

Duration: 3hrs

[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 [20]
- a What is good and bad design? explain with one example.
 - b What is the role of feedback in user interaction design?
 - c What do you mean by expressive interfaces explain with example
 - d Explain Cognition with one example of Memory aspect.
 - e What is user interaction design, and why is it important?
- 2 a What is the role of user research in user interaction design? [10]
- b What is the role of prototyping in user interaction design? Explain wireframe with example [10]
- 3 a Explain principles that support usability [10]
- b What is a conceptual model in user interface design, and why is it important? [10]
- 4 a What are key benefits of conducting task analysis during the design process? [10]
- b What are Different techniques for gathering data during the requirements gathering phase? [10]
- 5 a Write a note on 10 heuristics by Nielsen [10]
- b What is DECIDE framework? Explain in detail [10]
- 6 a Compare Controlled Setting, Natural Setting, and Any Setting Evaluation. [10]
- b What care will you take while designing an interface for a deaf person? Justify your answer with sample design. [10]

Time: 3 Hours

Marks: 80

- N. B.: 1. Question 1 is Compulsory
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 4. Assume suitable data, if required and state it clearly.

1. Attempt any FOUR
- a. Write a short notes on Service Capacity. [5]
 - b. Explain the steps of Capacity planning. [5]
 - c. Explain Forwards scheduling and backward scheduling. [5]
 - d. Write notes on MRP. [5]
 - e. Explain the objectives of Line balancing. [5]
 - f. Write notes on JIT [5]
- 2 a. Use largest Candidate rule to work out a solution on a precedence diagram. Assume cycle time is 1 min. find out a. theoretical number of stations. b. Efficiency and balance delay. [10]

| No. | ElementDescription | Time(min.) | Mustbe Precedenceby |
|-----|---------------------------------|------------|------------------------|
| 1 | Placeframeonworkholderandclamp | 0.2 | --- |
| 2 | Assembleplug,grommettopowercord | 0.4 | --- |
| 3 | Assemblebracketstoframe | 0.7 | 1 |
| 4 | Wirepowercordtomotor | 0.1 | 1,2 |
| 5 | Wirepowercordtoswitch | 0.3 | 2 |
| 6 | Assemblemechanismplatetobacket | 0.11 | 3 |
| 7 | Assemblebladetobacket | 0.32 | 3 |
| 8 | Assemblemotortobacket | 0.6 | 3,4 |
| 9 | Alignbladeandattachtomotor | 0.27 | 6,7,8 |
| 10 | Assembleswitchtomotorbracket | 0.38 | 5,8 |
| 11 | Attachcover,inspect,andtest | 0.5 | 9,10 |
| 12 | Placeintotepanforpacking | 0.12 | 11 |

- b. Explain the concept of wastes in JIT Manufacturing. How these wastes are eliminated in JIT Manufacturing? [10]
3. a. Explain different factors influencing Plant Layout. [10]
- b. Jobs each of which must be processed on the machine M1, M2, M6. The processing times in hrs are given (i) Find the optimal sequence. (ii) Minimum total elapsed time. (iii) Idle times associated with machines.

| Jobs | Processing times | | | | | |
|------|------------------|-------|-------|-------|-------|-------|
| | M_1 | M_2 | M_3 | M_4 | M_5 | M_6 |
| A | 18 | 8 | 7 | 2 | 10 | 25 |
| B | 17 | 6 | 9 | 6 | 8 | 19 |
| C | 11 | 5 | 8 | 5 | 7 | 15 |
| D | 20 | 4 | 3 | 4 | 8 | 12 |

4. a. The Following activities are involved in a XYZ project are given below along with relevant information. Construct the network and find the critical path also find the floats for each activity. [10]
 b. What is aggregate planning? Explain aggregate planning strategies in detail [10]
5. a. Following data refers to the past sales of one product [10]

| Year | 1982 | 1983 | 1984 | 1985 | 1986 | 1987 | 1988 | 1989 | 1990 |
|----------------------|------|------|------|------|------|------|------|------|------|
| Sales in ₹ (× 10000) | 39 | 54 | 62 | 73 | 85 | 100 | 95 | 105 | 120 |

Use least square method and estimate sales forecasting of year 1992.

- b. Bring out the difference between PERT and CPM. [10]
6. a. Explain Pillars of Lean Manufacturing in detail. [10]
 b. Explain Production and operations function in detail [10]

Time: 3hour

Max Marks: 80

- N.B.** (1) Question No. 1 is compulsory.
 (2) Attempt any three questions out of remaining five questions.
 (3) Assume suitable data if necessary.
 (4) Figures to the right indicate full marks.

- Q1. Solve any Four out of Five.** 20
- Illustrate the Cause-and-effect diagram with suitable example.
 - List and describe the dimensions of product quality.
 - What is single sampling plan? Explain with neat sketch.
 - What is Quality Circle? What are the steps involved in quality circle process.
 - Specify the difference between ISO9000 and QS9000.

- Q2.**
- What is cost of quality? What are its categories explain in brief. 10
 - What are the reasons for benchmarking and explain the important steps in the process of benchmarking. 10

- Q3.** 10
 Following are the inspection results of magnets for nineteen observations.

| Week No. | No. of Magnet inspected | No. of defective magnets | Week No. | No. of Magnet inspected | No. of defective magnets |
|----------|-------------------------|--------------------------|----------|-------------------------|--------------------------|
| 1 | 724 | 48 | 11 | 736 | 47 |
| 2 | 763 | 83 | 12 | 739 | 50 |
| 3 | 748 | 70 | 13 | 723 | 47 |
| 4 | 748 | 85 | 14 | 748 | 57 |
| 5 | 724 | 45 | 15 | 770 | 51 |
| 6 | 727 | 56 | 16 | 756 | 71 |
| 7 | 726 | 48 | 17 | 719 | 53 |
| 8 | 719 | 67 | 18 | 757 | 34 |
| 9 | 759 | 37 | 19 | 760 | 29 |
| 10 | 745 | 52 | | | |

Calculate the average fraction defective and 3 sigma control limits, construct the control chart and state whether the process is in statistical control.

- Explain the concept of Taguchi's quality function in detail. Give an example. 10

- Q4.**
- Discuss about the four important documents to be prepared for ISO9000 certification. 10
 - Elaborate on the concept of Win-win policy in the context of supplier relationship? 10

- Q5.**
- Describe Deming's philosophy for quality improvement. 10
 - Explain in brief Malcom Baldrige National Quality Award framework and criteria for performance excellence. 10

- Q6.**
- Explain how Six Sigma can be used to improve the quality of products and services in the manufacturing and service sectors. 10
 - Explain strategic approach to leadership in TQM. 10

(3 Hours)

[Total Marks: 80]

NB: 1. Question No. 1 is compulsory

2. Solve any three questions from remaining questions
3. Assume suitable data with proper justification if required
4. Use of standard design data book like PSG, Kale and Khandare is permitted.

Q.1) Answer any four 20

- (a) Explain the morphology of mechanical system design with neat flow chart.
- (b) State the significance of structural formula and structural diagram in the multispeed gear box design.
- (c) State the function of different type of piston rings.
- (d) State the churning phenomenon and its effect in a centrifugal pump.
- (e) Classify and compare wire rope according to twisting direction and according to wire size.

Q.2) For the specification of an EOT Crane,

Application - Class II

Load to be Lifted - 70 KN

Hoisting speed - 5 m/min

Maximum Lift - 10 m

i. Design a 6 X 37 type of rope and find its life. 6

ii. Design hook and check it at most critical cross section. 8

iii. Design rope drum and select suitable motor for hoisting. 6

Q.3.A) Design belt conveyor for following specification

Material to be handled -: Gypsum Stone,

Grain type -: Non standard

Working Capacity -: 125 TPH,

Length of conveyor -: 100 m

Inclination with horizontal -: 10°

Lump size -: 60 mm

i. Determine width and thickness of a conveyor belt 8

ii. Select suitable motor for conveyor. 4

iii. Determine length and diameter of top and bottom idler. 4

Q.3.B) Write a short note on take up arrangement in case of belt conveyor. 4

Q.4.A) The following data are pertaining to a 4-stroke single cylinder, water cooled petrol engine.

Brake power= 7.5 KW

Mass of reciprocating parts = 8 kg.

Length of connecting rod = 310 mm.

Stroke length = 150mm.

Speed = 3000 RPM.

Compression ratio = 5:1

Over speed= 10%

Design the following,

i. Piston and piston pin 8

ii. connecting rod for forged steel having "I" cross section with proportion 8
being depth = 6t and width = 4t, where "t" is thickness of web and flange.

- Q.4.B) Sketch different types of valves used in internal combustion engine 4
- Q.5.A) The following data refers to centrifugal pump for pumping water. 16
Static suction head= 4 m, Length of suction pipe= 8 m,
Static delivery head = 25 m, Delivery pipe length= 30 m,
Discharge = 1500 LPM,
i) Select suitable motor
ii) Determine inlet and tip diameter of an impeller
iii) Determine inlet and exit angle of an impeller
iv) Determine number of blades for an impeller.
- Q.5.B) Which shaft is heavily loaded in case of gear pump, Explain. 4
- Q.6) Design a layout of 6 speed gear box of milling machine having output speed ranging from 160 to 1000 rpm approximately. Power applied to the gear box is 6 KW at 960 rpm.
i. Choose standard step ratio and construct structural diagram. 8
ii. Construct ray diagram by deciding various reduction ratios. 6
iii. Determine the no of teeth on each gear. 6

(3 Hours)

Total Marks: 80

Note:

1. Question No. 1 is compulsory.
2. Attempt any **THREE** out of the remaining **FIVE** questions.
3. Assume suitable data if necessary.

- Q. 1.** Answer any **FOUR** of the following: **(20)**
- (a) Differentiate between Sales Budget and Marketing Budget?
 - (b) Explain the uses of Project Report for Entrepreneur.
 - (c) Write short note on PMEGP and its advantages.
 - (d) Explain any three characteristics of sole proprietorship.
 - (e) Explain about Women Entrepreneurship
- Q. 2.** (a) Entrepreneurs are “Dreamers with vision”. State how. **(10)**
(b) Explain the factors involved in the growth of an Enterprise. **(10)**
- Q. 3.** (a) State any four primary activities that are essential for a firm to have a competitive advantage as given by Porter. **(10)**
(b) Explain in short about Industrial Investment Bank of India Ltd. (IIBI) **(10)**
- Q. 4.** (a) Explain the forms of Business Ownership **(10)**
(b) What are the steps involved in Marketing plan? **(10)**
- Q. 5.** (a) What is Business Plan? State the importance of writing business plan for the Entrepreneur Group. **(10)**
(b) Idea germination is the seeding stage of a new idea in the creative process. Explain the next four steps in the process. **(10)**
- Q. 6.** **Attempt the following:-** **(20)**
- (a) Write in short about MSMED Act 2006.
 - (b) Who are Angel Investors? State any four features of Angel Investors.
 - (c) Explain the factors affecting channels of distribution with relation to market Considerations.
 - (d) Enlist two points as to why private company is more desirable than a public company.

Time: 3hrs.

Total Marks: 80

- N.B.: (1) Question No.1 is **Compulsory**.
 (2) Attempt any **THREE** from question No.2 to 6.
 (3) Use illustrative diagrams whenever possible.
 (4) Assume suitable data if necessary and mention it clearly.

- Q1) Solve any **Five** 20
- State the various direct applications of solar energy.
 - Factors affecting the biogas production
 - Present status of power generation of India
 - Define Slope, Zenith angle, Surface azimuth angle, Air mass
 - What is geothermal energy? State its limitations
 - State and explain methods of hydrogen production technologies.
- Q2) a) What is importance of renewable energy sources? What is the present energy scenario in India? 10
- b) Estimate the monthly average daily global radiation on a horizontal surface at Vadodara ($22^{\circ}00'N$, $73^{\circ}10'E$) during the month of March; If the average sunshine hour per day is 9.5. (Take values $a=0.28$ and $b=0.48$). 10
- Q3) a) What is Betz coefficient? Show that the ideal maximum theoretical efficiency is 59% for a horizontal axis wind mill. 10
- b) Explain the construction details and working of KVIC biogas digester. 10
- Q4) a) Following observation were recorded from a test on Biogas system: 10
 Calorific value of methane: $28.5MJ/m^3$, Burner efficiency: 60%, Number of Cows: 8, Retention period: 20 days, Temperature of fermentation: $30^{\circ}C$, Dry matter collected per cow per day: 2kg, Density of dry matter in the fluid in the digester: $50kg/m^3$, Biogas yield: $0.2m^3$ per kg of dry input, Methane proportion in the biogas: 0.7, Determine volume of digester and power available from biogas digester.
- b) How is Geothermal energy tapped? Enumerate problems in tapping. 10
- Q5) a) Explain single and double basin tidal power plants with neat sketches. 10
- b) What are the effects of various parameters on performance of Flat Plate Collector? 10
- Q6) a) Explain with neat sketch Wind Energy conversion system. Classify Windmills. 10
- b) Classify the different types of Concentrating solar collectors. Explain any one with schematic diagram. 10

Time: 3 hours

Max. Marks: 80

- Note: 1. Assume suitable data if necessary
 2. Figures to the right indicate full marks
 3. Question No. 1 is compulsory
 4. Solve any **three** out of the remaining **five** questions

Q1. Write short notes on following: (Any Four)

- | | | |
|---|----------------------------|---|
| A | Polyelectrolyte gels | 5 |
| B | Biomimetic Materials | 5 |
| C | Types of Magnetostriction. | 5 |
| D | Artificial Muscles | 5 |
| E | Thermoelectric materials | 5 |
| F | Self assembly process | 5 |

Q2.

- | | | |
|---|--|----|
| A | Classify non-polymer based Nano composites. | 5 |
| B | Discuss properties and characteristics of Composite Materials. | 5 |
| C | What is MEMS (Micro-electromechanical systems)? Explain in detail Microsensors and Microactuators used in a MEMS device. | 10 |

Q3.

- | | | |
|---|---|----|
| A | Write different classes of Self Replication. | 5 |
| B | What are the advantages and disadvantages of Hysteresis. | 5 |
| C | What is Magnetostriction? Describe working of Terfenol-D device with the help of neat sketch. | 10 |

Q4.

- | | | |
|---|---|----|
| A | Describe latest applications of ferrofluids. | 5 |
| B | Describe synthesis of Piezoelectric materials. | 5 |
| C | What is Soft matter? Describe it's properties and applications. | 10 |

Q5.

- | | | |
|---|--|----|
| A | Describe applications of Shape memory alloys. | 5 |
| B | Write short note on Hydrogen storage. | 5 |
| C | What are the various Energy Harvesting challenges? Explain Vibration energy Harvesting techniques. | 10 |

Q 6.

- | | | |
|---|--|----|
| A | What are the six basic steps of the LIGA process | 5 |
| B | Describe top-down and bottom-up approaches of self assembly. | 5 |
| C | Write short note on: 1. Laminated Object Manufacturing (LOM) 2. Fused Deposition Modelling (FDM) | 10 |

Time: 3-hour

Max. Marks: 80

Note:

1. Question No.1 is compulsory.
2. Attempt any three questions from the remaining.
3. Assume suitable data if required.

- Q1. Solve any four out of five. 5 Marks each**
- a Define adiabatic flame temperature, enthalpy of combustion & enthalpy of reaction.
 - b Derive an expression for the force exerted by a jet of water on a fixed curved plate in the direction of the jet.
 - c Write the differences between the mounting and Accessories of the boiler.
 - d Describe the working of reheating gas turbine plant with the help of a T-S diagram.
 - e Write a short note on the air vessel with a neat sketch.
- Q2. 20 Marks**
- a In a Parson reaction turbine, the angles of receiving tips are 35° and of discharging tips, 20° . The blade speed is 100 m/s. Calculate the tangential force, power developed, diagram efficiency, and axial thrust of the turbine if its steam consumption is 1 kg/min. **10 Mark**
 - b Write a short note on the Francis turbine. **5 Mark**
 - c Write a short note on the Turbojet engine. **5 Mark**
- Q3. 20 Marks**
- a The following data refers to a gas turbine plant:
 Power developed = 5 MW
 Inlet pressure and temperature of air to compressor = 1 bar and 30°C
 Pressure ratio of the cycle = 5
 Isentropic efficiency of the compressor = 80%
 Isentropic efficiency of turbines = 85%
 Maximum temperature in the turbines = 550°C
 Take for air, $C_p = 1.0 \text{ kJ/kgK}$, $\gamma = 1.4$ and
 for gases, $C_p = 1.15 \text{ kJ/kgK}$, $\gamma = 1.33$.
 If a reheater is used between two turbines at a pressure of 2.24 bar, calculate the following:
 (a) Mass flow rate of air,
 (b) The overall efficiency,
 Neglect the mass of fuel. **10 Mark**
 - b What is specific speed for turbine and centrifugal pump? **5 Mark**
 - c Write a short note on the Rocket engine. **5 Mark**

Q4. 20 Marks

- a** A boiler generates 8 kg of steam per kg of fuel burnt at a pressure of 12 bar from feed water entering at 80°C. The boiler is 75% efficient and its factor of evaporation is 1.15. Calculate
(a) Degree of superheat and temperature of the steam generated,
(b) Calorific value of fuel in k.J/kg,
(c) Equivalent evaporation in kg of steam per kg of fuel.
Take specific heat of superheated steam as 2.3 k.J/kg·K **10 Mark**
- b** Derive the condition for maximum blade efficiency of the impulse turbine. **5 Mark**
- c** What is the Classification of pumps? **5 Mark**

Q5. 20 Marks

- a** Determine the air–fuel ratio and the theoretical amount of air required by mass for the complete combustion of a fuel containing 85% of carbon, 8% of hydrogen, 3% of oxygen, 1% of sulfur, and the remaining ash. If 40% of excess air is used, what is the volume of air at 27°C and 1.05 bar pressure? Does this represent per kg of fuel? **10 Mark**
- b** A centrifugal pump has an impeller 0.5 m outer diameter and when running at 600 rpm discharges water at the rate of 8000 liters/minute against a head of 8.5 m. The water enters the impeller without whirl and shock. The inner diameter is 0.25 m, the vanes are set back at the outlet at an angle of 45° and the area of flow which is constant from inlet to outlet of the impeller is 0.06 m². Determine (a) the manometric efficiency of the pump, and (b) the vane angle at the inlet. **10 Mark**

Q6. 20 Marks

- a** Design a Francis turbine runner with the following data: Net head $H = 68$ m; speed $N = 750$ rpm; output power $P = 330$ kW; $\eta_h = 94\%$; $\eta_o = 85\%$; flow ratio $\psi = 0.15$; breadth ratio $n = 0.1$; inner diameter of the runner is half of the outer diameter. Also, assume 6% of the circumferential area of the runner to be occupied by the thickness of the vanes. The velocity of flow remains constant throughout and flow is radial at the exit **10 Mark**
- b** Draw a general layout of a hydroelectric power plant using an impulse turbine and define the following:
(a) Gross head, (b) Mechanical Efficiency, (c) Hydraulic efficiency, and
(d) Overall efficiency of the impulse turbine. **5 Mark**
- c** What do you mean by cavitation and its effect on the turbine and pump? **5 Mark**
