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Sixth Semester B.E./B.Tech. Degree Examination, Dec.2024/Jan.2025
Production and 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 operation management. Explain briefly classification of production systems.

(10 Marks)

   b. Define productivity. List the various factors affecting and improvements of the productivity.

(10 Marks)

OR

2 a. Enumerate in brief the importance of decision making and list the steps involved in it.

(10 Marks)

   b. Solve the following LPP by graphical method.

   $Z_{max} = 3x_1 + 4x_2$

   Subject to $x_1 + x_2 \leq 450$

   $2x_1 + x_2 \leq 600$ and

   $x_1, x_2 \geq 0$

(10 Marks)

Module-2

3 a. Define forecasting. What are the steps involved in forecasting process?   **(10 Marks)**

   b. Briefly explain a forecasting technique.   **(10 Marks)**

OR

4 a. Explain the following methods:

   (i) Source of redesigned product   (ii) Design for manufacturing   **(10 Marks)**

   b. A company adopts method of least squares to develop a linear trend equation for the data as shown in the table below:

Year (x)	1	2	3	4	5	6	7	8	9	10	11
Shipment in Tons (y)	2	3	6	10	8	7	12	14	14	18	19

   Calculate the trend for the year 12 and 20.   **(10 Marks)**

Module-3

5 a. List and briefly explain the factors affecting the capacity.   **(08 Marks)**

   b. Explain in brief the importance of capacity decisions.   **(04 Marks)**

   c. Location A would result in fixed costs of Rs.3,00,000 variable costs of Rs.63 per unit, revenues of Rs. 68 per unit. Annual fixed costs at location B are Rs. 8,00,000 with variable costs of Rs. 32 per unit revenue of Rs. 68 per unit. Sales volume is estimated to be 25,000 units/year. Which location is most attractive?   **(08 Marks)**

OR

6 a. Explain characteristics of Location Decisions.   **(06 Marks)**

   b. Explain in brief Designing of process layout.   **(08 Marks)**

   c. Explain the following :

   i) Identifying a country   ii) Identifying a community   **(06 Marks)**

Module-4

7 a. What is aggregate planning? Briefly explain strategies of aggregate planning. **(10 Marks)**

b. Explain the techniques for aggregate planning in services. **(10 Marks)**

OR

8 a. With flow chart, explain master production scheduling process. **(08 Marks)**

b. For the given data of supply, demand cost and inventory allocate the production capacity to fulfill request/demand at lowest cost method.

Supply Capacity

Period	Regular time	Overtime	Sub contract
A	70	15	750
B	65	20	1000
C	75	25	1250
D	80	30	1500

Demand and Inventory

Period	A	B	C	D
Unit of Demand	150	75	80	90

Inventory details :

Initial = 25 units ;   Final = 35 units

Regular Time cost/unit = Rs. 150 (40% of cost is labour cost)

Overtime cost per unit = Rs. 140

Subcontracting cost per unit is Rs.160

Inventory carrying cost per unit period = Rs. 3

Carrying cost per unit per period = Rs. 3. **(12 Marks)**

Module-5

9 a. Briefly explain with a flowchart of capacity requirement planning. **(10 Marks)**

b. Briefly explain the structure of an Enterprise Resource Planning System (ERP). **(10 Marks)**

OR

10 a. State the importance of purchasing and supply chain management. **(08 Marks)**

b. Briefly explain the following :
  i) Vender development
  ii) Make or Buy decision
  iii) E-procurement **(12 Marks)**

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Sixth Semester B.E./B.Tech. Degree Examination, Dec.2024/Jan.2025
Heat Transfer

Time: 3 hrs.   Max. Marks: 100

Note : 1. *Answer any FIVE full questions, choosing ONE full question from each module.*
2. *Use of Heat transfer Data book and Thermodynamics Data book is permitted.*
3. *Assume any missing data.*

Module-1

1   a.   Derive the 3 – Dimensional general heat conduction equation for steady state heat flow in terms of Cartesian co-ordinates. **(10 Marks)**

   b.   A wall is constructed of several layers. The first layer consists of brick (K = 0.66 w/mK), 25cm thick , the second layer 2.5cm thick mortar (K = 0.7 W/mK), the third layer 10cm thick limestone (K = 0.66 W/mK) and outer layer of 1.25cm thick plaster (K = 0.7 W/mK). The heat transfer coefficients on interior and exterior of the wall fluid layers are 5.8 W/m^{2}K and 11.6 W/m^2 K respectively. Find i)   Overall heat transfer coefficient
   ii)   Overall thermal resistance per m^2.
   iii)   Rate of heat transfer per m^2, if the interior of the room is at 26ºC while the outer layer is at -7ºC.
   iv)   Temperature at the junction between mortar and limestone. **(10 Marks)**

OR

2   a.   Derive the temperature distribution equation and heat transfer for a one dimensional conduction through a plane watt without heat generation. **(10 Marks)**

   b.   Explain the experimental procedure for determining overall heat transfer coefficient for a composite wall made up of three different materials with suitable sketch, tabulation of readings and formulae. **(10 Marks)**

Module-2

3   a.   Derive the equations to determine temperature distribution and heat transfer through a pin fin of infinitely long. **(10 Marks)**

   b.   A mild steel rod (K = 32 W/m ºC), 12mm in diameter and 60 mm long with an insulated end is to be used as spine. It is exposed to surroundings with a temperature of 60ºC and a heat transfer coefficient of 55 W/m^{2}ºC. If the base temperature of the fin is 95ºC, determine
   i)   Fin efficiency
   ii)   Temperature at the edge of a spine
   iii)   Heat transfer rate
   iv)   Effectiveness of fin. **(10 Marks)**

OR

4   a.   Derive temperature distribution equation for lumped parameter analysis of solids for transient heat conduction with negligible internal resistance. **(08 Marks)**

   b.   What is Biot number and Fourier number with their significance. **(04 Marks)**

c. A 15mm diameter mild steel sphere (K = 42 W/m°C) is exposed to cooling air flow at 20°C with the convection coefficient h = 120 N/m² °C. Determine :
   i) Time required to cool sphere from 550°C to 90°C.
   ii) Instantaneous heat transfer rate 2 minutes after start of cooling.
   iii) Total energy transferred from sphere during first 2 minutes.
   Take ρ = 7850 kg/m³ , C = 475 J/kg °C , α = 0.045 m²/h. **(08 Marks)**

Module-3

5 a. Explain the finite difference formulation of one dimensional steady state conduction for a plane wall using energy balance approach. **(10 Marks)**

   b. A large plate of thickness L = 4cm, having thermal conductivity K = 28 W/m°C in which heat is generated uniformly at a constant rate of $\dot{q}_{gm}$ = 5 × 10⁶ W/m³. One end of the plate is maintained at 0°C and other end is subjected to environment at T_∞ = 30°C , with heat transfer coefficient of h = 45 W/m²C. Considering three nodes as two nodes at the boundary and one in the middle. Determine the surface temperature of plate for steady state conditions using finite difference approach. **(10 Marks)**

OR

6 a. State and prove Kirchoff's law of radiation. **(06 Marks)**

   b. Explain : i) Stefan Boltzmann law   ii) Planck's law   iii) Wein's displacement law
   iv) Black body. **(08 Marks)**

   c. Two large parallel plates with ε = 0.5 each are maintained at different temperatures exchanging heat by radiation. Two equally large radiation shields with surface emissivity (ε = 0.05) are introduced between plates. Find the percentage reduction in net radiative heat transfer. **(06 Marks)**

Module-4

7 a. Explain with sketch, development of a velocity boundary layer and thermal boundary layer over a smooth flat plate. **(10 Marks)**

   b. Air is at 20°C is flowing over a flat plate which is 200mm wide and 500mm long. The plate is maintained at 100°C. Find the heat loss per hour from the plate if the air is flowing with 2m/s velocity. What will be effect the heat transfer if the flow is parallel to 200mm wide? **(10 Marks)**

OR

8 a. Define the following Dimensionless parameters :
   i) Reynolds number   ii) Nusselt number   iii) Prandtl number
   iv) Grashoff number   v) Stanton number. **(10 Marks)**

   b. A sheet metal air duct carries conditioned air at an average temperature of 10°C. The Duct size is 320mm × 200mm and length of the duct exposed to air at 30°C is 15m long. Find the heat gained by air in Duct. Take 200mm side as vertical and top surface of the duct is insulated. Use the following equations :
   N_u = 0.6 (Gr Pr)$^{0.25}$ for Vertical surface
   N_u = 0.27 (Gr Pr)$^{0.25}$ for Horizontal surface. **(10 Marks)**

Module-5

9 a. Explain the different regimes of boiling curves of water. **(10 Marks)**

b. A metal clad heating element of 10 mm dia and of emissivity 0.92 is submerged in water bath horizontally. If the surface temp of metal is 260°C, under steady boiling conditions, calculate the power dissipation per unit length for the heater water is exposed to atmospheric pressure and is at a uniform temperature. **(10 Marks)**

OR

10 a. Derive the expression for LMTD for a parallel flow heat exchanger. **(10 Marks)**

b. Steam condenses at atmospheric pressure on the external surface of tubes of condenser. The tubes are 12 in number and each is 30 mm dia and 10 m long. The inlet and outlet temperatures of cooling water flowing inside tubes are 25°C and 60°C.; if the flow rate is 1.1 kg/s. Calculate :
   i) Rate of condensation of steam.
   ii) Mean overall heat transfer coefficient based on inner surface area.
   iii) Number of Transfer Units (NTU).
   iv) Effectiveness of the condenser. **(10 Marks)**

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21ME63

Sixth Semester B.E./B.Tech. Degree Examination, Dec.2024/Jan.2025
Machine Design

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 hand book is allowed.
3. Missing data can be suitably assumed.

Module-1

1 a. Draw the stress-strain curve for mild steel and cast iron. Name the salient points.   **(05 Marks)**

   b. An unknown weight fails through 15 mm on a collar rigidly attached to the lower end of a vertical bar 3 m long and 500 mm^2 in section. If the maximum instantaneous extension is known to be 2 mm. What is the corresponding stress and the value of un-known weight. Take E = 200 KN/mm^2.   **(10 Marks)**

   c. An element is acted upon by the following stresses $\sigma_x = 120$ MPa ; $\sigma_y = 90$ MPa and $\tau_{xy} = 30$ MPa.

   (i)   Compute stresses on a plane inclined at $20°$.
   (ii) Find principal stresses and their direction.
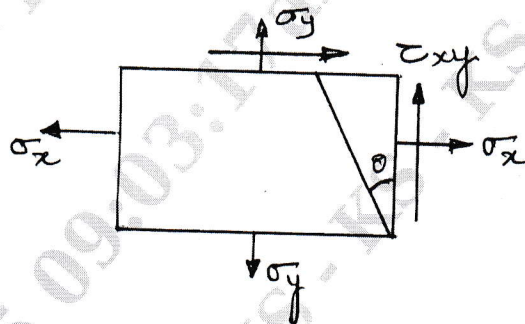   (iii) Find maximum shear stress and its direction.

Fig. Q1 (c)   **(05 Marks)**

OR

2 a. What are important mechanical properties of metals? Explain any three briefly.   **(05 Marks)**

   b. Derive the Soderberg's equation.   **(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. Take stress concentration into account.
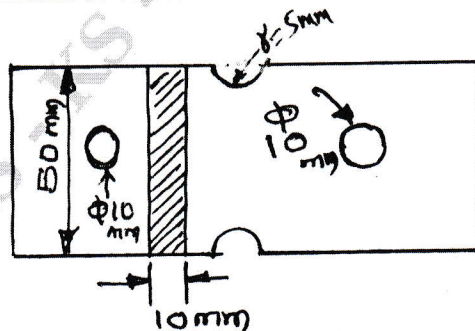

Fig. Q2 (c)   **(10 Marks)**

Module-2

3 a. A hollow shaft of 50 mm outside diameter and 30 mm inside diameter, 300 mm long is subjected to a torque of 4 N-m. What is the angle of twist if modulus of rigidity is 90 GPa.
(05 Marks)

b. Design flange coupling to connect the shafts of a motor and a centrifugal pump. Take factor of safety = 2 ; Allowable shear stress for CI flange = 15 MPa, Pump output = 3000 litre/min
Total head = 20 m
Pump speed = 600 rpm,
Pump efficiency = 70%
C40 steel shaft with $\sigma_y = 328.6$ MPa,
C30 steel for bolts and key with $\sigma_y = 294.2$ MPa.
(10 Marks)

c. What is coupling? What are the requirements of a good coupling?
(05 Marks)

OR

4 a. A simply supported shaft has the distance between supports as 600 mm. The load at the center is 15 KN. If the deflection at the center is to be limited to 0.02 mm. What should be the diameter of the shaft? If the shaft diameter is doubled, what will be the deflection at center? The modulus of elasticity is 210 GPa.
(10 Marks)

b. Design a helical compression spring to sustain an axial load of 3 kN. The deflection is 60 mm, spring index is '6'. The shear stress is not to exceed 300 MPa. Rigidity modulus of the spring is 81 GPa.
(10 Marks)

Module-3

5 a. Design a double riveted Lap joint to connect two plates each 20 mm thick. The allowable stress for rivets and plates are 90 MPa in tension, 60 MPa in shear and 150 MPa in crushing.
(10 Marks)

b. Determine the size of weld for a joint shown in Fig. Q5 (b). The allowable stress in the weld is 70 MPa.
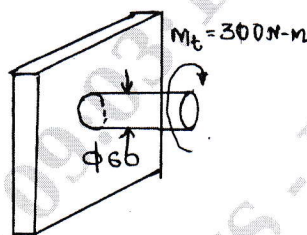**(05 Marks)**

Fig. Q5 (b)

c. Classify Riveted joints, sketch them neatly.
(05 Marks)

OR

6 a. List different types of fasteners and their uses.
(05 Marks)

b. Determine the size of the weld to be used for a bracket as shown in the Fig. Q6 (b). The load is 30 kN.
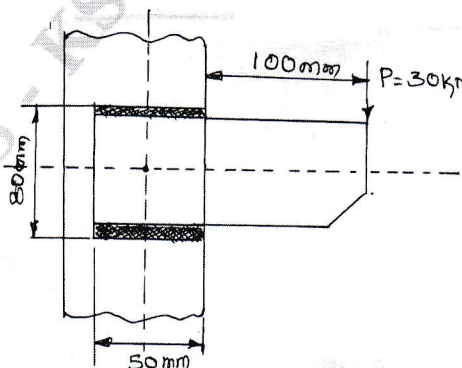**(15 Marks)**

Fig. Q6 (b)

Module-4

7   Design a pair of helical gear to transmit 12 kW at 1200 rpm of pinion. The velocity ratio is 3 : 1, pinion has 24 teeth and is made of 0.4% carbon steel untreated. The gear is made of cast steel, the teeth are $14\frac{1}{2}^{\circ}$ involute form in normal plane Helix angle is 25°.   **(20 Marks)**

OR

8   Design a pair of Right angle bevel gears to transmit 25 kW from a shaft rotating at 1200 rpm to another shaft to rotate at 500 rpm.   **(20 Marks)**

Module-5

9   a.   List important properties of Lubricants and briefly define any four.   **(06 Marks)**
     b.   Design the main bearings of a 4-stroke diesel engine to sustain a load of 6 kN. The operating speed of the shaft is 100 rpm.   **(14 Marks)**

OR

10   a.   A single block brake with drum diameter of 350 mm is shown in Fig. Q10. The angle of contact is 90° coefficient of friction is 0.33. Determine safe power that can be absorbed at 1440 rpm.   **(10 Marks)**
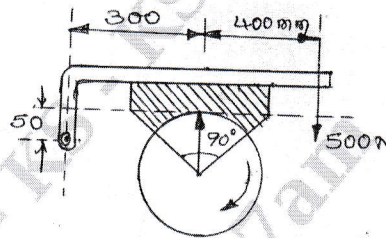

Fig. Q10 (a)

     b.   List various condition of Lubrication and briefly describe each.   **(10 Marks)**

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21ME641

Sixth Semester B.E./B.Tech. Degree Examination, Dec.2024/Jan.2025
Supply Chain Management and Introduction to SAP

Time: 3 hrs.

Max. Marks: 100

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

Module-1

1	a.	Explain the role of supply chain management in economy.	(10 Marks)
	b.	Describe decision phases of supply chain management.	(06 Marks)
	c.	Differentiate between Market and Hierarchy continuum.	(04 Marks)

OR

2	a.	Explain drivers of supply chain performance.	(10 Marks)
	b.	Differentiate between Make and Buy continuum.	(06 Marks)
	c.	Describe the four steps of contract negotiation process.	(04 Marks)

Module-2

3	a.	List the objectives of warehouse management.	(06 Marks)
	b.	Explain stores systems and procedures.	(08 Marks)
	c.	Explain distribution strategies in supply chain management.	(06 Marks)

OR

4	a.	Explain the material handling equipment used for material transportation.	(06 Marks)
	b.	Explain obsolete, surplus and scrap management.	(06 Marks)
	c.	Explain design options for a distribution network.	(08 Marks)

Module-3

5	a.	Explain the factors influencing network design in supply chain.	(08 Marks)
	b.	Explain demand planning.	(07 Marks)
	c.	Describe the advantages of multiple location inventory management.	(05 Marks)

OR

6	a.	Explain the role of pricing and revenue management in supply chain.	(08 Marks)
	b.	Explain the framework for network design decisions.	(07 Marks)
	c.	List the benefits of supply chain optimization modes.	(05 Marks)

Module-4

7	a.	Explain agile supply chain with its characteristics.	(08 Marks)
	b.	Explain the role of IT in supply chain.	(07 Marks)
	c.	Describe the activities involved in supply chain restructuring.	(05 Marks)

OR

8	a.	Explain reverse supply chain with its benefits.	(09 Marks)
	b.	Explain Supply chain mapping.	(07 Marks)
	c.	Describe bullwhip effect in supply chain.	(04 Marks)

Module-5

9 a. Describe the features of SAP MM. **(04 Marks)**

  b. Explain the sequential steps involved in procurement life cycle. **(08 Marks)**

  c. Explain invoice verification. **(08 Marks)**

OR

10 a. Describe purchase info record. **(04 Marks)**

  b. Explain the various units or levels of an enterprise structure. **(08 Marks)**

  c. Explain inventory management. **(08 Marks)**

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Sixth Semester B.E./B.Tech. Degree Examination, Dec.2024/Jan.2025
Renewable Energy Power Plants

Time: 3 hrs.   Max. Marks: 100

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

Module-1

1 a. Elaborate on India's production and reserves of commercial energy sources **(10 Marks)**
   b. What is the need for alternative energy sources? **(04 Marks)**
   c. Explain with a neat sketch, Solar radiation at the earth's surface. **(06 Marks)**

OR

2 a. With a neat sketch, explain the working principle of extra terrestrial radiation. **(10 Marks)**
   b. With a neat sketch, explain the working principle of shading ring pyreheliometer.
   (10 Marks)

Module-2

3 a. Define the following : i) Declination angle   ii) Latitude   iii) Hour angle
   iv) Zenith angle   v) Surface azimuth angle. **(10 Marks)**
   b. Describe with a neat sketch, the working principle of Solar pond. **(10 Marks)**

OR

4 a. List and explain the various parameters that effect the performance of flat plate collectors.
   (10 Marks)
   b. Explain with a neat sketch, photovoltaic conversion. **(10 Marks)**

Module-3

5 a. List the types of wind mills. Explain horizontal axis wind mill with neat sketch. **(10 Marks)**
   b. List the advantages , disadvantages and applications of wind energy. **(10 Marks)**

OR

6 a. Discuss the applications of biogas in engines. **(04 Marks)**
   b. Explain briefly the KVIC model biogas plant with a neat sketch. **(08 Marks)**
   c. With a neat sketch, explain working principle of Janta Model biogas digester (Fixed dome).
   (08 Marks)

Module-4

7 a. Discuss with a neat sketch, hydro power plant. **(10 Marks)**
   b. Explain with a neat sketch, Operation of double basin tidal power plant. **(10 Marks)**

OR

8 a. What are the different types of wave energy conversion devices? **(04 Marks)**
   b. With the help of neat diagram , explain wave energy conversion system by floats. **(08 Marks)**
   c. What are the advantages and limitation of wave energy conversion? **(08 Marks)**

Module-5

9 a. With a neat sketch, describe the closed cycle OTEC system. **(10 Marks)**

b. What are the problems associated with OTEC? **(05 Marks)**

c. What are the advantages and disadvantages of geothermal energy over other energy sources? **(05 Marks)**

OR

10 a. Explain with a neat sketch, working principle of vapour dominated geothermal plant. **(10 Marks)**

b. Describe with a neat sketch, geothermal energy system by Hot Dry Rock. **(10 Marks)**

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