

BANGLADESH UNIVERSITY OF ENGINEERING AND TECHNOLOGY, DHAKA

L-2/T-1 B. Sc. Engineering Examinations 2022-2023

Sub: **ME 203** (Engineering Thermodynamics)

Full Marks: 210

Time: 3 Hours

The figures in the margin indicate full marks.

Data book will be provided.

USE SEPARATE SCRIPTS FOR EACH SECTION

SECTION – AThere are **FOUR** questions in this section. **Question No. 1** is compulsory.Answer any **TWO** questions from the remaining **THREE** questions.

1. (a) Distinguish between 'heat' and 'work'. (10)
- (b) Apply the "Law of energy conservation" to show that 'energy' is a thermodynamic property. Give examples of various forms of thermal energy. (10)
- (c) With suitable diagrams, apply the 2nd-law of thermodynamics to show that: (10)

$$\eta_{rev} > \eta_{irr}$$
- (d) An adiabatic compressor is used to compress 0.5 kg of R134a from 140 kPa and -10°C to 1.4 MPa and 80°C . Estimate (15)
 - (i) isentropic efficiency of the compressor
 - (ii) entropy generation.
2. (a) With suitable assumptions, apply 1st law of thermodynamics to derive 'Bernoulli's Equation'. (10)
- (b) Briefly describe the 'zeroth law of thermodynamics'. (5)
- (c) Water vapour enters a subsonic diffuser at a pressure of 0.7 bar, a temperature of 160°C and a velocity of 180 m/s. Diffuser inlet area is 100 cm^2 . Fluid leaves the diffuser at 60 m/s and 1 bar pressure and heat loss to the surrounding is 0.6 kJ/kg. Estimate (15)
 - (i) final temperature
 - (ii) mass flow rate
 - (iii) Diffuser outlet area.
3. (a) State Kelvin-Planck statement of second-law of thermodynamics. Apply this statement and show that 'it is impossible to construct a perpetual-motion machine of second kind'. (10)
- (b) With suitable assumptions, show that $PV^{\gamma} = \text{constant}$ for isentropic processes. (10)
- (c) 1 kg of water at 100°C is pumped/compressed to 1.0 MPa from its saturation state. Estimate the required work if inlet water is (10)
 - (i) saturated liquid at 100°C
 - (ii) saturated vapour at 100°C .

Appraise the results obtained.

ME 203

4. (a) 0.1 kg of boiling water is mixed with 0.5 kg of ice at 0°C in a thermoflux and is allowed to achieve equilibrium in isolated condition. Analyse this example to demonstrate the 'principle of increase of entropy'. (10)
- (b) A steam turbine receives 10 kg/s stream at 15 MPa, 600°C. Twenty percent of the flow is extracted at 2 MPa, 350°C to a feed-water heater, and the rest exists the turbine at 75 kPa, 95% quality. Estimate the turbine output work. (10)
- (c) Explain the physical meaning of 'energy'. A steady-flow compressor is used to compress air from 1 bar, 25°C to 10 bar in an adiabatic process. Using the concept of 'energy', estimate the effectiveness of the compression process if the isentropic efficiency is 90%. (10)

SECTION – B

There are **FOUR** questions in this section. **Answer Q. No. 5** and any **TWO** from the rest.

Question No. 5 is compulsory.

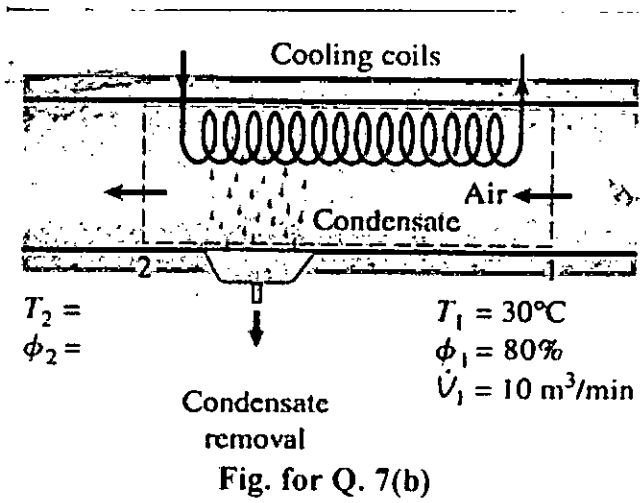
Assume reasonable values for missing data. All symbols have their usual meaning.

5. (a) How can we increase the efficiency of a steam turbine power plant operating based on Rankine cycle? Explain using T-s diagram. (10)
- (b) Consider a 420-MW steam power plant that operates on a simple ideal Rankine cycle. Steam enters the turbine at 10 MPa and 500°C and is cooled in the condenser at a pressure of 10 kPa. Show the cycle on a T-s diagram with respect to saturation lines, and determine (25)
- (i) the quality of the steam at the turbine exit.
- (ii) the thermal efficiency of the cycle, and
- (iii) the mass flow rate of the steam.
- (c) A Diesel engine runs on diesel cycle. In the cycle, compression begins at 0.1 MPa, 40°C, and the compression ratio is 15. The heat added is 1.675 MJ/kg. Utilizing the air-standard assumptions, find (10)
- (i) the cycle efficiency
- (ii) the MEP of the cycle.
6. (a) "In gas turbine power plants, intercooling and reheating are always used in conjunction with regeneration". Explain the statement showing all the processes in a block diagram and a T-s diagram. (10)
- (b) A gas-turbine power plant operating on an ideal Brayton cycle has a pressure ratio of 8. The gas temperature is 300 K at the compressor inlet and 1300 K at the turbine inlet. Utilizing the air-standard assumptions, determine (20)
- (i) the gas temperature at the exits of the compressor and the turbine,
- (ii) the back work ratio, and
- (iii) the thermal efficiency.
- Now, if the isentropic efficiency of the turbine and compressor is 0.85 and 0.75, respectively, determine the back work ratio for the above problem.

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7. (a) A garment industry has a 10 MW captive power plant. The current efficiency of the plant is 35%. The owner of the plant would like to increase the efficiency of the plant. Propose a methodology to increase the overall efficiency utilizing the exhaust heat of the plant. Explain with a schematic diagram. (10)

(b) Air enters a window air conditioner at 1 atm, 30°C, and 80 percent relative humidity at a rate of 10 m³/min and passes through a cooling coil. Determine exit temperature and relative humidity. Consider the rate of heat removal through the cooling coil is 301.82 kJ/min. Part of the moisture in the air condenses at a rate of 0.0765 kg/min and the enthalpy of the condensate is 84 kJ/kg. (20)



8. (a) A fluid may experience a large drop in its temperature as a result of throttling. Is this always true? Explain the process using *Joule-Thomson coefficient*. (10)

(b) Using the laws of thermodynamics and suitable assumptions, derive that (20)

$$C_p - C_v = -T \left(\frac{\partial p}{\partial v} \right)_T \left(\frac{\partial v}{\partial T} \right)_p^2 = \frac{\beta^2}{k_T} vT$$

Where, all the symbols have their usual meanings. Using this expression, show that for ideal gas,

$$C_p - C_v = R$$

BANGLADESH UNIVERSITY OF ENGINEERING AND TECHNOLOGY, DHAKA

L-2/T-1 B. Sc. Engineering Examinations 2022-2023

Sub : **ME 247** (Engineering Mechanics-1)

Full Marks : 210

Time : 3 Hours

The figures in the margin indicate full marks.

USE SEPARATE SCRIPTS FOR EACH SECTION

SECTION – AThere are **FOUR** questions in this section. **Question No. 1 is mandatory.**Answer any **THREE INCLUDING Q. No. 1.**

Symbols used have their usual meaning and interpretation.

1. (a) The truss shown in Fig. 1(a) is supporting an advertising panel. Calculate the forces in members BC, BE, and BD of the truss for a wind load equivalent to the two forces as shown in Fig. 1(a). State whether each member is in tension or compression. (18)
- (b) Knowing that the coefficient of static friction between the collar and the rod (as shown in Fig. 1(b) is 0.35, solve for the range of values of P for which equilibrium is maintained when $\theta = 50^\circ$ and $M = 20 \text{ N-m}$. (17)
- (c) Apply the parallel axis theorem to determine the moment of inertia of the area, shown in Fig. 1(c), with respect to the centroidal x and y axes. (18)
2. (a) Differentiate among truss, frame, and machine with appropriate figures. (10)
- (b) Knowing that the pulley has a radius of 0.5 m, determine the components of the reactions at A and E of the structure shown in Fig. 2(b). (16)
3. (a) Derive the relation between angle of friction and the coefficient of friction. (8)
- (b) A flat belt is used to transmit a couple from pulley A to pulley B. The radius of each pulley is 60 mm, and a force of magnitude $P = 900 \text{ N}$ is applied, as shown in Fig. 3(b), to the axle of pulley A. Knowing that the coefficient of static friction is 0.35, determine (i) the largest couple that can be transmitted, (ii) the corresponding maximum value of the tension in the belt. (18)
4. (a) A motor M is used to slowly reel in the cable as shown in Fig. 4(a). Knowing that the mass per unit length of the cable is 0.4 kg/m , determine the maximum tension in the cable when $h = 5 \text{ m}$. (13)
- (b) A thin semicircular plate has a radius a and a mass m as shown in Fig. 4(b). Determine the mass moment of inertia of the plate with respect to the centroidal axis AA'. (13)

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SECTION – B

There are **FOUR** questions in this section. Answer **Q. No. 5** and any **TWO** from the rest.

5. (a) Knowing that the tension in rope AC as shown in Fig. 5(a) is 365 N, determine the resultant of the three forces exerted at point C of post BC . Then resolve the resultant into two components directed along and perpendicular to the post BC . (15)
- (b) The wire AE is stretched between the corners A and E of a bent plate as shown in Fig. 5(b). Knowing that the tension in the wire is 435 N, determine the moment about x -, y -, and z -axes of the force exerted by the wire on corner A . (10)
- (c) A thin ring of mass 2 kg and radius $r = 140$ mm is held against a frictionless wall by a 125-mm string AB as shown in Fig. 5(c). Considering the ring as a three-force body, determine the tension in the string and the reaction at C . (10)
- (d) Using the Pappus Guldinus theorem, evaluate the volume of the storage tank shown in Fig. 5(d). (10)
6. (a) A lamp F is supported by several cords as shown in Fig. 6(a). Determine the tension developed in cords AC and BC required for equilibrium of the lamp if its mass is 20 kg. (15)
- (b) The frame ACD is hinged at A and D and is supported by a cable that passes through a ring at B and is attached to hooks at G and H . Determine the force in the portion BH of cable if the moment about the diagonal AD of the force exerted on the frame by portion BH of the cable is -90.5 N.m. (15)
7. (a) Four forces are applied to the machine component $ABDE$ as shown in Fig. 7(a). Replace these forces with an equivalent force-couple system at A . (15)
- (b) Member ABC as shown in Fig. 7(b) is supported by a pin and bracket at B and by an inextensible cord attached at A and C and passing over a frictionless pulley at D . For the loading shown and neglecting the size of the pulley, determine the tension in the cord and the reaction at B . (15)
8. (a) Locate the y -coordinate of centroid of the shaded area shown in Fig. 8(a). (15)
- (b) Determine the center of gravity of the homogeneous solid block shown in Fig. 8(b). (15)
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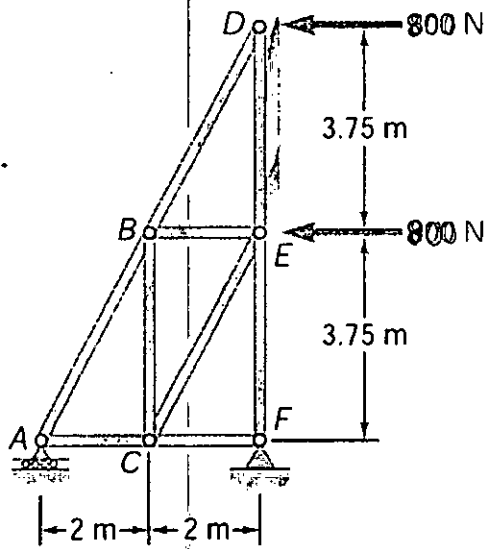


Fig. for Q. 1(a)

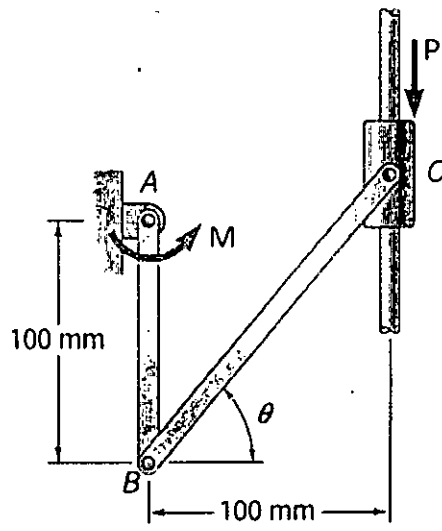


Fig. for Q. 1(b)

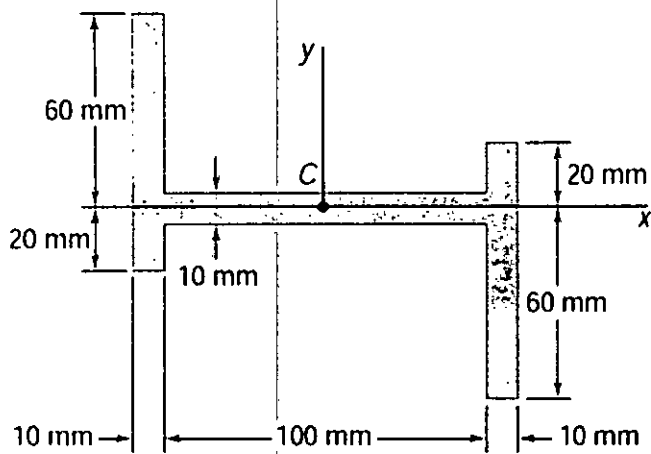


Fig. for Q. 1(c)

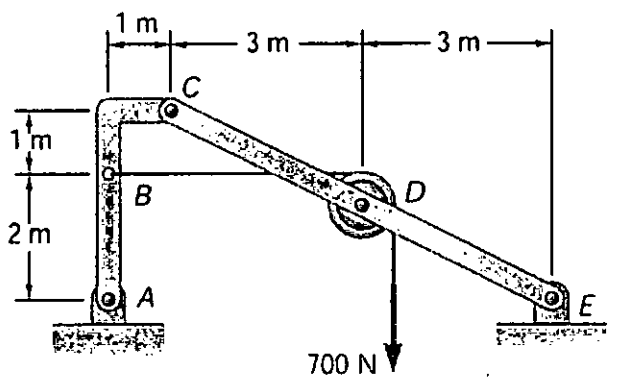


Fig. for Q. 2(b)

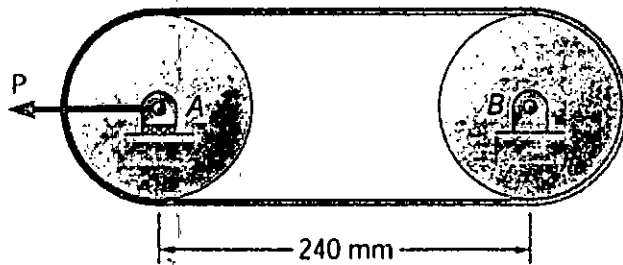


Fig. for Q. 3(b)

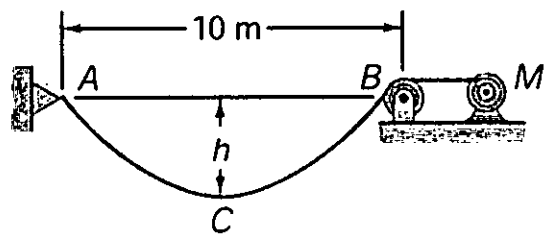


Fig. for Q. 4(a)

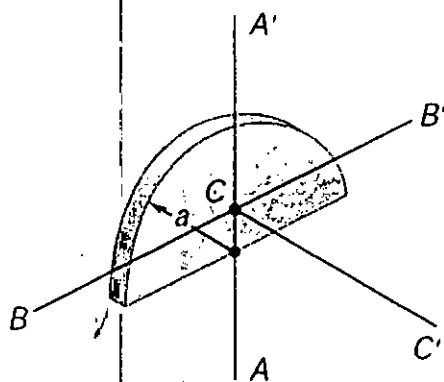


Fig. for Q. 4(b)

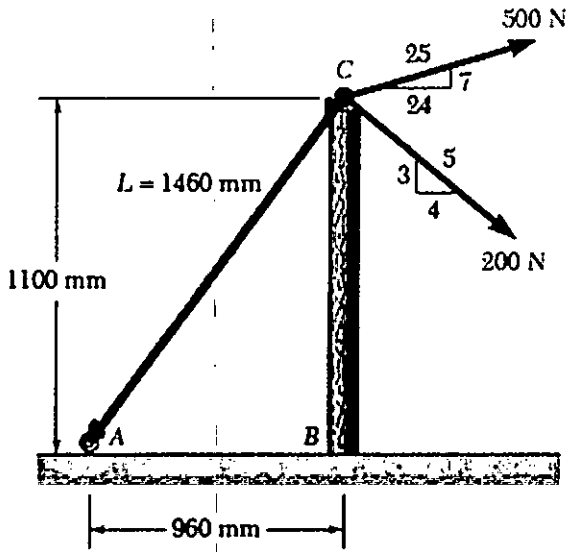


Fig. 5(a)

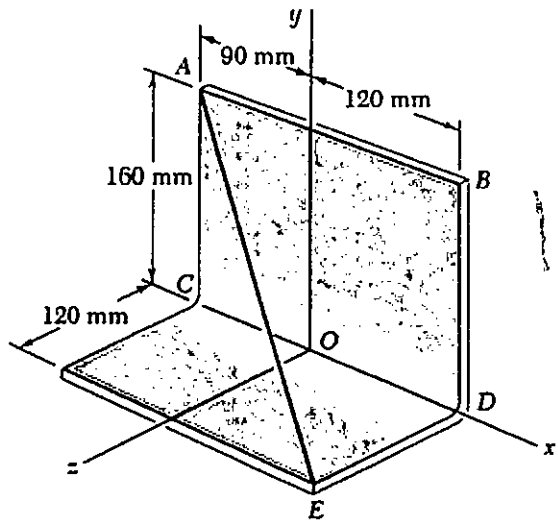


Fig. 5(b)

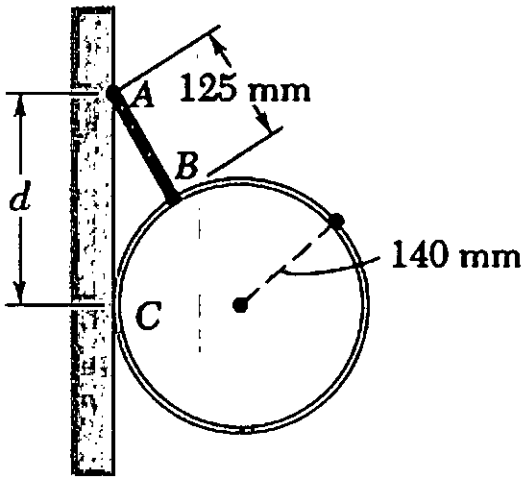


Fig. 5(c)

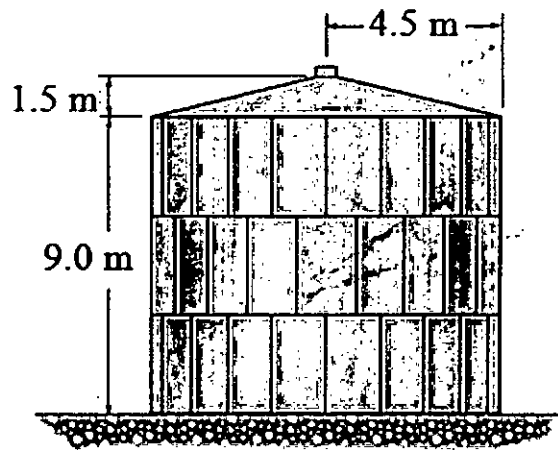


Fig. 5(d)

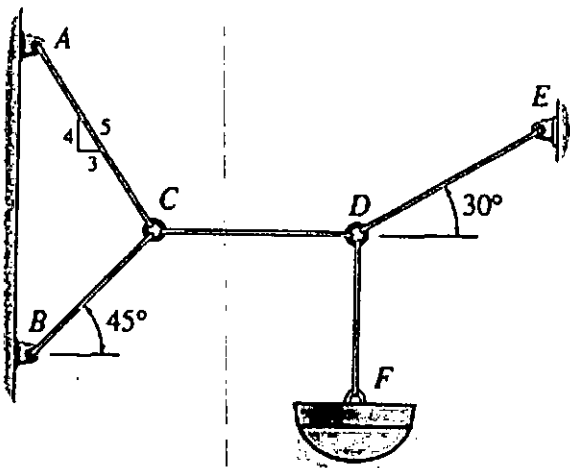


Fig. 6(a)

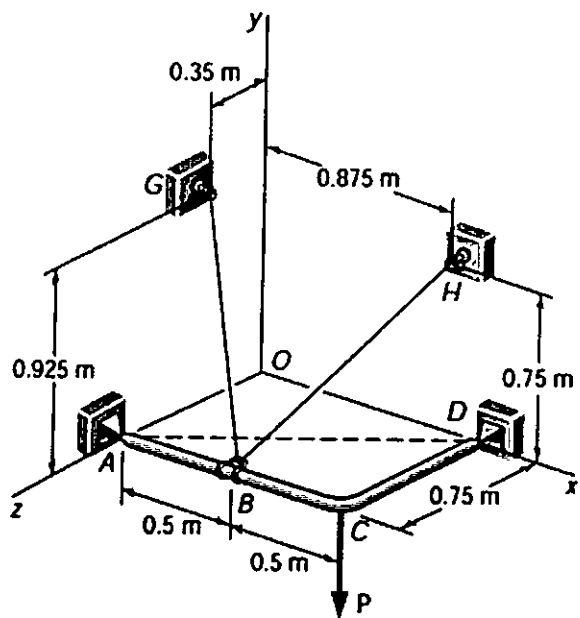


Fig. 6(b)

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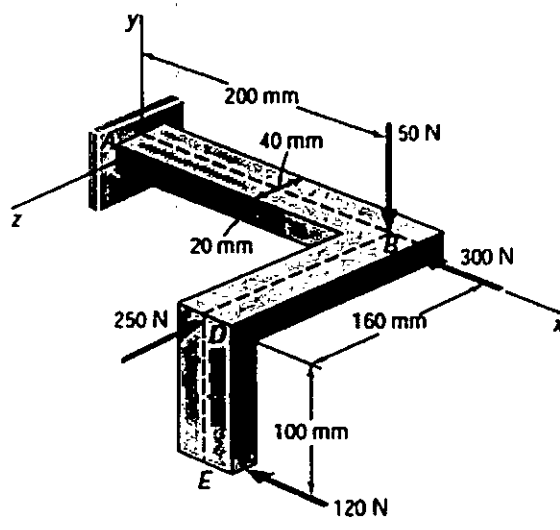


Fig. 7(a)

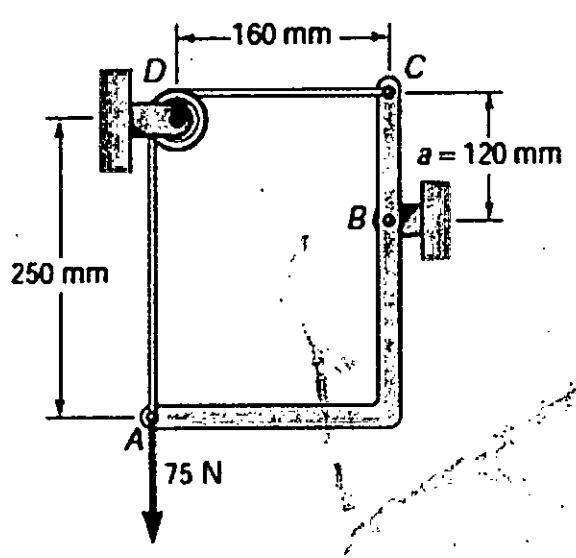


Fig. 7(b)

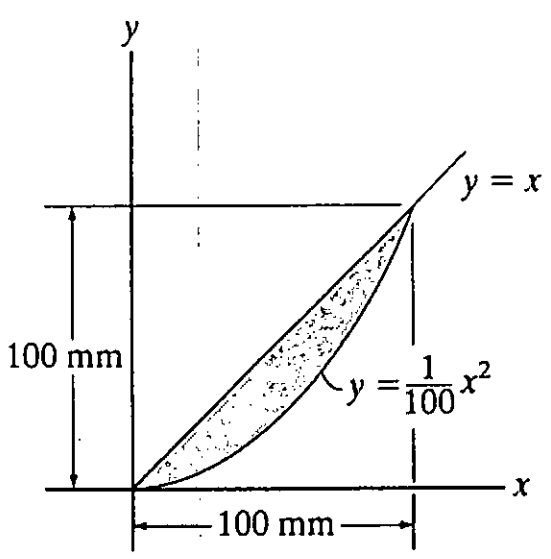


Fig. 8(a)

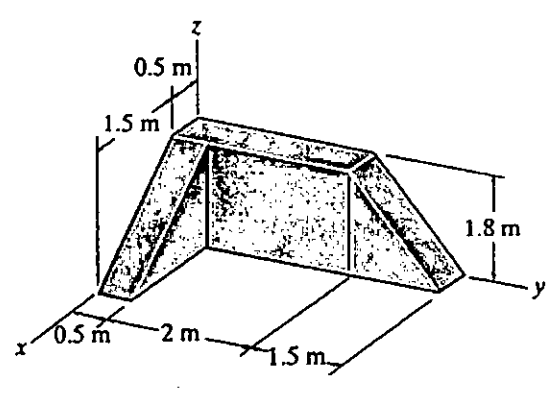


Fig. 8(b)

SECTION - A

There are **FOUR** questions in this section. Answer to **Question no. 1 compulsory**. Answer any **TWO** questions from Questions 2-4. The corresponding Course Outcomes (COs) of each part of Questions 1 and 5 are mentioned on the right most column. The COs of the Course are mentioned at the end of the question paper.

1. (a) The circuits shown in Fig. for Q 1(a) are simple switching circuits. For our operation, the input $V_i = 5V$, and we want the output to be as close to $0V$ as possible so that the transistors act as almost short circuits. (25)
(CO3)
- (i) For the circuit on the left with a BJT, it is given that $\beta = 10$. If the output $V_o = 0.2 V$, find the value of R_c . In which mode does the BJT operate?
- (ii) For the circuit on the right with a MOSFET, it is given that $k_n = 1 \text{ mA/V}^2$, $V_{th} = 1V$. If the output $V_o = 0.2 V$, find the value of R_D .
- (iii) For both circuits, calculate the resistive power losses in all the resistors, and based on your result, state which circuit is better.

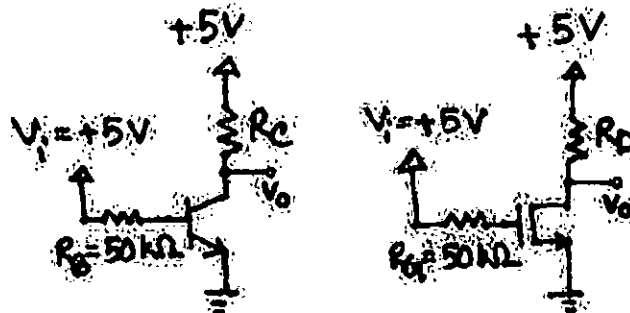


Fig. for Q 1(a)

- (b) Fig. for Q 1(b) shows the output vs input characteristics of a clipper circuit. (15)
- (i) Design the circuit with AC/DC sources, diodes and resistors. Choose the value(s) of the resistor(s) so that when $v_i = 4V$, the current supplied by the input source is 1 mA . Assume that the diodes have a constant voltage drop of $V_D = 0.7V$. (CO4)
- (i) Also, find the current in each diode when $v_i = -3V$.

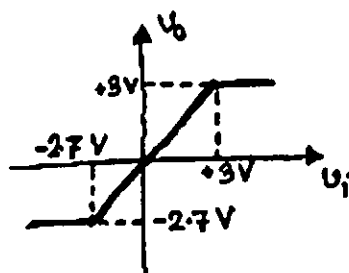


Fig for Q 1(b)

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Contd ... Q. No. 1

(c) For a half-wave rectifier using an SCR, the input AC signal is $v_i = 2 \sin(\omega t) V$. (6 $\frac{2}{3}$)

Determine the firing angle α of the SCR so that the average output voltage is $V_{dc} = 1/\pi V$. (CO4)

2. (a) In the circuit shown in Fig. for Q 2(a), for the operating mode of the BJT (which may be saturation or active), it is given that $\beta = 50$ and $V_{BE} = 0.7 V$. (20)

(i) Find all the node voltages V_B , V_E , and V_C .

(ii) In which mode does the BJT operate? Show your reasoning.

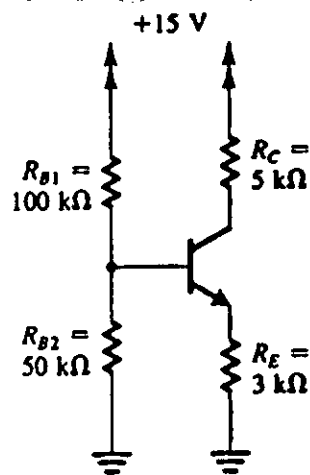


Fig. for Q 2(a)

(b) For the amplifier shown in Fig. for Q 2(b), find an expression for the voltage gain A_v (with load connected). Suppose that the value of α , β and g_m are already known. (16 $\frac{2}{3}$)

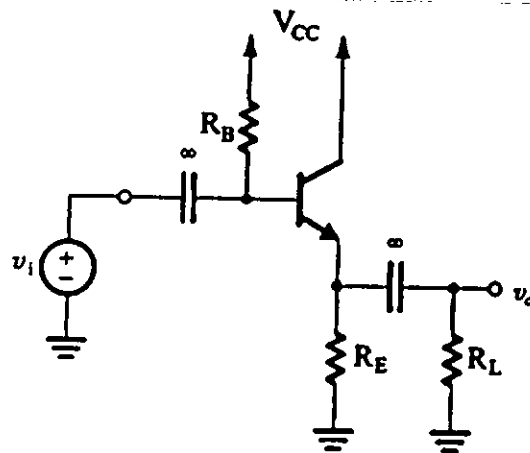


Fig for Q 2(b)

(c) Derive an equation relating speed (ω_m) and induced torque (τ_{ind}) of a DC shunt motor; and draw the speed vs torque curve. (10)

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3. (a) For the circuit shown in Fig. Q 3(a), it is given that $k_n = 0.25 \text{ mA/V}^2$ and $V_m = 1\text{V}$. (20)
 (i) If the MOSFET is turned on, in which mode does it operate? Explain your reasoning.
 (ii) If $R_D = R_S = 1\text{k}\Omega$, find the drain voltage V_D , source voltage V_S , and the drain current I_D .

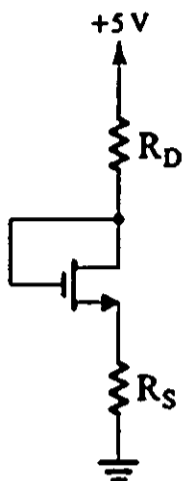


Fig. for Q 3(a)

- (b) For the amplifier shown in Fig. for Q 3(b), find an expression for the output resistance (R_{out}). Suppose that the value of g_m is already known through DC analysis. (16 $\frac{2}{3}$)

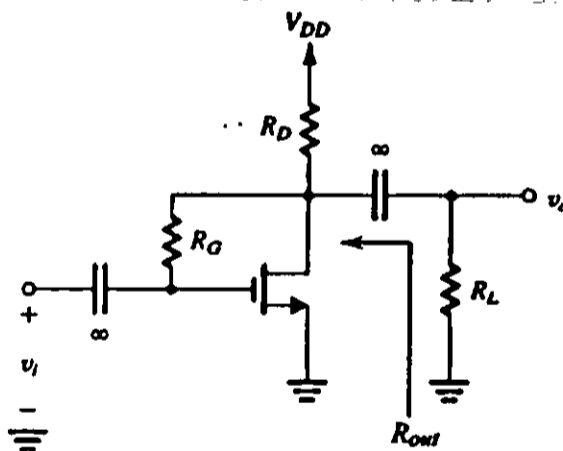


Fig for Q 3(b)

- (c) In Fig. for Q 3(c), v_s is a sinusoid with 40V p-p. Find the fraction of cycle for which the diode conducts. Assume 0.7V drop across the diode. (10)

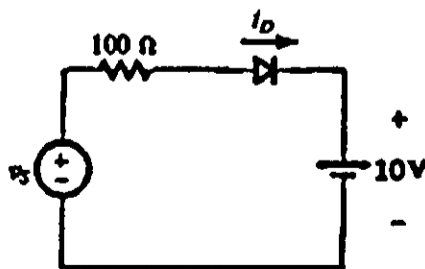


Fig. for Q 3(c)

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4. (a) A 50-hp, 200-V, 1200-rpm dc shunt motor with compensating windings has an armature resistance (including the brushes, compensating windings, and interpoles) of 0.03Ω . Its field circuit has a total resistance $R_{adj} + R_F$ of 50Ω , which produces a no-load speed of 1200 rpm. There are 1200 turns per pole on the shunt field winding. The input line current is 200 A. For these conditions, find- (i) the speed of this motor, (ii) the converted power, (iii) the induced torque. (20)

(b) In Fig. for Q. 4(b), find the current values through both the diodes, and the node voltage V_0 . Assume that the diodes have a constant voltage of 0.7V when turned ON. Explain your reasoning which diode(s) will be ON and which one(s) will be OFF. (16 $\frac{2}{3}$)

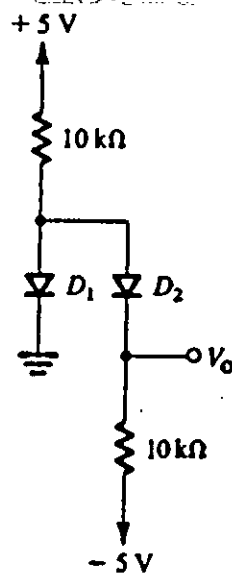


Fig. for Q.4(b)

(c) Mention the methods by which the speed of a DC shunt motor can be controlled. For each, you must briefly show the correlation of the varied parameters with the motor speed (i.e. whether the speed increases or decreases). (10)

SECTION – B

There are **FOUR** questions in this section. Answer to **Question no. 5** is compulsory.

Answer any **TWO** questions from Questions 6-8.

5. (a) Derive the equivalent circuit of a synchronous generator. Explain the armature reaction of a synchronous generator using necessary phasor diagram. (20)
(CO1)

(b) For a 25 kVA, 10/0.25 kV, 60 Hz transformer, the following results are obtained: (26 $\frac{2}{3}$)

Open-Circuit Test (on Primary)	Short-Circuit Test (on Primary)
$I_{oc} = 0.25 \text{ A}$	$V_{sc} = 480 \text{ V}$
$P_{oc} = 400 \text{ W}$	$P_{sc} = 250 \text{ W}$

(CO2)

(i) Find the approximate equivalent circuit of the transformer referred to the secondary side.

(ii) Calculate the full-load voltage regulation and efficiency at 0.8 pf leading condition.

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6. (a) Show that for a real single-phase transformer, voltage ratio of the primary and the secondary is not exactly equal to their turn ratio. (16)

(b) A 208 V, 60 Hz, six-pole Y-connected 25 hp wound rotor motor is tested with the following results: (30 2/3)

No-Load Test	208 V, 22 A, 1200 W, 60 Hz
Locked-Rotor Test	24.6 V, 64.5 A, 2200 W, 15 Hz
DC Test	13.5 V, 64 A

- (i) Find the equivalent circuit of this motor.
- (ii) What will be the starting torque and pullout torque of this motor?

7. (a) Explain the working principle of an induction motor. Is it possible to achieve synchronous speed for this motor? Explain why it will be or not be possible. (16)

(b) A 400 V, 60 Hz, Y-connected, six-pole synchronous generator has a per-phase synchronous reactance of 1.5 Ω. The full load armature current is 50 A at 0.8 pf lagging. The field current has been adjusted so that the terminal voltage is 400 V at no-load. (30 2/3)

- (i) What is the speed of rotation of this generator?
- (ii) What is the terminal voltage and voltage regulation at full-load condition?
- (iii) Suppose that the load is changed keeping the power factor same which causes the voltage regulation to drop down to 3/4 times of its previous value. Determine the change in the armature current.

8. (a) Describe the effect of load changes on a synchronous motor. What will happen if the induced torque gets higher than a pullout torque? Explain it using the torque-speed relationship of a synchronous motor. (20)

(b) The infinite bus shown in Fig. for Q 8(b), is operating at 480 V. Load 1 is an induction motor consuming 125 kW at 0.75 PF lagging, load 2 is an induction motor consuming 180 kW at 0.82 PF lagging and load 3 is a synchronous motor whose real power consumption is 160 kW. Find the transmission line current if the synchronous motor is adjusted to operate at (i) 0.85 PF lagging and (ii) 0.85 PF leading condition. Compare the transmission line losses of both scenarios. (26 2/3)

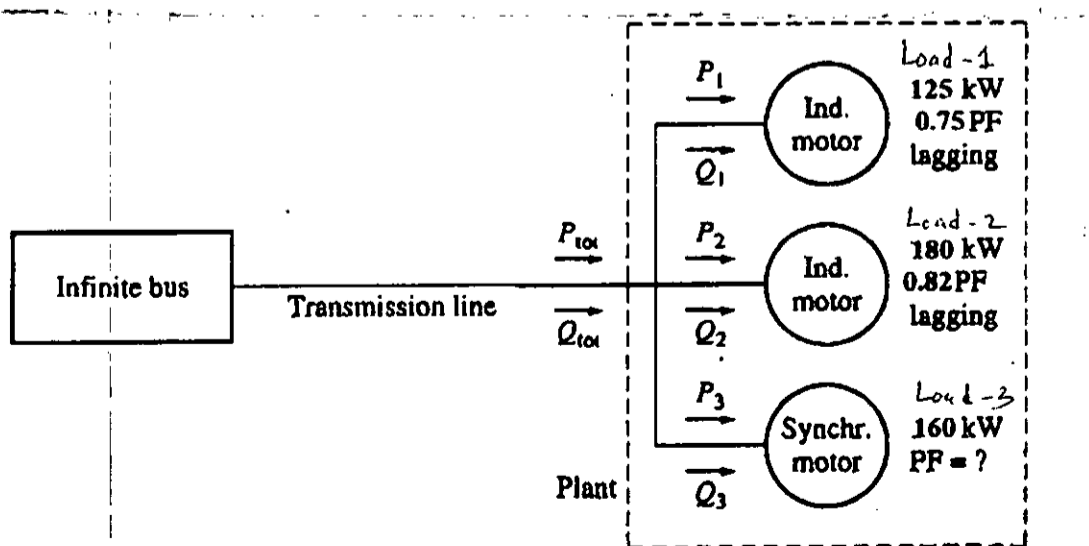


Fig for Q 8(b)

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Course Outcomes of EEE 259

CO No.	CO statement
CO1	Describe operating principle of electric machines and basic electronic devices
CO2	Apply the circuit based knowledge to solve problems relevant to the operation of electric machines and electronic devices
CO3	Compare the operation of diode, metal semiconductor field effect transistor and bipolar junction transistor in switching applications
CO4	Design electronic circuits using the knowledge obtained such as rectifier, amplifier, speed controller according to specification.

BANGLADESH UNIVERSITY OF ENGINEERING AND TECHNOLOGY, DHAKA

L-2/T-1 B. Sc. Engineering Examinations 2022-2023

Sub: **HUM 303** (Principles of Accounting)

Full Marks: 210

Time: 3 Hours

The figures in the margin indicate full marks.

USE SEPARATE SCRIPTS FOR EACH SECTION

SECTION – AThere are **FOUR** questions in this section. Answer any **THREE**.

1. (a) Define going concern assumption. (5)
- (b) Mr. Piter started his business "P Enterprise" at July 1, 2023. During his first month of operation he had the following transactions in July: (30)

- July 1: Started his business investing Tk. 550,000 in cash and an equipment of Tk. 50,000.
- July 2: Paid rent in advance for next two months total Tk. 30,000 in cash.
- July 4: Purchase supplies on credit Tk. 10,000.
- July 8: Purchase a car for office purpose for Tk. 90,000. Paid Tk. 30,000 in cash and signed a notes for the remaining amount.
- July 9: Provide services to the client and received Tk. 120,000 in cash.
- July 12: Payment of notes payable in cash related to transaction July 8.
- July 20: Owner withdrew Tk. 30,000 in cash from business for his personal needs.
- July 22: Paid telephone bill Tk. 10,000 on cash.

Required:

- (i) Prepare a tabular summary for the month of July.
- (ii) Prepare an income statement for the month of July.
2. (a) Following are the balance figure from the ledger of "Berger Company" for the year ended on 31st December 2023 – (17)

Accounts Title	Tk.	Accounts Title	Tk.
Cash	9,650	Accounts payable	2,500
Accounts receivable	11,500	Salaries payable	725
Supplies	2,160	Interest payable	100
Prepaid insurance	1,200	Unearned revenue	1,050
Equipment	18,000	Capital	22,000
Insurance expense	700	Drawings	1,600
Notes payable	11,400	Service revenue	17,100
Rent expense	2,900	Rent revenue	2,260
Interest expense	700	Salaries expense	8,725

Required: Prepare a trial balance.

HUM 303/ME**Contd ... Q. No. 2**

(b) Following information is available for "Fuwang Foods" –

(18)

Fuwang Foods Company
Income Statement
For the year ended December 31,2023

	Amount(Tk.)
Sales	900,000
Less: Sales returns and allowances	80,000
Net sales	820,000
Less: Cost of goods sold	300,000
Gross profit	520,000
Less: Operating expenses	100,000
Net income	420,000

Fuwang Foods Company
Balance Sheet
December 31,2023

<u>Asset</u>	<u>Amount(Tk.)</u>	<u>Liabilities and Equity</u>	<u>Amount(Tk.)</u>
Cash	90,000	Accounts payable	70,000
Investments (Short term)	30,000	Salary payable	50,000
Accounts receivable	50,000	Other current liability	25,000
Inventory	90,000	Long term debt	80,000
Investments (Long term)	50,000	Common stock (Tk. 10 par)	340,000
Plant asset (net)	400,000	Retained earnings	145,000
Total asset	710,000	Total Liabilities and Equity	710,000

Required: Calculate the following ratios –

- (i) Inventory turnover.
- (ii) Return on equity (ROE).
- (iii) Quick or acid test ratio.
- (iv) Debt to total asset ratio.
- (v) Current ratio.
- (vi) Profit margin ratio.

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3. The Trial Balance of "Sharp Company" at May 31, 2023 is given below –

(35)

"Sharp Company" Trial Balance May 31, 2023		
<u>Accounts Title</u>	<u>Debit (TK.)</u>	<u>Credit(Tk.)</u>
Cash	30,000	
Accounts receivable	42,000	
Prepaid insurance	2,400	
Supplies	1,500	
Office furniture	15,000	
Office equipment	36,100	
Interest payable		16,000
Tax payable		10,000
Accounts payable		4,500
Unearned service revenue		6,000
Capital		55,600
Service revenue		37,900
Salary expense	2,000	
Rent expense	1,000	
Total	130,000	130,000

Additional information:

- Supplies on hand Tk. 500.
- Accrued rent is Tk. 2,000.
- Tk. 2,000 of service performed during the month but has not been recorded as of May 31.
- Insurance policy is for two years.
- Office furniture is being depreciated Tk. 200 per month.

Required:

- (i) Prepare necessary adjusting entries.
- (ii) Prepare an adjusted trial balance as at May 31, 2023.

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4. The trial balance of Green Dairy Centre contained the following accounts on August 31, 2023, of the company's fiscal year.

(35)

**Green Dairy Centre
Trial Balance
August 31, 2023**

	Debit(Tk.)	Credit(Tk.)
Cash	26,700	
Accounts Receivable	30,700	
Merchandise Inventory (Aug 31, 2023)	44,700	
Prepaid insurance	6,200	
Store Equipment	85,000	
Trademark	52,800	
Accumulated Depreciation-Store Equipment		18,000
Delivery Equipment	48,000	
Accumulated Depreciation- Delivery Equipment		6,000
Notes Payable (long term)		51,000
Accounts Payable		48,500
Capital		110,000
Drawing	12,000	
Sales		794,200
Long term liability		22,300
Sales Returns and Allowances	13,300	
Cost of Goods Sold	497,400	
Salaries Expenses	140,000	
Advertising Expenses	26,400	
Utility Expenses	14,000	
Repair Expenses	12,100	
Delivery Expenses	16,700	
Rent Expenses	24,000	
Total	<u>10,50,000</u>	<u>10,50,000</u>

Other Data:

- (i) Salaries expenses 70% selling and 30% administrative.
- (ii) Rent expense and utilities expenses are 80% selling and 20% administrative.
- (iii) Repair expense is 100% administrative.

Required:

- (a) Prepare a multiple step income statement and an owner's equity statement for the year.
- (b) Prepare a classified balance sheet as on August 31, 2023.

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SECTION – B

There are **FOUR** questions in this section. Answer any **THREE**.

5. (a) How does cost and managerial accounting differ from financial accounting? **(10)**
 (b) When would job-order costing be used in preference to process costing? **(5)**
 (c) The following cost and inventory data are taken from the accounting records of MMZ Company for the year just completed: **(20)**

Costs incurred:

Direct labor cost	Tk. 70,000
Purchases of raw materials	Tk. 118,000
Indirect labor	Tk. 30,000
Maintenance, factory equipment	Tk. 6,000
Advertising expense	Tk. 90,000
Insurance, factory equipment	Tk. 800
Sales salaries	Tk. 50,000
Rent, factory facilities	Tk. 20,000
Supplies	Tk. 4,200
Depreciation, office equipment	Tk. 3,000
Depreciation, factory equipment	Tk. 19,000

	Beginning of the Year	End of the Year
Inventories:		
Raw materials	Tk. 7,000	Tk. 15,000
Work in process	Tk. 10,000	Tk. 5,000
Finished goods	Tk. 20,000	Tk. 35,000

Required: Prepare a schedule of cost of goods sold in good form.

6. (a) Due to erratic sales of its sole product—a high-capacity battery for laptop computers—PEM, Inc., has been experiencing difficulty for some time. The company's contribution format income statement for the most recent month is given below: **(25)**

Sales (19,500 units x Tk.30 per unit)	Tk. 585,000
Less variable expenses	409,500
Contribution margin	175,500
Less fixed expenses	180,000
Net operating loss	Tk. (4,500)

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Contd ... Q. No. 6(a)

Required:

- (i) Compute the company's CM ratio and its break-even point in both units and dollars.
- (ii) The president believes that a Tk. 16,000 increase in the monthly advertising budget, combined with an intensified effort by the sales staff, will result in an Tk. 80,000 increase in monthly sales. If the president is right, what will be the effect on the company's monthly net operating income or loss?
- (iii) Refer to the original data. The sales manager is convinced that a 10% reduction in the selling price, combined with an increase of Tk. 60,000 in the monthly advertising budget, will cause unit sales to double. What will the new contribution format income statement look like if these changes are adopted?
- (iv) Refer to the original data. The Marketing Department thinks that a fancy new package for the laptop computer battery would help sales. The new package would increase packaging costs by 0.75 Tk. per unit. Assuming no other changes, how many units would have to be sold each month to earn a profit of Tk. 9,750?

(b) PAMO Medicals Ltd. makes face masks for the prevention of high contagious virus.

For December 2020, PAMO Medicals incurred the following production costs:

(10)

Direct material per unit	Tk. 15
Direct labor per unit	Tk. 9
Variable manufacturing overhead per unit	Tk. 5
Sales commission per unit	Tk. 3
Total fixed manufacturing overhead	Tk.48,600
Budgeted units of production	12,000
Actual units of production	12,500
Selling price per unit	Tk. 40

Required: Compute PAMO Medicals' profit using variable costing if 10,800 units were sold at Tk. 40 each.

7. (a) For many years ABC Company has purchased the starters that it installs in its standard line of farm tractors. Due to a reduction in output, the company has idle capacity that could be used to produce the starters. The chief engineer has recommended against this move, however, pointing out that the cost to produce the starters would be greater than the current Tk. 8.40 per unit purchase price:

(20)

Contd P/7

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Contd ... Q. No. 7(a)

	Per Unit	Total
Direct materials	Tk. 3.10	
Direct labor	2.70	
Supervision	1.50	Tk. 60,000
Depreciation	1.00	40,000
Variable manufacturing overhead	0.60	
Rent	0.30	12,000
Total production cost	Tk. 9.20	

A supervisor would have to be hired to oversee production of the starters. However, the company has sufficient idle tools and machinery that no new equipment would have to be purchased. The rent charge above is based on space utilized in the plant. The total rent on the plant is Tk. 80,000 per period. Depreciation is due to obsolescence rather than wear and tear.

Required: Prepare computations showing how much profits will increase or decrease as a result of making the starters keeping in mind relevant costing concepts.

(b) The Wood Sprits Company produces two products—turpentine and methanol (wood alcohol)—by a joint process. Joint costs amount to Tk. 120,000 per batch of output. Each batch totals 10,000 gallons: 25% methanol and 75% turpentine. Both products are processed further without gain or loss in volume. Separable processing costs are methanol, Tk. 3 per gallon, and turpentine, Tk. 2 per gallon. Methanol sells for Tk. 21 per gallon. Turpentine sells for Tk. 14 per gallon.

(15)

Required:

- (i) How much of the joint costs per batch will be allocated to turpentine and to methanol, assuming that joint costs are allocated based on the number of gallons at splitoff point?
- (ii) If joint costs are allocated on an NRV basis, how much of the joint costs will be allocated to turpentine and to methanol?

8. (a) Company Z is considering the following information for the month of August 2023 –

(10)

	<u>Standard Quantity</u>	<u>Standard Price</u>
Direct material	5 lhr	Tk. 12 per lbs

During the month of August, 2023 the company produces 900 units.

Direct material purchased and used amount was 5500 pounds at a cost of Tk. 12.5 per pound.

Required: From the above data calculate material price and material quantity variance.

HUM 303/ME**Contd ... Q. No. 8**

(b) A firm is considering the following two investment proposals –

(25)

Cash Flows (Tk.)				
Projects	C ₀	C ₁	C ₂	C ₃
X	-25,000	+5000	+5000	+25640
Y	-28,000	+12672	+12672	+12672

The cost of capital is 12%.

Required:

- (i) Compute NPV for each project.
- (ii) Compute IRR for each project.

Factors value table							
Interest rate	14%	15%	16%	17%	18%	19%	20%
$\frac{\text{Year}}{3}$	2.322	2.283	2.246	2.210	2.174	2.140	2.106

- (iii) Based on your evaluation which project should be undertaken and why?
- (iv) Write-down the disadvantages of non-discounted cash flow approach.
