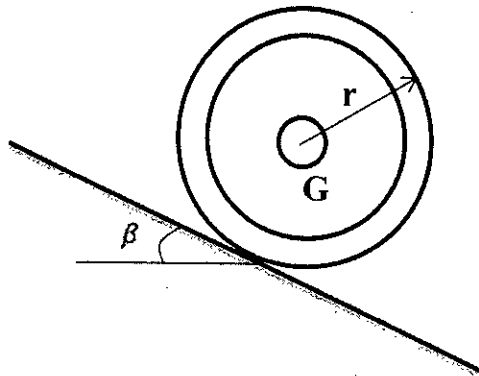


Fig. 7 (b)

8. (a) Define longitudinal vibration. Derive an expression for the natural frequency of the free longitudinal vibrations by equilibrium method. 115
- (b) Four mass A, B, C and D as shown below are to be completely balanced. 20

	A	B	C	D
Mass (kg)	-	30	50	40
Radius (mm)	180	240	120	150

The planes containing mass B and C are 300 mm apart. The angle between planes containing B and C is 90° . B and C make angles of 210° and 120° respectively with D in the same sense. Find

- i) The magnitude and the angular position of mass A.
- ii) The positions of planes A and D.

Khulna University of Engineering & Technology
Department of Industrial Engineering and Management
 B.Sc. Engineering 2nd Year 1st Term Examination, 2018
MATH 2111
 Mathematics-III

Full Marks: 210

Time: 3 hrs

- N.B:** i) Answer any **THREE** questions from each section in separate scripts.
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 iii) Assume reasonable data if missing any.

SECTION-A

1. (a) Describe the region determined by the following relation: $R_e\left(\frac{1}{z}\right) < 1$ 10
 (b) Examine the validity of limit of $f(z) = \frac{\bar{z}}{z}$ at origin. 10
 (c) Verify (i) Continuity, (ii) C. R. equations and Differentiability of the following 15
 function at $Z = 0$.

$$f(z) = \begin{cases} \frac{(x^3 - 3xy^2) + i(y^3 - 3x^2y)}{x^2 + y^2}; & \text{when } z \neq 0 \\ 0; & \text{when } z = 0 \end{cases}$$

2. (a) Define: singular point, removable singular point, pole and essential singular point 16
 with example.
 (b) State Cauchy's theorem and evaluate the integral $\oint_C \frac{dz}{z(z^2+9)}$, where C is the square 11
 bounded by $x = \pm 2$ and $y = \pm 2$.
 (c) Evaluate the following integral along C as described $\oint_C \frac{\sin \pi z^2 + \cos \pi z^2}{(z-1)(z-2)} dz$, where 08
 C is the circle $|z| = 3$.

3. (a) Find Laurent's expansion of $f(z) = \frac{z-1}{(z+2)(z+3)}$; 12
 (i) $|z| < 2$ (ii) $2 < |z| < 3$ (iii) $|z| > 3$
 (b) Define residue of a function $f(z)$. Find residue of the function $f(z) = \frac{z^4}{z^2+a^2}$. 10
 (c) Prove that $u = 2x(1-y)$ is harmonic. Find a function v such that $f(z) = u + iv$ 13
 is analytic. Express $f(z)$ in terms of Z .

4. Evaluate any two of the followings by contour integration: 35
 (a) $\int_0^\pi \frac{a \, d\theta}{a^2 + \sin^2 \theta}, a > 0$
 (b) $\int_0^\infty \frac{dx}{x^4+1}$
 (c) $\int_0^\infty \frac{x^{m-1}}{1+x} dx; 0 < m < 1$

SECTION-B

5. (a) Define order; degree; general solution and particular solution of a differential 10
 equation.
 (b) From the differential equation by eliminating arbitrary constants, $xy = ae^x +$ 15
 Be^{-x} . Hence write the order, degree and solution of the obtained equation.
 (c) Solve $\frac{dy}{dx} = (4x + y + 1)^2; y(0) = 1$ 10

6. Solve any three of the following differential equations (where $D = \frac{d}{dx}$) 35
- (a) $(D^2 - 2D)y = e^x \sin x$
 (b) $(D^2 + 1)y = \sin 3x \cos x$
 (c) $(D^2 - 4D + 4)y = x^3$
 (d) $(D^2 + 1)y = x \sin x$
7. (a) Solve by using the variation of parameter method: $\frac{d^2y}{dx^2} + 4y = 4 \tan 2x$ 12
 (b) Solve the following PDE by separation of variables: $\frac{\partial U}{\partial x} = 4 \frac{\partial U}{\partial y}$; $U(0, y) = 8e^{-3y}$ 13
 (c) Solve the following differential equation: $\frac{dy}{dx} + y \cot x = 5e^{\cos x}$ 10
8. (a) Find the Laplace transform of 12
- (i) t^n (ii) $e^{at} \sin bt$ (iii) $\cosh bt$
- (b) Evaluate $L^{-1} \left\{ \frac{1}{s^2(s+1)^2} \right\}$ 11
- (c) Using Laplace transformation, solve: $Y'' + 2Y' + 5Y = e^{-t} \sin t$ 12

Khulna University of Engineering & Technology
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B.Sc. Engineering 2nd Year 1st Term Examination, 2018

CSE 2111

Data Structures and Algorithms

Full Marks: 210

Time: 3 hrs

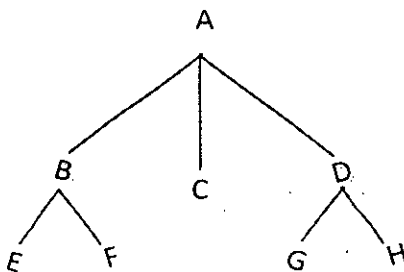
- N.B:** i) Answer any *THREE* questions from each section in separate scripts.
ii) Figures in the right margin indicate full marks.
iii) Assume reasonable data if missing any.

SECTION-A

1. (a) Define data structures? What are the objectives of studying data structures? 10
(b) What is the difference between linear and non-linear data structures? 06
(c) What is meant by dynamic memory allocation? Explain with an example. 07
(d) Write an algorithm to delete a specific element from a linear array. 12
2. (a) Define complexity of an algorithm. Explain the complexity for binary search algorithm. 08
(b) Write down the bubble sort algorithm and calculate its complexity for worst case and average case. 15
(c) What is string? Write an algorithm to reverse a string. 12
3. (a) Define stacks and queues with proper examples. 06
(b) Explain deletion operation for queue with algorithm. 10
(c) Consider the following infix expression: $Q: A + (B * C - D \uparrow (E - F) + G) * H$ 12
Transform the above expression into its equivalent postfix expression P.
(d) What is dequeue? Explain with example. 07
4. (a) What is linked list? State the differences between array and linked list. 10
(b) Write down the basic operations carried out in a linked list. 05
(c) Write an algorithm to delete a node from a two-way linked list. 12
(d) Write an algorithm to traverse a circular linked list. 08

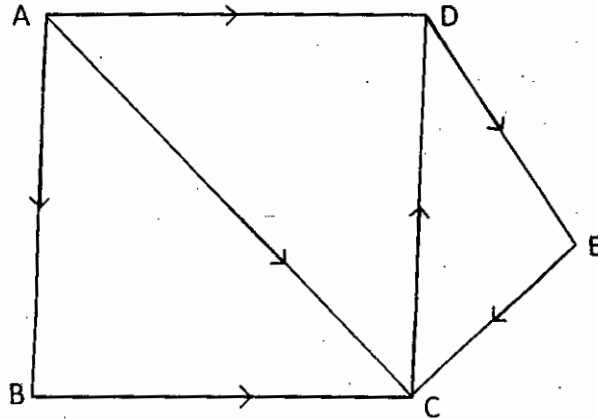
SECTION-B

5. (a) What is binary search tree (BST)? Explain the uses of BST with an example. 08
(b) Demonstrate the link representation of the following tree. 13

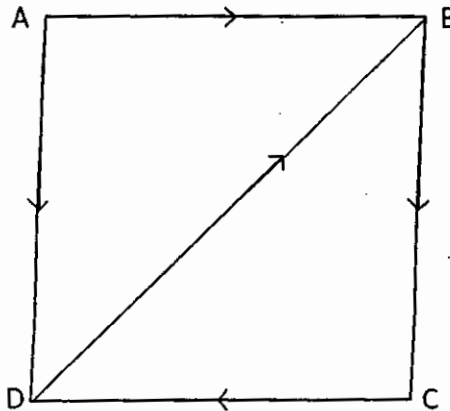


- (c) Draw a tree from the following traversal. 14
Pre-order: F B A D C E G I H
In-order: A B C D E F G H I
6. (a) Explain the following terms (tree related) with figures 06
(i) Siblings (ii) Generation and
(ii) Ancestor (iv) Complete binary tree

6. (b) Construct the binary search tree by the following numbers. 14
 14, 10, 17, 12, 18, 9, 16, 8, 11, 3, 21.
 Then delete 12, 8 and 14 from the tree.
- (c) Explain graph and mention its applications. 06
- (d) Discuss the sequential representation of graph with example. 09
7. (a) Define edge, connected graph, loop and outdegree. 08
- (b) Construct the linked representation of the following graph. 14



- (c) Find out the path matrix from the following graph by calculating the powers of its adjacent matrix. 13



8. (a) What is hashing? Mention its necessity. 08
- (b) Define hash function. There are 107 employees with 4-digit employee number (e.g. 3205, 7179). 200 three-digit available addresses: 501, 502, 503....., 700. Develop a hash function. 14
- (c) What is collision? Discuss the methods of collision resolution. 13

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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.
 ii) Figures in the right margin indicate full marks.
 iii) Assume reasonable data if missing any.

SECTION-A

1. (a) Define (i) node (ii) loop (iii) electrical circuit. State KVL and KCL. 10
 (b) Solve for the loop currents using loop analysis for the circuit shown in Figure 1(b). 15

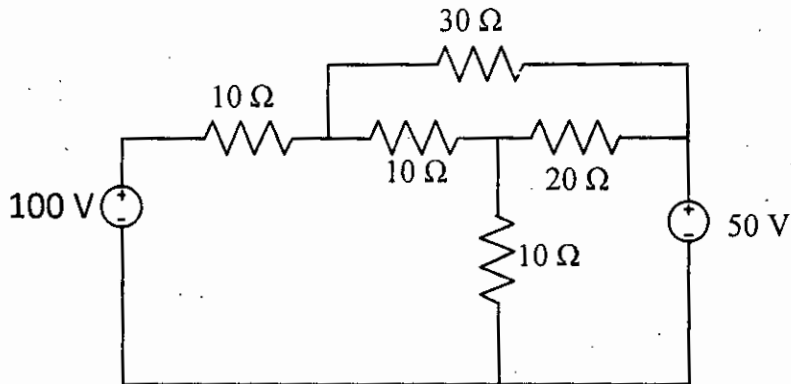


Figure 1(b)

- (c) State maximum power transfer theorem. Derive the condition for maximum power. 10
2. (a) Find R_{AB} for circuit shown in Figure 2(a). 15

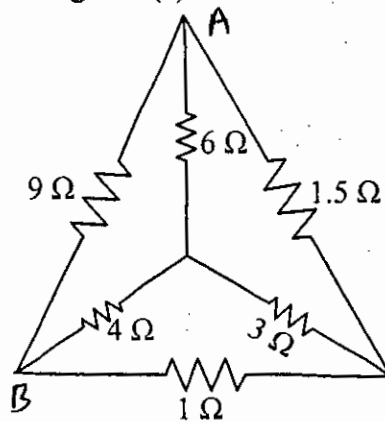


Figure 2(a)

- (b) State superposition theorem. Using superposition theorem, find the current through 10Ω resistor of Figure 2(b). 15

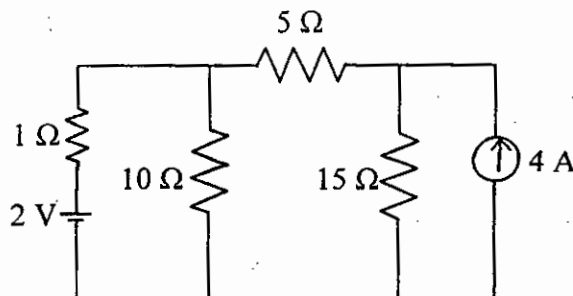


Figure 2(b)

- (c) Describe the conversion procedure of voltage source into current source. 05

3. (a) Explain briefly the principle and construction of a dc generator with neat sketches. 14
 (b) Describe the voltage build up process of a dc generator and also mention the causes of failure to build up. 11
 (c) What is lap winding? A long shunt compound generator delivers a load current of 50A at 500V and has armature, series field and shunt field resistances of 0.05Ω , 0.03Ω and 250Ω respectively. Calculate the generated voltage and the armature current. Allow 1V per brush for contact drop. 10
4. (a) What is back e.m.f. Write down its significance? 08
 (b) What are the factors controlling the speed of a dc motor? Describe one of them. 12
 (c) A 25KW, 250V dc shunt generator has armature and field resistance of 0.06Ω and 100Ω respectively. Determine the total armature power developed when working (i) as a generator delivering 25KW output and (ii) as a motor taking 25KW input. 10
 (d) Mention some applications of motors and generators. 05

SECTION-B

5. (a) Define alternating current, phase, phase difference and period. 05
 (b) Explain power factor with necessary diagram. Find the form factor of the half-wave rectified sine-wave shown in Figure 5(b). 15

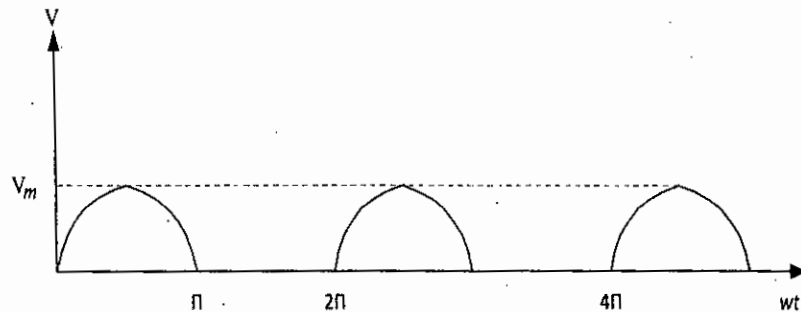


Figure 5(b)

- (c) Deduce an expression of impedance, real power, reactive power, average power and instantaneous power of R-L series circuit. 15
6. (a) Show that average power consumed by inductor or capacitor is zero. 10
 (b) A voltage $v = 200 \sin 377t$ is applied to an inductive branch and the maximum current is 10A. 15
 (i) Find the value of L in millihenrys
 (ii) If it is known that this inductive coil actually possesses 1Ω resistance, what is true value of L?
 (c) Draw and define each power of the power triangle. 10
7. (a) Write the general principle of an induction motor. 10
 (b) Describe the production of rotating field for three phase supply. Draw necessary diagrams. 10
 (c) Derive the equation of torque of an induction motor under running condition. 10
 (d) Derive the equation for frequency of induction motor current. 05
8. (a) What are the four transformer constants? How can you determine them? Describe transformer tests briefly. 10
 (b) What are the three phase transformer connections? Describe any two of them. 10
 (c) Show that 57.7% load of the original KVA capacity can be delivered by an open delta transformer bank. 05
 (d) Define synchronous generator and motor. Why are they so called? Write their advantages. Describe v-curves. 10

Khulna University of Engineering & Technology
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B.Sc. Engineering 2nd Year 1st Term Examination, 2018

HUM 2111

Financial, Cost and Management Accounting

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 accounting. Discuss the objectives of accounting. 10
(b) Mr. Sagor began a service centre named "Sun moon service centre" on May 01, 2018. The following transactions were completed during the month: 25
May 01: He invests cash TK. 180,000 and equipment TK. 45,000;
May 02: Rent paid in advance for four months TK. 16,000;
May 06: Purchase supplies for cash TK. 13,500;
May 09: Advertisement expense incurred in the local daily on credit TK. 5,000;
May 12: Service revenue earned TK. 85,000 (TK. 55,000 received in cash and the customers bill for the balance);
May 14: Withdraw cash for personal use TK. 7,500;
May 17: Purchase suppliers on account TK. 6,500;
May 20: Service rendered for cash TK. 35,000;
May 23: Cash paid for advertising bill on May 09;
May 25: Cash collection from customers bill on May 12, TK, 18,000;
May 31: Recognized that one month's rent is expired;
May 31: Suppliers used during the month TK. 13,000.
Required: Prepare a tabular analysis of above transactions and show effects on accounting equation.
2. (a) Define journal. Discuss the importance of journal. 10
(b) Children Park was started on May 1, 2017 by M. Islam. The following selected 25 events and transactions occurred during May 2017:
May 01: Mr. Islam invested TK. 2,00,000 cash.
May 04: Purchased land costing TK. 60,000 for cash.
May 08: Paid salaries to employee TK. 2,000.
May 11: Incurred advertising expense of TK. 18,000 on account.
May 12: Hired park manager at a salary of TK. 10,000 per month effective June.
May 13: Paid TK. 3,000 cash for one year insurance policy.
May 17: Withdrew TK. 6,000 cash for personal use.
May 20: Received TK. 57,000 in cash for entrance fees.
May 25: Sold 100 coupon books for TK. 50 cash.
May 30: Received TK. 6,000 in cash for entrance fees.
May 31: Paid TK. 9,000 on account for advertising incurred on May 11.
Instruction: Journalise above the transactions.
3. (a) What is meant by Trial balance? 05
(b) What are the basic differences between Trial balance and Balance sheet? 08
(c) From the following ledger balances of M/S Progati & Co. Prepare a trial balance 22 as on December 31, 2017:

	Amount (TK.)		Amount (TK.)
Cash.....	60,000	Discount.....	7,100
Account receivable	38,000	Insurance	3,000
Furniture.....	55,000	Opening stock.....	12,000

	Amount(TK.)		Amount(TK.)
Machinery.....	2,00,000	Notes receivable.....	30,000
Building.....	1,00,000		
Account payable	95,000	Irrecoverable debts...	5,000
Capital.....	3,00,000	Carriage inward	6,300
Drawings.....	35,000	Bad debts reserve	15,000
Purchases.....	3,10,000	Wages.....	27,700
Sales.....	4,75,000	Notes payable	48,000
Sales return.....	3,500	Bank charges....	2,000
Purchases return...	2,900	Advertisement exp.	8,300
Salaries.....	33,000	Closing stock	10,000

4. R. Kabir began operations as a private investigator on January 1, 2016. The Trial balance are as follows:

R. Kabir
Trial Balance

For the quarter ending March 31, 2016.

Account Titles	Debit (TK.)	Credit (TK.)
Cash.....	14,400	
Account receivable.....	7,620	
Supplies.....	1,250	
Prepaid insurance.....	4,400	
Equipment.....	38,000	
Notes payable.....		14,000
Accounts payable.....		14,350
Capital.....		28,000
R. Kabir, drawing.....	1,600	
Service revenue.....		17,620
Salaries expense.....	2,200	
Travel expense.....	2,000	
Rent expense.....	2,200	
Miscellaneous expense.....	300	
	73,970	73,970

Additional information:

- i) Suppliers on hand total TK 650 at March 31, 2016.
- ii) Depreciation on equipment per quarter TK. 500.
- iii) Insurance expired at the rate of TK. 250 per month.
- iv) Service provided but unbilled at March 31 TK. 950.

Instruction: (a) prepare a statement of comprehensive income (b) prepare owner's equity statement, and (c) prepare a statement of financial position during the quarter ended March 31, 2016.

SECTION-B

5. (a) What is meant by cost accounting?
- (b) Indicate the differences between cost accounting and financial accounting
- (c) Discuss the classification of cost.
- (d) "Cost accounting is a tool of management planning and control"- Explain.