(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)	What is a bend in a rope pulley hoisting system? How does it affect rope life?	5
	b)	Illustrate the design morphology process using a flowchart and relevant examples.	5
	c)	Why does cavitation occur in a centrifugal pump? Suggest suitable remedial measures.	5
	d)	What is piston ovality? Explain with the help of a neat diagram.	5
	e)	Derive the expression for hydraulic force developed in a gear pump.	5

Q 2 (a) Select a suitable 6×37 wire rope for a 150kN hoisting load and estimate its service life. **10**

(b) Select a suitable hook with trapezoidal cross section and check it at most critical cross section for design hoisting load of 50kN. Also select the suitable thrust bearing for it. **10**

Q 3 (a) Briefly explain belt construction and materials used. **5**

(b) Determine the width of the conveyor belt and motor capacity for the following specification **15**
Material to be conveyed : Gravel
Capacity : 100 TPH
Inclination : 10 degree
Centre to Centre distance : 50 m

Q 4 (a) What is the most cost-effective cross-section for a connecting rod, and why? **5**

(b) Determine bore diameter and design a piston for a 4-stroke, single cylinder, water cooled, vertical petrol engine with following specifications: **15**
Indicated power = 15 kW
Speed = 1200 rpm
Compression Ratio = 8

Q 5 (a) Write short notes on various pressure angle systems used in gear design. **5**

(b) Given the following specifications of a centrifugal pump,
- Total manometric head: 20 m,
- Discharge: 900 LPM,
- Motor speed : 1440 rpm,

   i. Required motor power **5**
   ii. Inlet and exit diameter of an impeller **5**
   iii. Number of impeller blades if inlet and exit angles are 20 and 25 degree respectively. **5**

Q.6 A spur gear box is required to transmit 12 KW power from an electric motor rated at 1440 rpm with reduction ratio of 4.
   i. Design a gear pair by selecting suitable material and design stresses. **10**
   ii. Check the gear for dynamic load and contact stresses. **10**

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Time: 3 Hours   Total Marks: 80

Note:

1) Question No.1 is Compulsory
2) Attempt any three questions out of remaining five questions.

Q1	**Attempt any four**	(20)
A.	Explain how Orbit plots help in diagnosing shaft-related faults in rotating machinery.	
B.	Briefly describe the function and need of a signal conditioning unit in a vibration data acquisition system.	
C.	What is the significance of blade pass frequency (BPF) in diagnosing faults in fans and blowers?	
D.	Describe the time domain and frequency domain indicators of unbalance in a rotating machine.	
E.	Define windowing in the context of FFT-based signal processing. Explain different types of windowing functions.	
F.	How can you identify a bent shaft condition using vibration analysis? Mention key indicators.	

Q2	A.	What is Fast Fourier Transform (FFT)? Discuss the importance of the following essential FFT settings in a Data Acquisition System: a) Plot Formats b) Frequency Span c) Frequency Resolution	(10)
	B.	Explain the basic maintenance principles in industrial machinery. How does condition-based maintenance differ from reactive and preventive maintenance?	(10)

Q3	A.	Discuss a case study on balancing problems in turbines. Explain the selection of sensors, recommended sensor locations, direction of measurement, and how data plots help identify unbalance.	(10)
	B.	What is misalignment? What are its different types? What are its unique vibration characteristics? Represent misalignment in time and frequency domain.	(10)

Q4	A.	What is a laser vibrometer? Explain its working principle and benefits over traditional contact-type vibration measuring instruments.	(10)
	B.	Explain the process of rolling element bearing fault diagnosis using vibration analysis. Describe the typical fault frequencies (BPFO, BPFI, BSF, FTF) and how they appear in the frequency spectrum.	(10)

Q5	A.	Explain the condition monitoring techniques used in sugar mills. Discuss the type of sensors used, optimal mounting locations, suitable plot types, and how faults are diagnosed.	(10)
	B.	Explain different sensor mounting techniques used in vibration measurement. How does mounting affect data accuracy?	(10)

Q6	A.	Illustrate the concept prognosis and diagnosis in vibration-based condition monitoring with example.	(10)
	B.	Explain the common types of faults encountered in gearboxes. How can vibration analysis help in identifying each of these faults?	(10)

Time :(Three Hours)   **Total Marks: 80**

Note: 1. Q1 is compulsory
           2. Solve any three from remaining
           3. Assume suitable data wherever required

Q.1	Write notes on. **(Any Four)**	**20**
	a) Product Lifecycle Phases	
	b) Reason for implementing a PDM system	
	c) Tools for virtual product development	
	d) Methodological Evolution in Product Design	
	e) Model analysis	
	f) General framework for LCCA	
Q.2 a.	State and explain end of life cycle strategies.	**10**
b.	Define PDM. What are the barriers to PDM implementation.	**10**
Q.3 a.	Define Change Management. Why Change Management is important in PLM?	**10**
b.	Explain the Product Design Process and its phases in the Development Process.	**10**
Q.4 a.	Explain phases of Life Cycle Analysis in ISO Standards	**10**
b.	Explain the Role of FEM and CAD in VPD.	**10**
Q.5 a.	What is New Product Development (NPD)? Explain its Strategies.	**10**
b.	Importance of Product Design in the Context of the Product Development Process.	**10**
Q.6 a.	Define Life Cycle Assessment (LCA). Explain the fields of Application of Life Cycle Assessment.	**10**
b.	Define Design for Environment. Explain the guidelines for design for environment.	**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.
(3) Assume suitable data, if required and state it clearly.

1		**Solve any four (all questions carry equal marks)**	**[20]**
	a	State the current role of non-conventional energy sources to fulfill energy requirement of state the Maharashtra.	**[5]**
	b	Define the following angles with a neat sketch (i) Surface azimuth angle (ii) Zenith angle (iii) Solar declination angle (iv) Solar altitude angle	**[5]**
	c	Explain the working principle of Ocean Thermal Energy Conversion (OTEC) system.	**[5]**
	d	Describe the working principle of horizontal axis wind turbine with a neat sketch.	**[5]**
	e	State the working principle of Solar Photovoltaics.	**[5]**
2	a	State Betz coefficient and derive the ideal maximum theoretical efficiency equation for the horizontal axis wind turbine.	**[10]**
	b	Estimate the average global radiation falling on a horizontal surface at Nagpur ($21^O15'$ N, $79^O09'$ E) during month of 16th March if the average sunshine hours per day is 9.2. Assume values for a=0.27 and b=0.50.	**[10]**
3	a	Explain the parameters which affects the rate of biogas production.	**[8]**
	b	Describe the working principle of oscillating water column wave energy system.	**[6]**
	c	Discuss the I-V characteristics of a solar PV cell with a neat sketch.	**[6]**
4	a	Explain the types of Fuel cells.	**[10]**
	b	A system-A, which consumes 81 kW of electric energy and its cost is Rs. 28,000/- while the System-B consumes 78 kW of energy and its cost is Rs. 32,0000/-. Both the systems run 1800 hrs a year and the cost of electric energy is Rs. 5 per kWh. Which system will be cheaper if a discount rate of 12% is considered when a life of 15 years is taken?	**[10]**
5	a	Following data is given for a family biogas digester; C.V. of methane = 24 MJ/m^3, Burner efficiency = 60 %, Number of cows = 4, Retention period = 30 days, Temperature of fermentation = 32^0C, Day matter collected/cow/day = 3 kg, Density of matter in the fluid in the digester = 50 kg/m^3 Biogas yield=0.27 m^3/ kg of dry input, Methane production in Biogas = 0.8. Determine volume of Digester and power available from biogas digester.	**[10]**
	b	State the significance of solar space heating and cooling.	**[5]**
	c	Classify the types of energy audit processes	**[5]**

6   a   Explain the working principle of following solar thermal devices with a neat sketch   **[10]**
        (i) Solar Pond
        (ii) Solar Distillation unit
    b   State the significance of Green Building.   **[5]**
    c   Explain the working principle of Savonius vertical axis wind turbine.   **[5]**

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Time: 3 Hours   **[MAX MARKS: 80]**

NB:
(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**   **[20]**
   a. What are technical measures of Information Security
   b. List down various Malwares and describe anyone.
   c. Explain concept of Identification, Authentication.
   d. Explain benefits of Cloud computing
   e. Illustrate various XSS attacks.

2. a. Illustrate an Overview of Certifiable Standards in (How, What, When, Who) terms. **[10]**

   b. Compare Intrusion Detection System (IDS) and Intrusion Prevention System (IPS).   **[10]**

3. a. Define and explain the concepts of Availability, MTBF, and MTTR. How are they interrelated in assessing the reliability and maintainability of a system? Provide appropriate formulas and examples.   **[10]**

   b. Summarize standards for information security and explain COBIT & OWASP in detail **[10]**

4. a. Explain NIST-SP-800-30: Risk Assessment Framework.   **[10]**

   b. Discuss server security within a Windows environment, including considerations related to Active Directory, antivirus protection, email security and defense against malware.   **[10]**

5. a. Compare the quantitative and qualitative risk assessment approaches.   **[10]**

   b. Describe various Disaster Recovery Techniques.   **[10]**

6. a. What are the key characteristics of NIST risk assessment framework?   **[10]**

   b. What are the objectives of IT ACT? Explain in detail IT ACT 2000 and IT ACT 2008.   **[10]**

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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.

			Marks
Q. 1		Solve **any four** of the following five questions (Each question carries 5 marks):	**20**
	a)	Summarize the concepts of Contract Management and Non-Disclosure agreement and their importance with the help of suitable examples.	
	b)	Explain the method of ABC analysis used for selective inventory control.	
	c)	Contrast the different types of transport methods used in Logistics.	
	d)	Differentiate between TMS and WMS with the help of diagram.	
	e)	List the six different types of distribution network designs and show their working with the help of neat sketches.	
Q. 2	**a)**	Illustrate the six stages of supply chain and show their contributions to increasing the value of the Supply Chain with the help of a neat diagram. Also show the importance of Money, Information and Material flow in a suitable Supply Chain case study.	**10**
	b)	Summarize the concept, causes and categories of Supply Chain Risk management in detail.	**10**
Q. 3	**a)**	Summarize the concept of Bullwhip effect and list the factors responsible for its reduction.	**5**
	b)	Define the concept of MOQ and list its benefits using suitable examples.	**5**
	c)	Summarize the concept of ABC analysis used for selective inventory control, using a suitable case study.	**10**
Q. 4	**a)**	Define outsourcing, list its types and explain and compare the 3PL and 4PL concepts in supply chain.	**10**
	b)	Differentiate between P system and Q system in inventory control.	**5**
	c)	A company has a demand of 12000 units per year for an item and it can produce the items at a unit cost of Rs. 120. The cost of one setup is Rs. 400 and the holding cost per unit per month is Rs. 0.15. Determine the optimum lot size and total cost per year.	**5**
Q. 5	**a)**	Define CSR and recall the initiatives and actions done under CSR.	**10**
	b)	List the different mathematical models used in SCM and recall their important points.	**10**
Q. 6	**a)**	List the Key issues in SCM and explain the four process cycles of Supply Chain using neat sketches.	**10**
	b)	Summarize the Role of IT in a supply chain.	**10**