(3 Hours) [Total Marks: 80]

N.B. 1) **Question No. 1 is compulsory**
2) Solve **Any Three** from remaining **Five** questions.
3) Use of standard data book like PSG, Mahadevan and Kale Khandare is permitted
4) Assume suitable data if necessary, giving justification

Q 1 Answer any **Four** from the following
a) Explain system concepts in design with suitable examples. 5
b) Explain different types of gear tooth failures. 5
c) Explain different types of take-up arrangement in belt conveyor. 5
d) Draw a neat sketch of centrifugal pump and explain its Working Principle. 5
e) Explain why an I – section with Ixx ≤ 4 Iyy is selected for connecting rods of an I.C. Engine? 5

Q 2 A two-stage gear box is used to transmit 10 KW power from an electric motor running at 1440 rpm to a machine with overall reduction ratio of 20. For the second stage spur gear pair, 20
1) Determine the module using bending failure.
2) Check the gear for dynamic load by using Buckingham's method.
3) Check the gears for wear strength.
4) Work out constructional details of gears.

Q 3 (a) The following specifications refer to an EOT crane. 20
        Load to be lifted: 200 KN.
        Hoisting speed: 12 m/min.
        Application: Class-II.
1) Select suitable wire rope, find its diameter and check it for expected life.
2) Select standard hook and check the induced stress only at 45° inclined plane
3) Design the pulley axle and select suitable bearing.
4) Design the cross piece, side plate and shackle plate.

Q 4 (a) Explain how assumptions made in Lewis equation are taken in account during design? 5

(b) The Specification of belt conveyer system are, 15
        Capacity = 250 TPH.
        Material to be conveyed = Lime stone.
        Maximum lump size = 70 mm.
        Inclination = 12°.
        Center to Center distance = 60 m. (Assume troughing angle 25°)
1) Design conveyor belt.
2) Find motor capacity.

Q 5 (a) A centrifugal pump is to be designed for following specifications: **10**
        Static suction head = 4m
        Length of suction pipe =11m
        Static delivery head =19m
        Length of delivery pipe = 40m
        Discharge =2500 LPM
        Fluid to be lifted = water at room temperature.
    1) Design impeller.
    2) Design impeller shaft.

(b) It is required to design the gear pump for flow 70 LPM and pressure 50 bar. **10**
    1) Select suitable motor power, determine gear module & check it for bending.
    2) Design the driver gear shaft.

Q.6 A four-stroke single cylinder water cooled Diesel engine develops 10KW brake power **20**
when operating at 1000rpm.
    1) Determine the size of engine (bore and stroke)
    2) Design wet liner and cylinder.
    3) Design piston with pin and piston rings
    4) Design the connecting rods

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Time: 3 Hours   Total Marks: 80

N.B. (1) Question No.1 is compulsory
      (2) Attempt any three questions out of remaining five questions.

Q .1   (a) What type of data analytics is used in healthcare?   (5)
        (b) Which imaging technologies do not use radiation? Explain those technologies
        in brief.   (5)
        (c) What you mean by the term Natural Language Processing for clinical/medical
        text data   (5)
        (d) Define Advanced Data Analytics for Healthcare with 6(six) real-world
        applications.   (5)

Q.2   (a) How could advances in genome analysis lead to more personalised medicine? (10)

        (b) What is visualization? Explain different types of visualization techniques, tools

        with Advantages and Disadvantages.   (10)

Q.3   (a) Illustrate Predictive Modelling in Healthcare with few examples (atleast 2)   (10)

        (b) Describe: -   (10)

            1. BAN
            2. Dense/Mesh area network for smart living environment
            3. SENSOR TECHNOLOGY
            4. Image Registration
            5. Feature Extraction

Q.4   (a) What is validation of clinical prediction models?   (10)

        (b) Explain types of Fraud detection in healthcare with the help of example.   (10)

Q.5   (a)What are the challenges one may face while processing covid clinical reports?   (10)

        (b) Define Data science with applications of healthcare data analytics.   (10)

Q.6   (a) Illustrate the process of information extraction from clinical text.   (10)

        (b) Define Biomedical Imaging Modalities with their Applications.   (10)

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Duration: 3 Hours   **Maximum Marks: 80**

N.B.: -
1. Question No 1 is Compulsory
2. Solve any three questions from remaining questions
3. Assume suitable data if required and mention it clearly
4. Figures to right indicate full marks

Q1		Solve any four of following	
	[A]	Explain change management for PLM.	5
	[B]	Explain concept of reference model	5
	[C]	Explain reasons for implementing a PDM	5
	[D]	Explain need for Life Cycle Environmental Strategies.	5
	[E]	Explain limitations of Life Cycle Assessment	5
Q2	[A]	Explain various End-of-Life Strategies with suitable examples	10
	[B]	Explain various barriers to PDM implementation	10
Q3	[A]	Explain various phases of LCA in ISO Standards	10
	[B]	Explain role of Modelling and simulations in Product Design with suitable example.	10

Q4 [A] Explain what do you mean by New Product Development (NPD) and explain following
        concepts: -
        i.   Product Configuration
        ii. Variant Management   10

   [B] With suitable example explain how will you develop PLM Vision and PLM Strategy.   10

Q5 [A] With suitable example explain relationship of Concurrent Engineering and Life Cycle
        Approach   10

   [B] Explain the concept of Design for Environment with suitable example.   10

Q6   Write Short notes on:-
   [A] General Framework for LCCA   10
   [B] 3D CAD systems and realistic rendering techniques   10

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Duration: 3hours   **[Max Marks: 80]**

N.B. : (1) Question No 1 is Compulsory.
      (2) Attempt any three questions out of the remaining five.
      (3) All questions carry equal marks.
      (4) Assume suitable data, if required and state it clearly.

1   **Attempt ANY FOUR questions of the following.**   **[20]**

a)   State the role of non-conventional energy sources in the current energy scenario of the **[5]**
India.

b)   Discuss the I-V characteristics of a solar PV cell.   **[5]**

c)   State the factors considered for site selection to install wind power plant.   **[5]**

d)   Discuss the different methods of hydrogen production and storage.   **[5]**

e)   Explain the working of solar pond.   **[5]**

2   a)   Illustrate the working principle of KVIC biogas plant with the neat sketch.   **[10]**

b)   Estimate the monthly average daily global radiation on a horizontal surface at Ratnagiri **[10]**
($16°59'$ N, $72°05'$ E) during the 16th march if the average sunshine hours per day is 9.5.
Assume the value of a = 0.31 and b = 0.43. (Assume I_{sc} =1353 W/m^2

3   a)   Discuss types of fuel cells briefly   **[8]**

b)   Describe the working principle of natural circulation solar water heater system.   **[8]**

c)   Calculate the sunset hour angle and day length at a location, latitude 28.6 °N on June 28.   **[4]**

4   a)   Wind at 1 standard atmospheric pressure & 15 °C has a velocity of 15 m/s, turbine **[10]**
diameter is 120 m & turbine operating speed is 40 rpm at maximum efficiency. Calculate:
(a) Total Power Density in wind stream.
(b) Maximum Power Density.
(c) Reasonably obtainable Power Density assuming η = 35%
(d) Maximum Torque & Axial Thrust.

b)   Describe the working principle of liquid dominated geothermal power plant.   **[5]**

c)   Describe the types of solar photovoltaic systems.   **[5]**

5   a)   Illustrate the working principle of Open and Closed OTEC system with the neat sketch.   **[10]**

b)   Following data is given for a family biogas digester; C.V. of methane = 28 MJ/m^3, Burner **[10]**
efficiency = 70 %, Number of cows = 8, Retention period = 20 days, Temperature of
fermentation = 300 °C, Dry matter collected/cow/day = 2 kg, Density of matter in the
fluid in the digester = 50 kg/m^3, Biogas yield = 0.2 m^3/ kg of dry input, Methane
production in Biogas = 0.7. Determine volume of Digester and power available from
biogas digester.

6 a) Illustrate the working principle of single & double basin tidal system with neat sketch. [8]

   b) Solar thermal power plant system installation is expected to minimize the plant's annual [8]
       energy bill by Rs. 14 lacs. If the capital cost of new solar thermal power plant installation
       is Rs. 89 lacs and the annual operating and maintenance cost is 5 lacs. Determine, (a) The
       expected payback period for the proposed project. (b) The initial rate of return/return on
       investment.

   c) Differentiate between the vertical and horizontal axis wind turbine. [4]

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Time: 3 hours   Max.Marks:80

N.B.: 1. Q. 1 is compulsory.
      2. Solve any three from the remaining five questions.
      3. All question carry equal marks.

Q.1 Answer any FOUR   (5x4=20 marks)
    a) Explain the different ways of representing a vibration signal .
    b) Describe different sensor mounting techniques?
    c) Discuss the different ways of Signal analysis.
    d) Differentiate between Misalignment and Unbalance Fault diagnosis.
    e) Describe different faults associated with a Gearbox.
    f) Describe the characteristic of cavitation experienced in Centrifugal pump.

Q.2 a) Discuss vibration-based condition monitoring? Explain benefits of it.   (10 marks)

    b) List different types of maintenance? Explain any one in brief.   (10 marks)

Q.3 a) Explain different faults associated with Rolling element bearing?   (10 marks)

    b) Write a short note on Classification of signals,   (10 marks)

Q.4
    a) Explain in brief Bent shaft defect? What are its unique vibration characteristics?
                                                             (10 marks)
    b) Describe the different applications of Laser Doppler vibrometry (LDV).   (10 marks)
Q.5
    a) What are different faults associated with pumps , fans and blowers? What are their unique
    vibration characteristics?   (10 marks)
    b) Explain misalignment with its different types? What are its unique vibration characteristics?
                                                             (10 marks)

Q.6
    a) What are the challenges that needed to be addressed by the vibration monitoring system in
        sugar mills   (10 marks)

    b) Describe the methods to reduce the gearbox problems using condition monitoring
                                                                   (10 marks)

Time: 3 Hours   Max. Marks: 80

Note :
- **Question no.1 is compulsory.**
- Solve **any three** questions from the **remaining** five questions.
- Figure to the right indicates full marks.
- Assume suitable data wherever required, but justify the same.

Q. 1   Attempt **any four** questions from following. (Each question carries 5 marks)

   a) Differentiate between an Efficient Supply Chain and a Responsive Supply Chain.

   b) Compare the various design options for a Distribution Network in a Supply Chain.

   c) Differentiate between Bar Codes and RFID used in Supply Chains.

   d) State the assumptions underlying the basic EOQ model.

   e) Compare 3PL and 4PL with respect to Supply Chain Management.

Q. 2 **a)** Describe are the functions served by inventories. What are the various types of inventories?   **10**

   b) State the various risks a Supply Chain is subjected to. How can the various risks be overcome in a supply chain?   **10**

Q. 3 **a)** What is meant by Selective Inventory Control? Classify various Selective Inventory Control Techniques and describe them in brief.   **10**

   b) Describe the SCOR Model in Supply Chain Management.   **10**

Q. 4 **a)** Sujata Fan Manufacturing Company uses 2,40,000 bearings per year and the usage is fairly constant at 20,000 bearings per month. Each bearing costs the company Rs. 3. The carrying cost for the company has been estimated at 15% of the average inventory investment. The cost to place an order and process the delivery is Rs. 60.   **10**

    a. Calculate the economic order quantity.

    b. What is the stock turnover rate ignoring safety stock if the EOQ is ordered frequently?

    c. What will be the effect on total cost if stock turnover rate is reduced to one-third by infrequent ordering?

   b) What is the objective of Logistics Management? Describe the main components of Logistics.   **10**

Q. 5 **a)** What is the functional role of IT in a Supply Chain?   **10**

   b) Describe a Transport Management System (TMS) with the help of a neat labelled sketch.   **10**

Q. 6 **a)** Describe the factors affecting distribution network design.   **10**

   b) What is a resilient supply chain? How does supply chain resilience work?   **10**

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