

(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 is permitted
 4) Assume suitable data if necessary, giving justification

- Q1 Answer any **Four** from the following
- a) Why factor of safety is necessary in design of mechanical elements? Discuss the important factors influencing the selection of factor of safety. **5**
- b) Discuss on various types of threads used for power screw. **5**
- c) What do you mean by endurance limit? How the endurance limit of a component is decided? **5**
- d) Discuss advantages and disadvantages of rolling contact bearings over sliding contact bearings **5**
- e) What is surge in spring? How it can be eliminated. **5**
- Q2a) Design a Knuckle joint subjected to an axial pull of 10 KN. Selecting suitable material for all the parts decide the allowable stresses. Design should include figures for the Joint and failure areas. **15**
- Q2b) Explain overhauling of screw and self-locking of screw. **05**
- Q3a) A solid shaft transmitting 40 KW at 960 rpm, is supported on two bearings 1m apart and has two spur gears keyed on it. The pinion is having 200 mm PCD and is located 150 mm to the left of RH bearing and tangential force acts horizontally on it. The gear is having 500 mm PCD and is located 250 mm to the right of LH bearing, and tangential force acts vertically downward on it. Select suitable material and determine the diameter of shaft using maximum shear stress theory. **15**
- Q3b) Draw and explain different fatigue stress cycles. **05**
- Q4a) A DGBB is subjected to a radial load of 4.5KN and an axial load of 2.5KN. The bearing rotates at 600 rpm. Considering the expected life of 18000 hours with survival probability of 93% and operating temperature of 135 °C, select a suitable standard bearing. **10**
- Q4b) Following data is given for a 360° hydrodynamic bearing. **10**
 Radial load = 6.5KN, Journal speed = 1200 rpm, journal diameter = 60 mm, bearing length = 60 mm, minimum oil film thickness = 0.009 mm. The class of fit is H7e7 normal running fit. Specify the viscosity of lubricating oil that you will recommend for this application. Choose the lubricant (SAE No.) if mean operating temperature of the bearing is given as 100°

- Q5a) A single cylinder four stroke cycle internal combustion engine produces 15 KW power at 700 rpm. Design a suitable flywheel, assuming coefficient of fluctuation of speed as 0.04. The torque developed during the power stroke may be considered as sine curve and work done during the power stroke is 30% more than the work done per cycle. **10**
- Q5b) Design a chain drive to meet the following specification **10**
Input power = 5.5 KW, Input speed = 300 rpm, Output speed = 100 rpm.
- Q6a) A helical compression spring is subjected to a maximum force of 5000N with a corresponding deflection of 70 mm. The spring is to operate over a 50 mm diameter rod. Determine the wire diameter and number of active turns. Also decide other details such as free length, pitch, helix angle. Check for solid stress and buckling. State whether the spring is a closed coiled helical spring. For the material of the spring assume following properties. **15**
- $$S_u = \frac{2000}{d^{0.17}} \text{ Mpa} \quad S_{ys} = \frac{1200}{d^{0.17}} \text{ Mpa} \quad G = 80 \text{ Gpa}$$
- Q6b) State different theories of failure and explain any two in details. **05**
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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 Explain Categorical data and quantitative data.
 - b Find S.D of the average temperature recorded over a five-day period last winter
18,22,19,25,12
 - c Define Binomial distribution and Poisson distribution.
 - d Explain Type1 and Type 2 error in detail.
 - e Define the following key terms for simple linear regression.
 i)Response ii) Record iii) Independent variable iv) Regression co-efficient v)

Residuals

- 2 a The runs scored in a cricket match by 11 players are as [10]
 follows:7,16,121,51,101,81,1,16,9,11,16.
 Find mean, mode, median for the given data.
- b An agent sells life insurance policies to five equally aged healthy people. [10]
 According to recent data, the probability of a person living in these conditions
 for 30 years or more is 2/3.Caluclate the probability that after 30 years if
- i) All five people are still living.
 - ii) At least three people are still living.
 - iii) Exactly two people are still living (Hint: Binomial Distribution)

- 3 a X is a normally distributed variable with mean $\mu=30$ S. D $\sigma=4$.Find i) $P(X<40)$ [10]
 ii) $P(X>21)$ iii) $P(30<X<35)$

- b Brief the steps in multinomial distribution goodness of fit. Elaborate the steps [10]
 with an example.

- 4 a Brief the steps in test of independence. Elaborate the steps with an example [10]

- b Find the simple linear regression that fits the given data and co efficient of [10]
 determination.

Bill	34	108	64	88	99	54
Tip	5	17	11	8	14	5

5 a In the context of multiple linear regression. Explain what is over fitting and multi collinearity. [10]

b Predict equation for y. [10]

y	x1	x2
-3.7	3	8
3.5	4	5
2.5	5	7
11.5	6	3
5.7	2	1

6 a Explain TIME SERIES PATTERNS [10]

- i) Horizontal Pattern ii) Trend Pattern iii) Seasonal Pattern
- iv) Trend and Seasonal Pattern v) Cyclical Pattern

b Consider the following time series data. [10]

Week	1	2	3	4	5	6
Value	18	13	16	11	17	14

Using the naive method (most recent value) as the forecast for the next week, compute the following measures of forecast accuracy.

- i) Mean absolute error. ii) Mean squared error.
- iii) Mean absolute percentage error. iv) Determine the forecast for week 7?

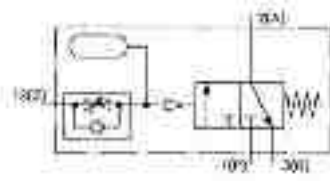
(3 hours)

Total Marks: 80

- NB 1) **Question No. 1 is compulsory**
 2) **Attempt any three questions out of the remaining five questions.**
 3) **Figures to the right indicate full marks.**
 4) **Assume suitable data wherever required but justify the same.**

Q1. Attempt any four (20)

- A. Explain the difference between programmable and flexible automation.
 B. Explain Automation migration strategy.
 C. List and explain types of joints used in Robots.
 D. Identify the component and explain the functioning of the component.



- E. What is an end effector? Explain the magnetic gripper with suitable example.

Q2 A. Design electro Pneumatic circuit for two cylinder operation with following sequence using 5/2 both side solenoid operated valve as DCV. (10)

A+B+Delay B- A-

With user selection option single cycle Multicycle operation.

- B. Explain concept of Artificial Neural Networks (ANN) in detail. List and define Terminologies of ANNs. (10)

Q3 A. What is a significance of Cascade method? List rules for cascade method along with example. (10)

- B. Differentiate between PLC and Relays. (05)

- C. Write short note on industrial application of Robots. (05)

Q4 A. Compare Supervised, Unsupervised and reinforcement learning with different parameters. (10)

B. Design simple pneumatic circuit for two cylinder operation with following sequence using 4/2 pilot operated valve as DCV using cascade method (10)

Delay B+ A+ A- B

With user option of single cycle – multi cycle. Also draw displacement diagram.

Q5 A. Explain depth first search algorithm with example. (08)

- B. Write note on different actuation methods for Direction control valves (05)

- C. Explain linear regression technique with suitable example. (05)

Q6 A. Explain hierarchical Clustering with as example. (08)

- B. Write detail note on Meter in circuit used in Hydraulics operations. (05)

- C. For a given data set [2,4,10,12,3,20,30,11,25], find the final cluster centres using K=2 clusters. (05)

=====XOX=====

(3 Hours)

(Maximum Marks: 80)

- NB.** 1. **Question number One** is compulsory
2. Attempt **any three out of remaining five** questions
3. Assume suitable data
4. Figures to the right indicate the maximum marks

- Q1 Attempt any FOUR: (20)**
- a) Define and classify Cybercrime
 - b) Comment on Windows OS Artifacts
 - c) Explain Principles of Digital Forensic.
 - d) Which are the Goals of Incident Response
 - e) How to Acquire Image over a Network
- Q2 a) Explain Digital Forensics and its lifecycle. (10)**
b) Explain in detail Incidence Response Methodology (10)
- Q3 a) Describe Steps to prevent cybercrime and explain Hackers, Crackers and Phreakers (10)**
b) Explain Forensic Investigation Report Writing in terms of Standards, Content, Style, Formatting and Organization. (10)
- Q4 a) Describe Digital Investigation Staircase Model (10)**
b) How to Acquire an Image with dd Tools and with Forensic Formats (10)
- Q5 a) Describe in details OS File Systems. (10)**
b) Explain Network-Based Evidence acquisition and its analyzing. (10)
- Q6 a) Explain Need and types of Computer Forensic Tools in detail. (10)**
b) In Mobile Forensics explain Challenges, Evidence Extraction Process, Types of Investigation, and Procedure for Handling an Android Device. (10)

Time: 3 hour

Max Marks: 80

Note: 1. Q1 is compulsory
2. Solve any three from remaining

- Q1 Solve any Four out of Six 20**
- A. Classify Rolling processes. Write advantages and applications of rolling.
 - B. Classify metal spinning, write applications, and explain any one type of it.
 - C. Differentiate Direct and indirect extrusion.
 - D. Explain various defects in forging with their causes and remedies.
 - E. What is spring back in bending? Explain how it can be minimized.
 - F. Write advantages and limitations of hot and cold working
- Q2 20**
- A. A block made of a perfectly plastic material with yield stress of 160 MPa in plain strain has dimensions 200 x 100 x 150 mm (b x h x w). Calculate the peak pressure P at the centre of the die. Also calculate minimum pressure at the edges. Assume sticking friction condition and Tresca's yield criterion.
 - B. Explain the effect of temperature and strain rate on metal forming.
- Q3 20**
- A. The thickness of plate is reduced from 30 mm to 10 mm by successive cold rolling passes using identical rolls of diameter 600 mm. Assume that there is no change in width and coefficient of friction between the rolls and the workpiece is 0.1. Calculate the minimum number of passes required.
 - B. What is maximum draft in rolling? Derive equation for maximum draft.
- Q4 20**
- A. In a wire drawing operation, the initial wire diameter is 7 mm and final wire diameter is 6.3 mm. the half die angle $\alpha=10^\circ$. Find the drawing stress considering $\mu=0.1$ and $k=20 \text{ N/mm}^2$. Also calculate the maximum reduction possible.
 - B. Explain tube drawing process.
- Q5 20**
- A. Explain stretch forming with advantages, limitations, and applications.
 - B. Write types, causes, and remedies for deep drawing defects.
- Q6 20**
- A. Explain explosive forming process with advantages, limitations, and applications
 - B. Explain various defects in extrusion with their causes and remedies.

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 Write short note on multi staging of reciprocating compressor.
- b Describe working of reheating gas turbine plant with the help of a T-S diagram.
- c Write the differences between Mountings and Accessories of boiler.
- d Write short note on air vessel with neat sketch.
- e Write short note on reciprocating pump with indicator diagram.

Q2. a The steam at 4.9 bar and 160°C is supplied to a single-stage impulse turbine at a mass flow rate of 30 kg/min, from where it is exhausted to a condenser at a pressure of 19.6 kPa. The blade speed is 300 m/s. The nozzles are inclined as 25° to the plane of wheel and the outlet blade angle is 35°. Neglecting friction losses, determine Theoretical power developed by the turbine, (b) diagram efficiency, and (c) stage efficiency. **10 marks**

b Explain the construction and working of once through boiler with neat sketch. **5 marks**

c Write the Function and location of Blow off cock, Fusible plug, pressure gauge & water level indicator in boiler. **5 marks**

Q3. a The air enters the compressor of an open cycle constant pressure gas turbine at a pressure of 1 bar and temperature of 20°C. The pressure of the air after compression is 4 bar. The isentropic efficiencies of compressor and turbine are 80% and 85% respectively. The air-fuel ratio used is 90: 1. If flow rate of air is 3.0 kg/s, find:
(i) Power developed.
(ii) Thermal efficiency of the cycle.
Assume $C_p = 1.0$ kJ/kg K and $\gamma = 1.4$ of air and gases
Calorific value of fuel = 41800 kJ/kg. **10 marks**

b Write short note on Francis turbine. **5 marks**

c Write short note on Turbojet engine. **5 marks**

Q4.

a Calculate the efficiency of (a) boiler, (b) economiser, and (c) whole plant having the following data:

(a) Boiler:

Mass of the feed water = 2060 kg/h

Mass of the coal burnt = 227 kg/h

Calorific value of coal = 30, 000 kJ/kg

Enthalpy of steam produced = 2750 kJ/kg

(b) Economiser:

Inlet temperature of feed water = 15°C

Exit temperature of feed water = 105°C

Atmospheric air temperature = 18°C

Temperature of flue gases entering = 370°C

Mass of flue gases = 4075 kg/h

Specific heat of flue gases = 1.3 kJ/kg.°C.

8 marks

b Derive the condition for maximum blade efficiency of impulse turbine. **8 marks**

c What is the Classification of pumps? **4 marks**

Q5.

a A pump operates at a maximum efficiency of 82% and delivers 2.25 m³/s under a head of 18 m while running at 3600 r.p.m speed. Compute the Power and specific speed of the pump. Also determine the discharge, head and power input to pump at a shaft speed of 2400 r.p.m. Cite the assumption made, if any.

10 marks

b Write short note on Centrifugal compressor. **6 marks**

c What is specific speed for turbine and centrifugal pump? **4 marks**

Q6.

a A Pelton wheel has a mean bucket speed of 12 m/s and is supplied with water at a rate of 750 liters per second under a head of 35 m. If the bucket deflects the jet through an angle of 160°, find the power developed by the turbine and its hydraulic efficiency. Take the coefficient of velocity as 0.98. Neglect friction in the bucket. Also determine the overall efficiency of the turbine if its mechanical efficiency is 80%. **10 marks**

b What is multistaging of impulse turbine? and What is degree of reaction? **5 marks**

c What do you mean by cavitation and its effect in turbine and pump? **5 marks**
