CBCS SCHEME

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18ME51

Fifth Semester B.E. Degree Examination, June/July 2024
Management and Economics

Time: 3 hrs. Max. Marks: 100

Note: *1. Answer any FIVE full questions, choosing ONE full question from each module.*
2. Use of Discrete compound interest factors handbook tables is permitted.

Module-1

1 a. Define Management. Discuss the functions of Management. **(10 Marks)**

b. Define planning and discuss the steps involved in planning. **(10 Marks)**

OR

2 a. Discuss management as a Science, Art profession. **(10 Marks)**

b. Briefly discuss types of plans. **(10 Marks)**

Module-2

3 a. What do you mean by span of control? List the factors influencing span of management. **(10 Marks)**

b. Explain Maslow need hierarchy theory in brief. **(10 Marks)**

OR

4 a. Explain : i) MBO ii) MBE. **(10 Marks)**

b. Briefly explain steps in controlling. **(10 Marks)**

Module-3

5 a. Explain problem solving and decision making process. **(08 Marks)**

b. An engineer has his last 10 years of service. Determine the amount to be deposited at the end of every year if he wishes to withdrawn Rs 15000 every year for 8 years after his retirement. The amount deposited earns an interest rate of 10% compounded annually. **(12 Marks)**

OR

6 a. Explain :
i) Law of demand
ii) Law diminishing returns
iii) Income elasticity of demand. **(06 Marks)**

b. A Man planning to build his house. He plans to invest Rs. 40,000 per year for the next 10 years. The Bank offers 12%. Interest rate compounded annually. Fine the maturity value of his account after 10 years. **(14 Marks)**

Module-4

7 a. Explain IRR and MARR. **(08 Marks)**

b.

	Particulars	Machine A	Machine B
1	Initial investment	30,000	42,000
2	Annual receipts	20,000	26,000
3	Annual expenditures	5,500	7,000
4	Economics life	4 years	4 years

Using above details Determine the payback period and comment on it. **(12 Marks)**

OR

8 a. Explain briefly conductions for present worth comparison. **(06 Marks)**

b. Rs 10 crores was generated by the management of an engineering college for new mechanical block. Annual maintenance of block estimated to be Rs. 10 lakh in addition 12 lakh will be needed every year for 10 years for painting and repairs. If budget granted has to take care of perpetual maintenance. How much of the amount can be used for initial construction costs? Deposited funds can earn 6% rate of interest compounded annually. Assume taxes and inflation does not come into picture. **(14 Marks)**

Module-5

9 a. Discuss various causes of deprivation. **(05 Marks)**

b. Explain briefly need for estimation and costing. **(05 Marks)**

c. An investment of Rs. 8000/- is made by person for purchase of machine. Its salvage value after 5 years is 1000. Using straight line find the book value at the end of each year. **(10 Marks)**

OR

10 a. Differentiate between estimation and testing. **(05 Marks)**

b. Explain briefly the objectives of costing. **(05 Marks)**

c. A cost iron component, as shown in figure below is to be manufactured. Estimate the selling price per piece from the following data :

Density of material = 7.2gm/cc
Cost of molten metal = Rs. 20/kg
Process scrap = 20% of net weight
Scrap return value = Rs.6/kg
Administrative overheads = Rs.30/hour
Sales overheads = 20% of factory cost
Profit = 20% of factory cost

Other expenditures are as follow :

Operation	Time/piece minutes	Labour cost per hour is Rs.	Shot overheads Rs./hour
Moulding and paring	15	20	60
Shot blasting	5	10	40
Fettling and inspections	6	10	40

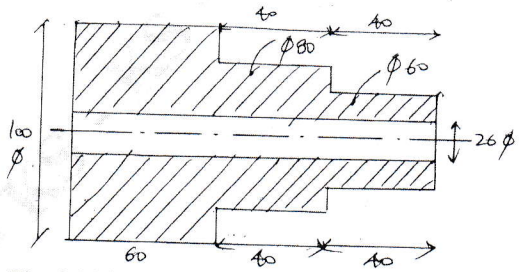

Fig.Q10(c) All dimensions are in 'mm' **(10 Marks)**

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18ME52

Fifth Semester B.E. Degree Examination, June/July 2024
Design of Machine Elements – I

Time: 3 hrs. Max. Marks: 100

Note: 1. *Answer any FIVE full questions, choosing ONE full question from each module.*
2. *Use of design data book is permitted.*
3. *Any missing data may suitably assume.*

Module-1

1 a. Explain the importance of standards in design. List the different types of standards in use. **(05 Marks)**

b. Briefly discuss the factors influencing the selection of suitable materials for machine elements. **(05 Marks)**

c. A 50 mm steel rod supports a 9 kN load and in addition to this torsional moment of 100 N-m is applied on it as shown in Fig.Q1(c). Determine the maximum tensile and maximum shear stresses.

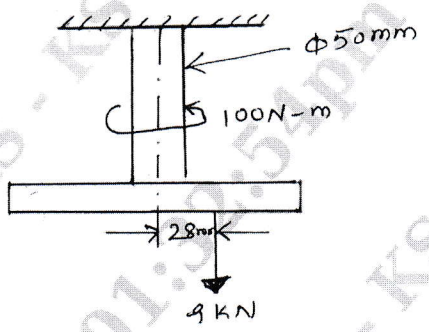

Fig.Q1(c) **(10 Marks)**

OR

2 a. Explain the following theories of failure:
(i) Maximum Normal Stress Theory
(ii) Maximum Shear Stress Theory **(05 Marks)**

b. Define stress concentration. Describe any two methods used to minimize the stress concentration. **(05 Marks)**

c. Determine the safe load that can be carried by a bar of rectangular cross-section shown in Fig.Q2(c), limiting the maximum stress to 130 MPa taking stress concentration into account.

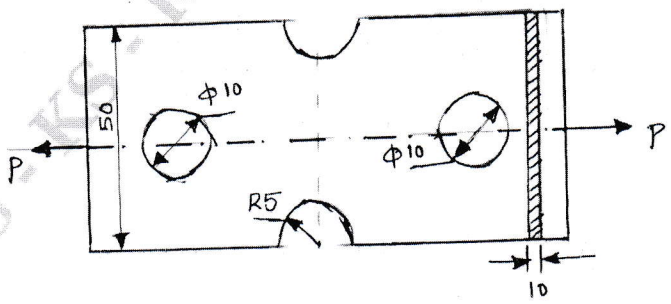

Fig.Q2(c) **(10 Marks)**

Module-2

3 a. Define impact load. Derive an expression for impact stress in a axial bar of C/S "A" and length "L" due to the impact load "W" falling from a height "h" from the collar. **(08 Marks)**

b. A cantilever beam of width 50 mm, depth 150 mm is 1.5 m long. It is struck by a weight of 1000 N that falls from a height of 10 mm at its free end. Determine the following:

(i) Impact factor
(ii) Instantaneous maximum deflection
(iii) Instantaneous maximum stress
(iv) Instantaneous maximum load

Take $E = 20.6 \times 10^4$ N/mm^2 **(12 Marks)**

OR

4 a. Explain briefly fatigue load and LCF (Low Cycle Fatigue). **(04 Marks)**

b. A transmission shaft carries a pulley midway between two bearings. The bending moment at the pulley varies from 200 N-m to 600 N-m as the torsional moment of the shaft varies from 70 N-m to 200 N-m. The frequencies of variation of bending and torsional moments are equal to the shaft speed. The shaft is made of steel FiE (σ_u = 540 MPa, σ_y = 400 MPa). The corrected endurance strength of the shaft is 200 MPa. Determine the diameter of the shaft, using FoS = 2. **(16 Marks)**

Module-3

5 A horizontal piece of commercial shafting is supported by two bearings 1.5 m apart. A keyed gear 20° involute and 175 mm in diameter is located 400 mm to the left of the right bearing and is driven by a gear directly behind it. A 600 mm diameter pulley is keyed to the shaft 600 mm to the right of the left bearing and drives a pulley with a horizontal belt directly behind it. The tension ratio of the belt is 3 to 1, with the slack side on top. The drive transmits 45 KW at 330 rpm. Take $C_m = C_t = 1.5$. Calculate the necessary diameter of the shaft and angular deflection in degrees. Use allowable shear stress 40 MPa and $G = 80 \times 10^9$ N/mm^2. **(20 Marks)**

OR

6 a. Prove that square key is equally strong in shear and compression. **(06 Marks)**

b. Design a protected type cast iron flange coupling for a steel shaft transmitting 30 kW at 200 rpm. The allowable shear stress in the shaft and key material is 40 MPa. The maximum torque transmitted to be 20% greater than the full load torque. The allowable shear stress in the bolt is 60 MPa and the allowable shear stress in the flange is 40 MPa. **(14 Marks)**

Module-4

7 a. List the assumptions made for designing the riveted joint for pressure vessels. **(06 Marks)**

b. Design a triple riveted butt joint two plates of thickness 10 mm. The pitch of rivets in the extreme rows, which are in single shear is twice the pitch of rivets in the inner rows which are double shear. The design stresses of the materials of the main plate and the rivets are as follows:

For plate material in tension, σ_t = 120 MPa
For rivet material in compression σ_c = 160 MPa
For rivet material in shear τ = 80 MPa **(14 Marks)**

OR

8 a. What are advantages of welded joints over riveted joint? **(06 Marks)**

b. A welded connection of steel plates as shown in Fig.Q8(b) is subjected to an eccentric load of 10 kN. Determine the throat dimension of weld, if the permissible stress is limited to 95 N/mm^2. Assume static conditions.

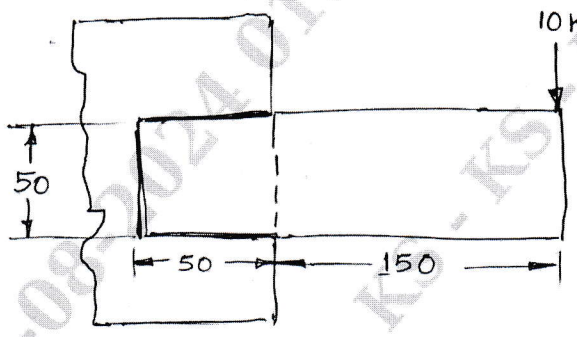

Fig.Q8(b) **(14 Marks)**

Module-5

9 a. Design a knuckle joint to transmit 150 kN. The design stresses may be taken as 75 N/mm^2 in tension, 60 N/mm^2 in shear and 150 N/mm^2 in compression. **(10 Marks)**

b. A flat circular plate is used to close the flanged end of a pressure vessel of internal diameter 300 mm. The vessel carries a fluid at a pressure of 0.7 N/mm^2. A soft copper gasket is used to make the joint leak proof. Twelve bolts are used to fasten the cover plate onto the pressure vessel. Find the size of bolts so that the stress in the bolts is not to exceed 100 N/mm^2. **(10 Marks)**

OR

10 a. Explain self locking and overhauling in power screws. **(04 Marks)**

b. A screw jack is to lift a load of 80 kN through a height of 400 mm. Ultimate strength of screw material in tension and compression is 200 N/mm^2 and in shear 120 N/mm^2. The material for nut is phosphor bronze for which the ultimate strength is 100 N/mm^2 in tension and 90 N/mm^2 in compression and 80 N/mm^2 in shear. The bearing pressure between the nut and the screw is not to exceed 18 N/mm^2. Design the screw and nut and check for the stresses. Take FoS = 2. Assume 25% overload for screw rod design. **(16 Marks)**

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18ME53

Fifth Semester B.E. Degree Examination, June/July 2024
Dynamics of Machines

Time: 3 hrs. Max. Marks: 100

Note: Answer any FIVE full questions, choosing ONE full question from each module.

Module-1

1 a. State the conditions for static equilibrium of a body subjected to system of (i) Two forces (ii) Three forces. **(06 Marks)**

b. In the Slider Crank mechanism the crank and connecting rod lengths are 80mm and 240mm respectively. When the crank has turned by 60° from IDC, a force of 2 kN acts on the piston towards crank shaft. Determine the torque on the crank for static equilibrium. **(14 Marks)**

OR

2 a. State and explain D'Alembert's principle. **(05 Marks)**

b. In a vertical petrol engine, the crank and connecting rod lengths are 60mm and 270mm respectively. The diameter of the piston is 100mm, mass of the reciprocating parts is 1.2kg and speed 1800 rpm. During the expansion stroke when the crank has turned 20° from top dead centre the gas pressure is 650 kN/m^2. Determine (i) Net driving force on the piston (ii) Force on the connecting rod (iii) Thrust on the cylinder walls (iv) Torque on the crank. **(15 Marks)**

Module-2

3 a. State the conditions for (i) Static balancing (ii) Dynamic balancing **(04 Marks)**

b. A rotating shaft carries four masses A, B, C and D having radii of mass centre 30mm, 38mm, 40mm and 35mm respectively, from the axis of rotation. The masses are 7.5kg, 5kg and 4 kg for A, C and D respectively. The axial distances between the planes of rotation of A and B is 400mm and between B and C is 500mm. The masses A and C are at right angles to each other. Find for complete balance,

i) The angles between the masses B and D from mass A
ii) The axial distance between the planes of rotation of C and D
iii) The magnitude of mass B **(16 Marks)**

OR

4 In a 4 cylinder inline engine running at 1800rpm, the crank and connecting rods are 60mm and 240mm respectively. The cylinders are spaced at 150mm apart. If the cylinders are numbered 1 to 4 in sequence from one end, the crank appears at intervals of 90° in end view in the order 1-4-2-3. The reciprocating mass in each cylinder is 1.5kg. Determine graphically

i) Unbalanced primary and secondary forces
ii) Unbalanced primary and secondary couples with reference to central plane of the engine. **(20 Marks)**

Module-3

5 a. Define the following terms with respect to governors:
i) Isochronism ii) Sensitiveness iii) Effort iv) Power **(08 Marks)**

b. Each arm of a porter governor is 200mm long and is pivoted on the axis of the governor, the radii of rotation of the balls at minimum and maximum speeds are 120mm and 160mm respectively. The mass of the sleeve is 24kg and mass of each ball is 4kg. Find sleeve lift and the range of speed of the governor if the friction at the sleeve is 18N. **(12 Marks)**

OR

6 a. With a neat sketch show the following :
i) Axis of spin ii) Axis of precession iii) Axis of couple iv) Plane of spin
v) Plane of precession vi) Plane of couple. **(06 Marks)**

b. The turbine rotor of a ship has a mass of 2.2 tonnes and rotates at 1800 rpm clockwise when viewed from the stern. The radius of gyration of the rotor is 320mm. Determine the gyroscopic couple and its effect when the
(i) Ship turns right at a radius of 250mm with a speed of 25 kmph
(ii) Ship pitches with the bow rising at an angular velocity of 0.8 rad/s. **(14 Marks)**

Module-4

7 a. Derive the natural frequency of the spring mass system considering the mass of the spring into account using energy method. **(10 Marks)**

b. Find the natural frequencies of the system shown in Fig.Q7(b) by using Newton's method.

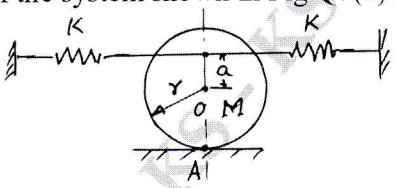

Fig.Q7(b) **(10 Marks)**

OR

8 a. Define logarithmic decrement and derive the equation for the same in terms of damping factor. **(10 Marks)**

b. In a single degree damped vibrating system, a suspended mass of 8 kg makes 30 oscillations in 18 seconds. The amplitude decreases to 0.25 of the initial value after 5 oscillations Determine the
(i) Stiffness of the spring (ii) Logarithmic decrement
(iii) Damping factor (iv) Damping coefficient **(10 Marks)**

Module-5

9 a. Derive an expression for the transmissibility ratio. **(10 Marks)**

b. A single cylinder vertical engine has a mass of 400kg and is mounted on a steel chassis frame. The static deflection owing to the weight of the chassis is 2.4mm. The reciprocating masses of the engine amounts to 18kg and the stroke of the engine is 160mm. A dashpot with a damping coefficient of 2 N/mm/s is also used to dampen the vibrations. In the steady state of the vibrations, determine
(i) the amplitude of the vibration if the driving shaft rotates at 500 rpm
(ii) the speed of the driving shaft when the resonance occurs. **(10 Marks)**

OR

10 a. Define the terms :
(i) Magnification factor (ii) Transmissibility ratio (iii) Vibrations isolation
(iv) Critical speed **(08 Marks)**

b. A rotor has a mass of 12 kg and is mounted midway on a 24mm diameter horizontal shaft supported at the ends by two bearings. The bearings are 1m apart. The shaft rotates at 2400rpm. If the centre of mass of the rotor is 0.11mm away from the geometric centre of the rotor due to certain manufacturing defect find (i) the steady state amplitude of vibration (ii) the dynamic force transmitted to the bearings. Take E = 200 GPa. **(12 Marks)**

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18ME54

Fifth Semester B.E. Degree Examination, June/July 2024
Turbo Machines

Time: 3 hrs. Max. Marks: 100

Note: 1. Answer any FIVE full questions, choosing ONE full question from each module.
2. Use of thermodynamics data hand book and Mollier chart permitted.

Module-1

1 a. Define turbomachine. Explain the classification of turbomachines. **(06 Marks)**

b. List any six differences between turbomachines and positive displacement machines. **(06 Marks)**

c. Tests on a turbine runner 1.25 m in diameter at 30 m head gave the following results : Power developed 736 kW, Speed 180 rpm and discharge 2.7 m^3/s. Find diameter, speed and discharge 2.7 m^3/s. Find diameter, speed and discharge of a runner to operate at the same efficiency. What is the specific speed of both turbines to give 1472 kW at 45 m head. **(08 Marks)**

OR

2 a. Define Isentropic efficiency and stage efficiency for a compression process. Show that the polytropic efficiency for expansion process is given by, $\eta_P = \frac{\gamma}{(\gamma-1)}\frac{(n-1)}{n}$, where $\gamma \rightarrow$ ratio of specific heats. **(10 Marks)**

b. A 16 stage axial flow compressor is to have a pressure ratio of 6.3 and test have shown that a stage efficiency of 89.5% can be obtained. The intake conditions are 288 K and 1 bar pressure. Find (i) Overall efficiency (ii) Polytropic efficiency (iii) Preheat factor. **(10 Marks)**

Module-2

3 a. Define degree of reaction and utilization factor. Derive an expression relating utilization factor with degree of reaction. **(10 Marks)**

b. At a stage in 50% reaction axial flow turbine running at 3000 rpm, the mean diameter is 685 mm. If the maximum utilization for the stage is 0.915. Calculate the inlet and outlet absolute velocities for the rotor. Draw the velocity triangles and find power output for the flow rate of 1.5 kg/s. **(10 Marks)**

OR

4 a. Draw the velocity triangles for an axial flow compressor and show that for an axial flow compressor the degree of reaction is given by $R = \frac{V_a}{2u}\left[\frac{\tan\beta_1 + \tan\beta_2}{\tan\beta_1 \times \tan\beta_2}\right]$,

Where V_a = Axial flow velocity, u = Blade Speed, β_1 and β_2 = Inlet and Outlet blade angles with respect to tangential direction. **(10 Marks)**

b. A radial flow pump having impeller diameters 5 cm and 12.5 cm runs at 1500 rpm. The inlet blade angle is 50°. The fluid enters the impeller without any whirl component while the flow component remains constant. Determine the specific work and degree of reaction at a blade outlet angle of 70°. Also find at what outlet angle the impeller becomes a zero work impeller. **(10 Marks)**

Module-3

5 a. What is necessity for compounding steam turbines? Briefly explain the different compounding methods. **(08 Marks)**

b. In a Curtis stage with two rows of moving blades, the rotor blades are equiangular. The first rotor has an angle of 29° each while second rotor has an angle of 32° each. The velocity of steam at the exit of the nozzle is 530 m/s and the blade coefficients are 0.9 in the first, 0.95 in the stator and in the second row. If the absolute velocity at the stage exit should be axial. Find : (i) Mean blade speed
(ii) The rotor efficiency
(iii) The power output for a flow rate of 32 kg/sec. **(12 Marks)**

OR

6 a. For a reaction steam turbine (Parason's turbine), show that the condition for maximum blade efficiency is $\phi_{optimum} = \cos\alpha_1$ and determine the equation for maximum blade efficiency. **(10 Marks)**

b. A stage of a turbine with Parason's blading deliver dry saturated steam at 2.7 bar from the fixed blades at 90 m/s. The mean blade height is 40 mm and the moving blade exit angle is 20°. The axial velocity of steam is $\frac{3}{4}$ of the blade velocity at the mean readius. Steam is supplied to the stage at the rate of 9000 kg/hr. The effect of the blade tip thickness on the annulus area can be neglected. Calculate
(i) Wheel speed (ii) The diagram efficiency (iii) The diagram power
(iv) The enthalpy drop of the steam in this stage. **(10 Marks)**

Module-4

7 a. Draw the inlet and exit velocity triangles for a pelton wheel turbine. Show that maximum hydraulic efficiency is given by $(\eta_h)_{max} = \frac{1+\cos\beta_2}{2}$. Assume that relative velocity remains constant. **(10 Marks)**

b. In a power station, a pelton wheel produces 15,500 kW under a head of 350 m while running at 500 rpm. Assume a turbine efficiency of 0.84 coefficient of velocity for nozzle as 0.98. Speed ratio = 0.46 and Blade coefficient = 0.86. Calculate (i) Number of jets (ii) Diameter of each jet (iii) Tangential force on the buckets. If the bucket deflect the jet through 165°. **(10 Marks)**

OR

8 a. State the functions of a draft tube. Explain briefly different types of draft tubes. **(06 Marks)**

b. The inner and outer diameters of a Francis turbine are respectively 30 cm and 60 cm water enters the turbine at an angle of 20° to the wheel tangent and leaves the turbine radially. If the velocity of flow remains constant throughout at 3 m/s and speed of runner is 300 rpm. Calculate (i) Inlet and exit blade angles (ii) Theoretical power developed if the width of the wheel at inlet is 15 cm. Neglect thickness of blades. **(08 Marks)**

c. A Kaplan turbine produces 30000 kw under a head of 9.6 m while running at 65.2 rpm. The discharge through the turbine is 350 m^3/s. The tip diameter of the runner is 7.4 m. The hub diameter is 0.432 times the tip diameter. Calculate :
(i) Turbine efficiency (ii) Specific speed of turbine
(iii) Speed ratio (based on tip diameter). **(06 Marks)**

Module-5

9 a. What is priming? Why priming is required in centrifugal pump? **(03 Marks)**

b. Derive an expression for minimum starting speed of a centrifugal pump. **(05 Marks)**

c. A centrifugal pump discharges 0.15 m^3/s if water against a head of 12.5 m, the speed of the impeller being 600 rpm. The outer and inner diameters of the impeller are 500 mm and 250 mm respectively and the vanes are bent back by 35° to the tangential at the exit. If the area of flow remains 0.07 m^2 from the inlet to outlet. Calculate (i) Manometric efficiency of the pump (ii) Vane angle at inlet (iii) Loss of head of Inlet to the impeller when the discharge is reduced by 40% without changing the speed. **(12 Marks)**

OR

10 a. Define Slip actor and Power input factor. **(03 Marks)**

b. Air is compressed in a centrifugal compressor from 27° to 150° C and pressure from 1 bar to 3 bar. Find Isentropic efficiency and power developed. Take C_P = 1.005 KJ/kgK, $\dot{m} = 0.467$ kg/s, $\dot{m}$ = Mass flow rate. **(05 Marks)**

c. A centrifugal compressor running at 5950 rpm has a impeller tip diameter 100 cm, mass flow rate of air 30 kg/s, total pressure ratio 2.125, pressure at inlet 1 bar and temperature 25° C. Slip coefficient is 0.9 and mechanical efficiency 0.97. Find (i) Total efficiency (ii) Temperature of air at exit (iii) Power input (iv) Pressure coefficient. **(12 Marks)**

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18ME55

Fifth Semester B.E. Degree Examination, June/July 2024
Fluid Power Engineering

Time: 3 hrs. Max. Marks: 100

Note: Answer any FIVE full questions, choosing ONE full question from each module.

Module-1

1 a. Define Fluid Power System. Sketch and explain the structure of a hydraulic Control System **(08 Marks)**

b. State Pascals law. Explain the concept of force multiplication. **(08 Marks)**

c. A haydraulic press has a ram of 25cm diameter and a plunger of diameter 4cm. If a load of 40 kN is to be lifted, find the magnitude of the minimum force to be applied on the plunger to keep the 40 kN in balance. **(04 Marks)**

OR

2 a. What are the desirable properties of hydraulic fluid? Explain briefly any 8 of them. **(08 Marks)**

b. Define Seal. Explain briefly how hydraulic seals are classified. **(06 Marks)**

c. Explain the various filtering locations used in filtering the oil in hydraulic system **(06 Marks)**

Module-2

3 a. Explain with a neat sketch the working principle of an external gear pump. **(08 Marks)**

b. Explain pump theory of a positive displacement pump and what are the factors to be considered for selecting a hydraulic pump. **(08 Marks)**

c. A vane pump has a rotor of diameter 50mm, a cam ring of diameter 80mm and the vane width of 40mm. Compute the volumetric displacement if the eccentricity is 10mm. **(04 Marks)**

OR

4 a. Explain single acting and double acting hydraulic cylinder with diagram and their graphic symbol. **(08 Marks)**

b. With is an accumulator? Explain with a neat sketch the working principle of gas loaded accumulator with graphic symbol. **(06 Marks)**

c. A hydraulic motor has a volumetric displacement of 123 cm^3 operating at a pressure of 60 bar and speed 1800 rpm. If the actual flow rate consumed by the motor is 0.004 m^3/sec and the actual torque delivered by the motor is 100Nm. Find i) Volumetric efficiency ii) mechanical efficiency iii) overall efficiency. **(06 Marks)**

Module-3

5 a. Define control valves. Explain the classification of control valves. **(05 Marks)**

b. Explain the following valves with graphical symbol.
i) Compound pressure relief valve
ii) Pressure reducing valve
iii) Shuttle valve **(15 Marks)**

OR

6 a. Explain the concept of meter-in and meter-out circuits. List the advantages and limitations of the circuit. **(10 Marks)**

b. What is regenerative circuit? Mention its applications. **(04 Marks)**

c. Explain with a neat sketch, sequencing circuits. **(06 Marks)**

Module-4

7 a. Explain with a neat sketch the working of pneumatic filter. **(06 Marks)**

b. List the characteristics of compressed air in pneumatic system. **(06 Marks)**

c. Explain with a neat sketch
i) Rodless cylinder ii) Impact cylinder. **(08 Marks)**

OR

8 a. Explain with a neat sketch with graphical system
i) Quick exhaust valve ii) Time delay valve iii) Twin pressure valve. **(15 Marks)**

b. Briefly explain cylinder cushioning. **(05 Marks)**

Module-5

9 a. Explain the following with truth table X symbol
i) OR gate ii) AND gate **(10 Marks)**

b. Explain the sequencing of two cylinders A and B using cascading method circuit for cylinder sequence A^+ B^+ B^- A^- **(10 Marks)**

OR

10 a. Explain the following pneumatic circuit
i) Supply air throttling ii) Exhaust air throttling **(10 Marks)**

b. Write short notes on the following :
i) Solenoid ii) Electromagnetic Relay **(10 Marks)**

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18ME56

Fifth Semester B.E. Degree Examination, June/July 2024
Operations Management

Time: 3 hrs. Max. Marks: 100

Note: Answer any FIVE full questions, choosing ONE full question from each module.

Module-1

1 a. Define Operations Management. Sketch and explain the schematic model for operations/production system. **(06 Marks)**

b. Define productivity. List the factors affecting productivity. **(06 Marks)**

c. A glass factory specializing in crystal is experiencing a substantial backlog, and the firm's management is considering three courses of action:
A – Arrange for subcontracting
B – Begin overtime production
C – Construct new facilities
The correct choice depends largely upon future demand, which may be low, medium or high. By consensus, management ranks the respective probabilities as 0.10, 0.50 and 0.40. A cost analysis reveals the effect upon profits that is shown in Table.Q1(c). [Profits are in thousands rupees]

	Profit (Rs. 000) if demand is		
	Low (P = 0.10)	Medium (P = 0.50)	High (P = 0.40)
A – Arrange subcontracting	10	50	50
B – Begin overtime	–20	60	100
C – Construct facilities	–150	20	200

Table.Q1(c)

(i) State which course of action would be taken under a criterion of (1) maximax (2) maximin (3) maximum expected value.

(ii) Depict the problem in the form of a decision tree. **(08 Marks)**

OR

2 a. Explain the characteristics, advantages and limitations of (i) Batch production (ii) Mass production. **(10 Marks)**

b. Solve the following problem using graphical linear programming:
Maximize Z = 6A + 3B (revenue)
Subject to
Material $20A + 6B \leq 600$ kg
Machinery $25A + 20B \leq 1000$ hr
Labour $20A + 30B \leq 1200$ hr
$A, B \geq 0$ **(10 Marks)**

Module-2

3 a. What are forecasts? List and explain the steps in the forecasting process. **(07 Marks)**

b. Briefly explain the forecasting methods based on judgment and opinion. **(05 Marks)**

c. Explain exponential smoothing. Given the following data as shown in Table.Q3(c).

Period	1	2	3	4	5
Number of complaints	60	65	55	58	64

Table.Q3(c)

Prepare a forecast using each of these approaches:
(i) The appropriate Naïve approach.
(ii) A three-period moving average.
(iii) A weighted average using weights of 0.50 (most recent), 0.30 and 0.20. **(08 Marks)**

OR

4 a. What is a time series? Explain the components of a time series. **(06 Marks)**

b. Explain simple linear regression. The general manager of a building materials production plant feels that the demand for plasterboard shipments may be related to the number of construction permits issued in the country during the previous quarter. The manager has collected the data as shown in Table.Q4(b).

Construction permits (X)	15	9	40	20	25	25	15	35
Plaster board shipments (Y)	6	4	16	6	13	9	10	16

(i) Find the regression equation.
(ii) Determine a point estimate for plasterboard shipments when the number of construction permits is 30. **(14 Marks)**

Module-3

5 a. Explain design capacity and system capacity. An automobile component manufacturer has the plan of buying a moulding machine which can manufacture 1,70,000 good parts per year. The moulding machine is a part of a product line. The system efficiency of the product line is 85%.
(i) What is the required systems capacity?
(ii) Assume that it takes 100 seconds to mould each part and the plant operates 2000 hours per year. If the moulding machines are used only 60% of the time and are 90% efficient, what is the actual output of the moulding machine per hour?
(iii) How many moulding machines would be required? **(10 Marks)**

b. Explain the strategic importance of location decisions. Also list the steps involved in making a facility location decision. **(10 Marks)**

OR

6 a. Explain the factors that determine effective capacity. **(10 Marks)**

b. Explain the concept of cost-volume analysis. The owner of Old-Fashioned Berry Pies is contemplating adding a new line of pies, which will require leasing new equipment for a monthly payment of Rs.6000. Variable costs would be Rs.2 per pie and pies would retail for Rs.7 each.
(i) How many pies must be sold in order to breakeven?
(ii) What would the profit (loss) be if 1000 pies are made and sold in a month?
(iii) How many pies must be sold to realize a profit of Rs.4000? **(10 Marks)**

Module-4

7 a. Explain aggregate planning and master scheduling with an example. Also list the decision variables used in aggregate planning and their associated costs. **(10 Marks)**

b. Given the accompanying supply, demand, cost and inventory data [Tables.Q7(b)(i) and Q7(b)(ii)] for a firm that has a constant workforce and wishes to meet all demand (with no backorders), allocate production capacity to satisfy demand at minimum cost.

Tables.Q7(b)(i) Supply capacity (units)

Period	Regular time (Rs.100/unit)	Overtime (Rs.125/unit)	Subcontract (Rs.130/unit)
1	60	18	1000
2	50	15	1000
3	60	18	1000
4	65	20	1000

Unused capacity in regular time costs at Rs.50 per unit.

Table.Q7(b)(ii) Demand and Inventory

Demand:				
Period	1	2	3	4
Units	100	50	70	80
Inventory:				
Initial = 20, Final = 25, carrying cost = Rs.2/unit – period				

(10 Marks)

OR

8 a. With reference to Master Production Schedule (MPS), explain the following:
(i) Major inputs to MPS
(ii) Demand time fence and planning time fence
(iii) Available to promise inventory and its determination **(09 Marks)**

b. A shoe company schedules running shoe production in lot sizes of 40 units (each of which consists of a carton of pairs). They have a beginning inventory of 45 units and have developed a forecast of demand as shown in Table.Q8(b). The company has received orders for 22 units in week 1, 9 units in week 2, 4 units in week 3, 15 units in week 4, and 5 units in week 5. Set up a master production schedule, and find the Available-To-Promise inventory values for weeks 1 through 8.

Planning Time Fence								
Period	1	2	3	4	5	6	7	8
Forecast	20	20	30	20	20	13	15	20

Table.Q8(b)

(11 Marks)

Module-5

9 a. Explain MRP and CRP. What are the essential inputs and outputs in an MRP system? **(10 Marks)**

b. The product structure tree for X is as shown in Fig.Q9(b), with the number of units required shown in brackets. What quantities of E, J and K are required to complete 500 units of X?

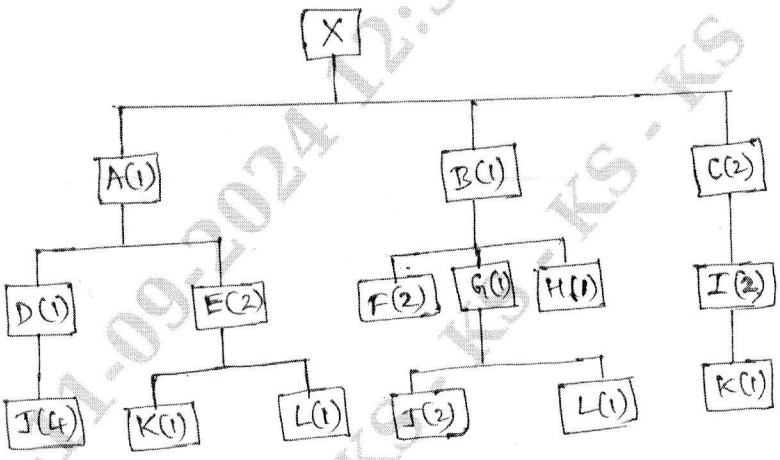

Fig.Q9(b) **(10 Marks)**

OR

10 a. What is a supply chain? Draw a typical manufacturing supply chain and explain. **(05 Marks)**

b. Define supply chain management. List the benefits of effective supply chain management. **(05 Marks)**

c. With a neat block diagram, explain the steps in the procurement process. **(10 Marks)**

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