CBCS SCHEME

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21ME42

Fourth Semester B.E. Degree Examination, June/July 2023
Machining Science and Jigs & Fixtures

Time: 3 hrs. Max. Marks: 100

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

Module-1

1 a. Define the working principle of lathe. How can you specify a lathe? **(06 Marks)**

b. Explain with neat sketch, the working of Radial drilling machine. **(08 Marks)**

c. Explain briefly with sketches at any three drilling operation. **(06 Marks)**

OR

2 a. Draw the engine lathe and cable the parts and discuss the function of lathe parts. **(10 Marks)**

b. Difference between upmilling and down milling process. **(05 Marks)**

c. With a neat sketch, explain construction and working of common grinding machine. **(05 Marks)**

Module-2

3 a. Distinguish between orthogonal and oblique cutting with a neat sketch. **(06 Marks)**

b. List and explain different types of chips formed in metal cutting process. **(08 Marks)**

c. Sketch and explain single point turning tool geometry. **(06 Marks)**

OR

4 a. List and explain different types of cutting tool materials and state their specific applications. **(06 Marks)**

b. Draw a merchant's circle diagram, using usual notations and state the assumptions. **(08 Marks)**

c. List the various types of cutting fluids used in metal cutting briefly. Explain. **(06 Marks)**

Module-3

5 a. What is machinability? Define machinability index. **(04 Marks)**

b. What are the factors affecting on tool life? **(06 Marks)**

c. Explain the process of Electroplating. **(10 Marks)**

OR

6 a. Describe the importance of surface finish process. **(04 Marks)**

b. With a neat sketch, explain the Honing process. **(06 Marks)**

c. Briefly explain powder coating and Galvanizing process. **(10 Marks)**

Module-4

7 a. Explain with neat sketch the process of Abrasive Jet Machining. **(10 Marks)**

b. Explain with neat sketch the process of ultrasonic machining process. **(10 Marks)**

OR

8	a.	Explain with neat sketch of Electro Discharge machining.	(10 Marks)
	b.	Explain with neat sketch of Laser beam machining.	(10 Marks)

Module-5

9	a.	What are the importances of Jigs and Fixtures in industries?	(06 Marks)
	b.	List the types of Jigs and Fixtures.	(06 Marks)
	c.	What are the materials used to manufacture Jigs and Fixtures?	(08 Marks)

OR

10	a.	What are the factors to be considered to design Jigs and Fixtures?	(06 Marks)
	b.	Briefly explain on Template, Plate, Channel in Jigs.	(06 Marks)
	c.	Briefly explain the importance of fixtures in milling and turning.	(08 Marks)

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CBCS SCHEME

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21ME44

Fourth Semester B.E. Degree Examination, June/July 2023
Mechanics and Materials

Time: 3 hrs. Max. Marks: 100

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

Module-1

1 a. Define the following terms :
i) Elasticity ii) Stress iii) Strain iv) Young's modulus v) Poison's ratio. **(05 Marks)**

b. Derive an expression for extension of the uniformly tapered circular bar subjected to an axial load. **(05 Marks)**

c. A member ABCD is subjected to point loads P_1, P_2, P_3 and P_4 as shown in Fig.Q1(c). Calculate the force P_2 necessary for equilibrium if $P_1 = 45kN$, $P_3 = 450kN$ and $P_4 = 130kN$. Determine stresses in each member and also determine the total elongation of the member assuming the $E = 2.1 \times 10^5 N/mm^2$.

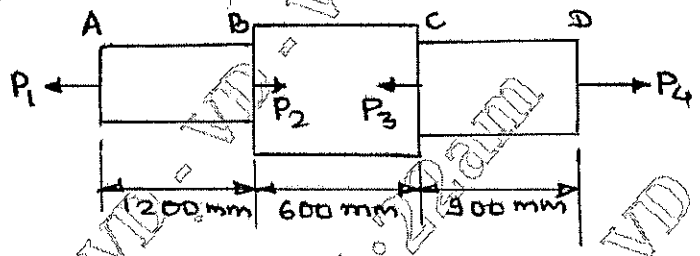

Fig.Q1(c) **(10 Marks)**

OR

2 a. Derive relationship between modulus of elasticity and modulus of rigidity. **(10 Marks)**

b. A compound bar is made up of a central steel plate 50mm wide and 10mm thick to which copper plate 50mm wide and 5mm thick are connected rigidly on each side. The length of the compound bar at room temperature is 1000mm. If the temperature is raised by 100°C, determine the stress in each material and change in length of the compound bar. Assume $E_{st} = 200GPa$, $E_{CO} = 100GPa$. **(10 Marks)**

Module-2

3 a. Derive an expression for the normal stress and shear stress on a plane inclined at 'θ' to the vertical axis in a biaxial stress system. **(10 Marks)**

b. An element with the stresses acting on it as shown in Fig.Q3(b). Determine :
i) Principal stresses and its locations
ii) Maximum shear stresses and its locations.

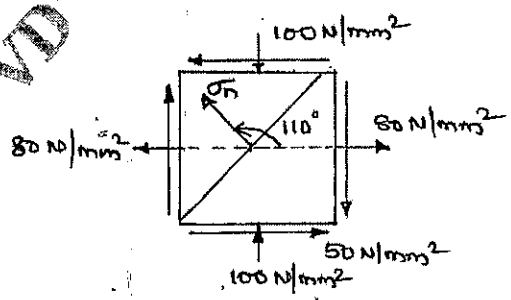

Fig.Q3(b) **(10 Marks)**

OR

4 The state of stress at a point in a strained material is shown in Fig.Q4. Determine :

a. Stresses on a plane whose normal is at an angle of 45° with reference to 80N/mm^2 stress direction

b. Magnitude of principal stresses and their location

c. Maximum and minimum shear stress and their location

d. Draw Mohr's circle and verify the results obtained analytically.

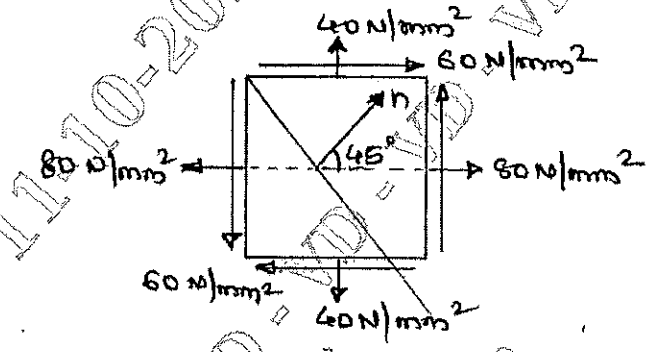

Fig.Q4 **(20 Marks)**

Module-3

5 a. Obtain expressions relating load, shear force and bending moment. **(05 Marks)**

b. Draw the shear force and bending moment diagram for the beam shown in Fig.Q5(b).

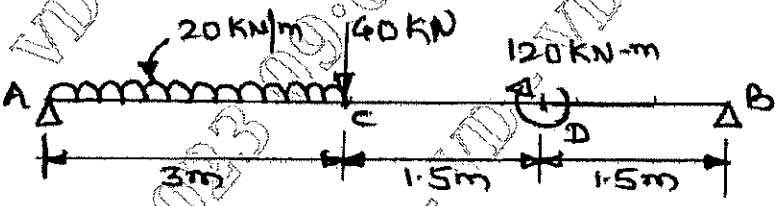

Fig.Q5(b) **(15 Marks)**

OR

6 a. Derive the equation $\frac{M}{I}=\frac{\sigma_b}{Y}=\frac{E}{R}$ with usual notations. State the assumptions in the derivation. **(10 Marks)**

b. A beam having T-section with its flanges of 180mm × 10mm and web of 220mm × 10mm is subjected to sagging bending moment 15kN-m. Determine the maximum tensile stress and maximum compressive stress, and their location in the section. **(10 Marks)**

Module-4

7 a. Derive differential equation for deflection of beam. **(10 Marks)**

b. Determine slope and deflection for a cantilever beam of length L and subjected to UDL W/unit length. **(10 Marks)**

OR

8 a. State assumptions and derive the torsional equation $\frac{T}{J} = \frac{\tau}{R} = \frac{G\theta}{L}$. **(10 Marks)**

b. A hollow shaft of diameter ratio 3/8 is required to transmit 588kW at 110rpm, the maximum torque being 120% of the mean. Shear stress is not exceed 63N/mm^2 and twist in a length of 3m not to exceed 1.4° calculate external diameter of shaft which would satisfy these conditions. Take modulus of rigidity as 84GPa. **(10 Marks)**

Module-5

9 a. Derive an expression for circumferential stress and longitudinal stress for a thin cylinder. **(10 Marks)**

b. Derive an expression for strain energy for a member subjected to axial load. **(05 Marks)**

c. A steel bar 15mm diameter is pulled axially by a force of 10kN. If the bar is 250mm long, calculate the strain energy stored per unit volume of the bar and total strain energy stored by the bar. Take $E = 2 \times 10^5$ N/mm^2. **(05 Marks)**

OR

10 a. Obtain the expression for Euler's critical load for a long column with both ends hinged. Also state assumptions made. **(10 Marks)**

b. A thick cylinder with internal diameter 80mm and external diameter 120mm is subjected to an external pressure of 40N/mm^2 when the internal pressure is 120N/mm^2. Plot the variation of circumferential stress and radial pressure on the thickness of the cylinder. **(10 Marks)**

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CBCS SCHEME

21ME482

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Question Paper Version : A

Fourth Semester B.E. Degree Examination, June/July 2024
Introduction to AI and ML

Time: 1 hr.] [Max. Marks: 50

INSTRUCTIONS TO THE CANDIDATES

1. Answer all the **fifty** questions, each question carries one mark.
2. Use only **Black ball point pen** for writing / darkening the circles.
3. **For each question, after selecting your answer, darken the appropriate circle corresponding to the same question number on the OMR sheet.**
4. Darkening two circles for the same question makes the answer invalid.
5. **Damaging/overwriting, using whiteners** on the **OMR** sheets are strictly prohibited.

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1. What is one of the key goals of AI?
   a) Creating Perfectly logical agents
   b) Simulating intelligent behavior
   c) Achieving Consciousness in machines
   d) Emulating human Emotions in robots

2. In which decade did AI experience its first "AI Winter", a period of reduced funding and interest in AI research?
   a) 1960s b) 1970s c) 1980s d) 1990s

3. Which AI approach aims to pass the imitation game?
   a) Rational Agent Approach
   b) Turing Test Approach
   c) Law of Thought Approach
   d) Cognitive Modeling Approach

4. The Cognitive Modeling Approach in AI primarily focuses on :
   a) Simulating laws of thought
   b) Emulating human emotions in AI agents
   c) Formal logic and reasoning
   d) Imitating human thought processes

5. What is the primary goal of machine learning in AI?
   a) To develop advanced computer hardware
   b) To simulate human thought processes
   c) To enable computers to learn from data and improve performance
   d) To emulate human emotions in AI agents

6. What is the key advantage of Expert systems in AI?
   a) They can learn from data and adapt over time.
   b) They can make decisions based on formal logic
   c) They can mimic human emotions effectively
   d) They are highly interpretable and can explain their reasoning

7. Natural Language Processing (NLP) in AI deals primarily with:
   a) Understanding and generating human language
   b) Decision-making in autonomous systems
   c) Simulating human cognition
   d) Image and Video analysis

8. How does Gmail Employ NLP for Email filtering?
   a) By sorting emails alphabetically
   b) By categorizing emails based on the sender's location
   c) By analyzing email content and categorizing them accordingly
   d) By filtering emails based on their size

9. Systems for differently-abled individuals is an example of,
   a) Face recognition
   b) Content-Based image Retrieval
   c) Smart Interactions
   d) Environment perception

10. Which statement is true regarding Alpha Go?
   a) It was developed by researchers at Deep Mind.
   b) It defeated the world chess champion.
   c) It represents a strong AI agent
   d) All of these

11. Random forest is an ensemble learning technique that combines multiple :
   a) Regression models
   b) Clustering algorithms
   c) Decision trees
   d) K-Nearest Neighbors (KNN)

12. What is the primary characteristic of supervised machine learning?
   a) It requires labeled data for training
   b) It does not require any data for training
   c) It focuses on unsupervised feature extraction
   d) It only uses reinforcement signals for learning

13. Reinforcement learning is commonly used in :
   a) Image segmentation
   b) Autonoumous robotics
   c) Spam email detection
   d) Sentiment analysis

14. What is an example of ordinal data?
   a) Email addresses of users
   b) Colors of Cars (eg. Red, Blue, Green)
   c) Movie genres (eg., action, comedy, drama)
   d) Education levels (eg.high school, bachelor's, Master's)

15. Which machine learning algorithm is used for classification tasks, such as spam email detection or image recognition?
   a) Linear regression
   b) Decision tree
   c) K-means clustering
   d) Principal component Analysis

16. In unsupervised learning, the algorithm aims to :
   a) Predict a target variable
   b) Learn from rewards and punishments
   c) Cluster data into groups based on similarity
   d) Classify data into predefined categories

17. In Weka, what does the term "Outlier" refer to in data pre-processing?
a) Missing values in the dataset
b) Instances with Extreme attribute values
c) Instances with multiple class labels
d) Feature with low information gain

18. Which of the following is a technique used in Weka for handeling high-dimensional data through feature reduction?
a) K-means clustering
b) Support Vector Machines
c) Decision Tree Pruning
d) Principal Component Analysis

19. In machine learning, what is the primary use of probability distributions such as Gaussian (Normal) distribution?
a) To describe the shape of data
b) To classify data points
c) To calculate the mean and median
d) To perform regression analysis

20. How do search algorithms contribute to network routing in machine learning?
a) They define the structure of computer networks
b) They control network security
c) They determine the optimal paths for data or packets to travel
d) They manage network hardware

21. Overfitting in machine learning occurs when a model:
a) Performs well on both training and testing data
b) Generalizes well to new data
c) Has high bias and low variance
d) Fits the training data too closely and performs poorly on testing data

22. K-means is an unsupervised learning algorithm used for :
a) Classification
b) Clustering
c) Regression
d) Dimensionality reduction

23. If the lift value for an association rule is exactly 1, what can be inferred about the rule?
a) The rule is not significant
b) The antecedent and consequent are independent
c) The rule has perfect confidence
d) The antecedent and consequent are negatively correlated

24. Underfitting occurs when :
a) The model has high bias and low variance
b) The model has low bias and high variance
c) The model has both high bias and high variance
d) The model has neither bias and nor variance

25. What is the purpose of pruning in decision trees for numeric prediction?
a) To add more branches to the tree
b) To increase the depth of the tree
c) To remove unnecessary branches
d) To generate association rules

26. What does "Gini impurity" measure in decision trees?
a) The variance of the target variable
b) The likelihood of misclassifying a random data point
c) The reduction in variance after a split
d) The purity of a node with respect to class labels.

27. Precision in a confusion matrix is equal to?
a) (True positives + False positives) / (True positives + False Negatives)
b) True positives / (True positives + False positives)
c) True negatives / (True negatives + False negatives)
d) (True positives + True negatives) / (True positives + False positives)

28. Purpose of the "Centroid" of a cluster is?
a) To represent the most common data point in the cluster
b) To represent the geographic center of the cluster's data points
c) To measure the dispersion of data points in the cluster
d) To store the cluster's ID

29. What is the primary goal of the Apriori algorithm in data mining?
a) Regression analysis
b) Clustering
c) Association rule discovery
d) Classification

30. In association rule mining, what is the "support" of a rule?
a) A measure of how often the items in the rule appear together in the data set.
b) The confidence level of the rule
c) The lift value of the rule
d) The size of the dataset

31. Which nature-inspired technique is often used for solving complex optimization problems by simulating the process of evolution?
a) Simulated Annealing
b) Particle Swarm Optimization
c) Ant Colony optimization
d) Genetic Algorithm

32. What is the primary use of perceptrons in machine learning?
a) Image classification
b) Natural Language processing
c) Binary classification tasks
d) Reinforcement learning

33. What role do mutation and cross over play in genetic algorithms?
a) They determine the initial population
b) They control the rate of genetic variation
c) They calculate fitness scores
d) The select the fittest individuals

34. What role do activation functions play in artificial neural networks?
a) They determine the learning rate
b) They define the network's architecture
c) They enable complex, nonlinear mappings between input and outputs
d) They decide the population size in genetic algorithms

35. What is the key feature of Recurrent Neural Networks (RNNs) that makes them suitable for tasks involving sequential data?
a) RNNs have more layers than other neural network types
b) RNNs use convolutional operations
c) RNNs can maintain a memory of previous inputs
d) RNNs are primarily used for image classification

36. Which nature-inspired technique is particularly useful for solving combinatorial optimization problems, such as the traveling salesman problem?
a) Generic Algorithm
b) Particle Swarm Optimization
c) Simulated Annealing
d) Ant Colony Optimization

37. Which of the following tasks is not typically associated with image data labeling in supervisely?
a) Object detection
b) Image compression
c) Image segmentation
d) Image classification

38. In the context of Weka Weather prediction, term "Feature Selection" refer to
a) Selecting Weather forecasting models
b) Choosing the most relevant input variables
c) Determining the location of weather sensors
d) Labeling weather data

39. What is the neural network layer responsible for capturing hierarchical features in data?
a) Input layer
b) Hidden layer
c) Output layer
d) Activation layer

40. What is the primary inspiration behind Ant Colony Optimization?
a) The behavior of social insects like ants
b) The process of natural selection
c) The cooling process of materials
d) Quantum computing principles

41. What is a neural network layer?
a) A type of deep learning algorithm
b) A component that performs computations and transformations on data
c) A specific type of data structure used for storing neural network weights
d) A type of deep learning activation function

42. Which of the following is a key characteristic of deep learning models?
a) They have a limited number of layers
b) They use rule-based decision-making
c) They require large amounts of labeled data
d) They are always interpretable

43. What is the purpose of the back propagation algorithm in training a neural network?
a) To initialize network weights
b) To calculate the loss function
c) To optimize the learning rate
d) To update network weights to minimize errors

44. Which activation function is commonly used in deep learning to introduce non - linearity?
a) Linear activation
b) Sigmoid activation
c) Identity activation
d) Threshold activation

45. In medical image analysis, what is the primary goal of image segmentation?
a) Identifying anomalies or diseases
b) Enhancing image resolution
c) Converting images to grayscale
d) Removing noise from images

46. Which deep learning framework is commonly used for medical image analysis?
a) Tensor flow
b) Pytorch
c) Keras
d) Scikit-learn

47. Which AI technique is often used to create artwork in a style similar to famous painters?
a) Natural Language Processing
b) Reinforcement Learning
c) Generative Adversarial Networks
d) Support Vector Machines

48. What is the primary characteristic of an artificial agents?
a) It can only perform pre-defined tasks
b) It can autonomously perform tasks and make decisions
c) It always requires human intervention
d) It cannot interact with the environment

49. What are chatbots commonly used for in customer services?
a) Handeling only simple inquiries
b) Providing Emotional support and counseling
c) Solving complex technical issues
d) Assisting customers with physical tasks

50. In what industry are virtual assistants like Siri and Alexa widely used?
a) Healthcare
b) E-Commerce
c) Space Exploration
d) Agriculture

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21ME61

Sixth Semester B.E./B.Tech. Degree Examination, June/July 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 and explain operation management function, with block diagram. **(10 Marks)**

b. Differentiate between goods and services. **(10 Marks)**

OR

2 a. Explain the characteristics of operation decisions. **(10 Marks)**

b. Mention the frame work for decision making process. **(10 Marks)**

Module-2

3 a. Explain the elements of good forecast. **(10 Marks)**

b. Mention the steps involved in forecast process. **(10 Marks)**

OR

4 a. Explain long term, short term and intermediate forecasts. **(10 Marks)**

b. With the help of least-squares method, develop a linear trend equation for the data shown in the table and

i) Compute the constants a and b in the regression equation

ii) Forecast a trend value for the year 2002 and 2008.

Year	1991	92	93	94	95	96	97	98	99	2000	2001
Shipments (tones)	2	3	6	10	8	7	12	14	14	18	19

(10 Marks)

Module-3

5 a. Explain the importance of capacity decisions. **(10 Marks)**

b. Explain measuring capacity with examples. **(10 Marks)**

OR

6 a. Name the different types of processing layouts and explain any two. **(10 Marks)**

b. Explain the need for layout decisions. **(10 Marks)**

Module-4

7 a. Explain purpose and scope of aggregate planning. **(10 Marks)**

b. Name the different strategies involved in aggregate planning. **(10 Marks)**

OR

8 a. What are the objectives of master scheduling process? **(10 Marks)**

b. Mention the planning horizon of master schedule. **(10 Marks)**

Module-5

9 a. Mention the benefits in material requirement planning. **(10 Marks)**

b. Explain briefly MRP inputs. **(10 Marks)**

OR

10 a. Explain the importance of purchasing in supply chain management. **(10 Marks)**

b. Define tender and mention the approaches to supply chain management. **(10 Marks)**

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21ME62

Sixth Semester B.E./B.Tech. Degree Examination, June/July 2025
Heat Transfer

Time: 3 hrs. Max. Marks: 100

Note:

1. **Answer any FIVE full questions, selecting one Full question from each module.**
2. **Use of Heat transfer Data hand book, Thermodyamics Data hand Book, and steam tables are permitted.**
3. **Assume missing data suitably.**

Module-1

1 a. What are three ways heat is transferred? In brief explain them. **(05 Marks)**

b. What are boundary conditions? Explain any one of the boundary conditions with a sketch. **(05Marks)**

c. Derive the general three – dimensional unsteady state heat condition equation with heat generation, in a Cartesian coordinate system for an isotropic material with assumptions made. **(10 Marks)**

OR

2 a. Find the heat flow rate through the composite wall as shown in Fig.Q2(a). Assume one – dimensional flow. $K_a = 150$ w/m°C $K_b = 30$ w/ m°C, $K_c = 65$ w/ m°C, $K_d = 50$ w/ m°C.

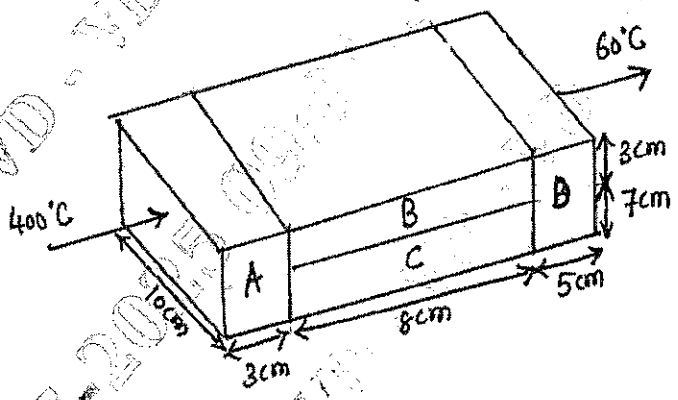

Fig. Q2(a)

(10 Marks)

b. Explain the experimental method of determining the thermal conductivity of a metal rod. **(10 Marks)**

Module-2

3 a. Define Fin, and list the common types of fin configurations. Write a note on any two types of fin with a neat sketch. **(05Marks)**

b. Define Efficiency of fin and Effectiveness of fin. In brief discuss on both. **(05 Marks)**

c. With assumptions, derive an expression for temperature distribution and rate of heat transfer for an infinitely long fin. **(10 Marks)**

OR

4 a. Write a note on transient heat conduction. How to analyze transient heat flow? **(05 Marks)**

b. Write a note on Biot number and Fourier number with their significance on transient heat conduction. **(05 Marks)**

c. A steel ball of 5 cm diameter at 450°C is suddenly placed in a controlled environment of 100°C Considering the following data, find the time required for the ball to attain a temperature of 150°C. Take C_ρ= 450 J/kg–K, K = 35 w/mk, h = 10 w/m^2-k, $\rho = 8000\ kg/m^3$. **(10 Marks)**

Module-3

5 a. Differentiate between the experimental, analytical and numerical methods of determining the solution of a heat transfer problem. **(10 Marks)**

b. Explain the finite difference formulation of the differential equation of one – dimensional steady heat conduction. **(10 Marks)**

OR

6 a. State :
i) Emissivity
ii) Stefan Boltzmann's law
iii) Kirchoff's law
iv) Plank's law
v) Wein displacement law **(10 Marks)**

b. Write a brief note on the Radiation shape factor ad Radiation shields. **(10 Marks)**

Module-4

7 a. With neat sketches, explain velocity boundary layer and thermal boundary layer over flat plate. **(10 Marks)**

b. With assumptions derive an expression for Nusselt's number in terms of Reynold's number and Prandtl's number for forced convection. **(10 Marks)**

OR

8 a. Define the following terms with their significance.
i) Reynolds number
ii) Nusselt number
iii) Prandtl number
iv) Laminar flow
v) Turbulent flow. **(10 Marks)**

b. Air at 20°C and at atmospheric pressure flows over a flat plate at a velocity of 1.8 m/s. If the length of the plate is 2.2 m and is maintained at 100°C, calculate the heat transfer rate per unit width using the properties of air at mean bulk temperature of $\left(\frac{100+20}{2}\right) = 60°C$

are $\rho = 1.06\ kg/m^3$, $C\rho = 1.005 \frac{KJ}{Kg}$, $K = 0.02894 \frac{W}{m°C}$,

$P_r = 0.696$, $\nu = 18.97 \times 10^{-6} \frac{m^2}{S}$. **(10 Marks)**

Module-5

9 a. Discuss the regimes of pool boiling curve for water. **(10 Marks)**

b. Saturated steam at t_{sat} = 90°C (ρ = 70.14 KPa) condenses on the outer surface of a 1.5 m long 2.5 m OD vertical tube maintained at a temperature T_∞ = 70°C. Assuming film condensation calculate :

1) The local transfer coefficient at the bottom of the tube.

2) The average heat transfer coefficient over the entire length of the tube.

Properties of water at 80°C are ρ_l = 974 kg/m^3, K_t = 0.668 w/mk, μ_l = 0.335 x 10^3 kg/ms, h_{fg}= 2309 kJ/kg, $\rho_v << \rho_r$. **(10 Marks)**

10 a. Define heat Exchanger and Logarithmic Mean Temperature difference. Differentiate between parallel and counter –flow heat exchangers. **(10 Marks)**

b. In a counter flow double pipe heat exchanger, water is heated from 25°C to 65°C by an oil with a specific heat of 1.45 kJ/kg and mass flow rate of 0.9 kg/s. The oil is cooled from 230°C to 160°C. If the overall heat transfer coefficient is 420 w/m°C, calculate the following :

i) the rate of heat transfer

ii) the mass flow rate of water and

iii) the surface area of the heat Exchanger. **(10 Marks)**

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21ME63

Sixth Semester B.E./B.Tech. Degree Examination, June/July 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 permitted.
3. Assume missing data suitably.

Module-1

1 a. Explain the following:
i) Elasticity
ii) Plasticity
iii) Ductility
iv) Brittleness
v) Factor of safety. **(10 Marks)**

b. Determine the required thickness of the steel bracket at section A-A when loaded as shown in Fig.Q.1(b) in order to limit the tensile stress to 100 N/mm^2. **(10 Marks)**

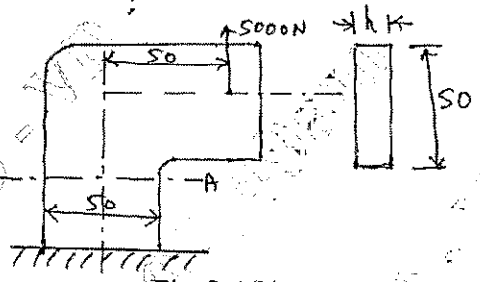

Fig.Q.1(b)

OR

2 a. A notched flat plate shown in Fig.Q.2(a) is subjected to bending moment of 10 N.m. Determine the maximum stress induced in the member by taking the stress concentration into account. **(10 Marks)**

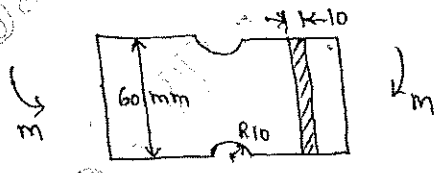

Fig.Q.2(a)

b. Derive an equation for impact stress induced in a member subjected to axial impact loading. **(10 Marks)**

Module-2

3 a. With usual notations prove that a hollow shaft is always stronger than a solid shaft of the same material, weight and length when subjected to simple torque and hence deduce that

$$\frac{\text{Torque on hollow shaft}}{\text{Torque on solid shaft}} = \frac{1+k^2}{\sqrt{1-k^2}} > 1, \text{ where } k = \frac{D_i}{D_o}$$ **(14 Marks)**

b. A shaft is required to transmit 1 MW at 240 rpm. The shaft must not twist more than 1° on a length of 15 diameters. If the modulus of rigidity for the shaft material is 80 kN/mm^2, find diameter of the shaft. **(06 Marks)**

OR

4 a. Write design procedure for flange coupling. **(08 Marks)**

b. Design a value spring for an automobile engine, when the value is closed, the spring produces a force of 45 N and when it opens, produces a force of 55 N. The spring must fit over the value bush which has an outside diameter of 20 mm and must go inside a space of 35 mm. The lift of the value is 6 mm. The spring index is 12. The allowable stress may be taken as 0.33 GPa, modulus of rigidity 80 Gpa. **(12 Marks)**

Module-3

5 a. Sketch and explain failure modes of riveted joints. **(08 Marks)**

b. A double riveted lap joint is to be made between 9 mm plates, if the safe working stresses in tension, crushing and shear are 80 N/mm^2, 120 N/mm^2 and 60 N/mm^2 respectively, design the riveted joint. **(12 Marks)**

OR

6 a. A plate of 80 mm wide and 10 mm thick is to be welded to another plate by means of two parallel fillet welds. The plates are subjected to a load of 50 kN. Find the length of weld so that maximum stress does not exceed 50 N/mm^2. Consider the joint under static loading and then under dynamic loading. **(10 Marks)**

b. A flat circular plate is used to close the flanged end of a pressure vessel of internal diameter 300 mm. The vessel carries a fluid at a pressure of 0.7 N/mm^2. A soft copper gasket is used to make the joint leak proof. Twelve bolts are used to fasten the cover plate onto the pressure vessel. Find the size of bolts so that the stress in the bolts is not to exceed 100 N/mm^2. **(10 Marks)**

Module-4

7 A pair of carefully cut spur gears with 20° full depth involute profile is used to transmit 12 kW at 1200 rpm of pinion. The gear has to rotate at 300 rpm. The material used for both pinion and gear is medium carbon steel whose allowable bending stress may be taken as 230 MPa. Determine the module and face width of spur pinion and gear. Suggest suitable hardness. Take 24 teeth on pinion, modulus of elasticity may be taken as 210 GPa. **(20 Marks)**

OR

8 a. Derive an equation for formative or virtual or equivalent number of teeth for bevel gear. **(08 Marks)**

b. Following data refer to a worm and worm gear drive centre distance 200 mm, PCD of worm 80 mm, number of start 44, axial module 8 mm, transmission ratio 20, worm gear is phosphor bronze with σ_{au} 55 MPa, worm is of hardened ground steel, tooth form 20° FD involute. Determine following:
Number of teeth on worm gear, lead angle face width of worm gear to transmit 15 kW of power at 1750 rpm of worm based on the beam strength of worm gear. **(12 Marks)**

Module-5

9 a. Determine the power transmitted by a single pair plate clutch assuming uniform pressure distribution. The friction surfaces have an outside diameter of 350 mm and an inner diameter of 280 mm. The co-efficient of friction is 0.25 and the maximum allowable pressure is 0.85 MPa. **(10 Marks)**

b. A single block brake is shown in Fig.Q.9(b). The drum diameter is 250 mm. The contact angle is 90°. If an operating force of 700 N is applied at the end of the lever and the coefficient of friction is 0.35, determine the torque that may be sustained by the brake. **(10 Marks)**

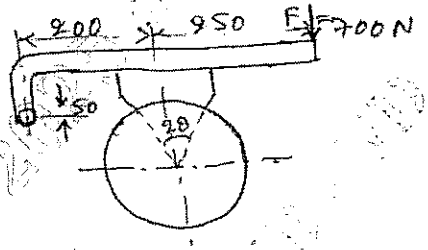

Fig.Q.9(b)

OR

10 a. Explain hydrodynamic theory of lubrication with sketch. Pressure distribution in bearing and graph showing variation of friction with speed. **(10 Marks)**

b. A single row deep groove ball bearing has a specific dynamic capacity of 46.3 kN. The actual radial load F_r = 9 kN. The speed of rotation is 1800 rpm. What is the life in i) Cycles of operation ii) in hours iii) What is average life? **(10 Marks)**

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CBCS SCHEME

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21ME652

Sixth Semester B.E./B.Tech. Degree Examination, June/July 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. Briefly explain energy resources and its classifications. **(06 Marks)**

b. What is the need of non-conventional energy sources. **(06 Marks)**

c. Briefly describe energy alternatives : i) Photovoltaic ii) Tar Sand and oil shale. **(08 Marks)**

OR

2 a. With a neat sketch explain : i) Sunshine recorder ii) Pyranometer. **(08 Marks)**

b. Distinguish between beam and diffused radiations. **(06 Marks)**

c. Explain terrestrial and extra terrestrial radiations. **(06 Marks)**

Module-2

3 a. Define : i) Solar latitude ii) Declination angle iii) Zenith angle iv) Surface aziniuth angle v) Hour angle. **(10 Marks)**

b. With neat sketch explain any two types of concentrating collectors. **(10 Marks)**

OR

4 a. Explain with sketch : i) Solar distillation ii) Solar pond. **(10 Marks)**

b. With a neat sketch, explain photovoltaic conversion. Given one application of solar cell. **(10 Marks)**

Module-3

5 a. List the types of wind mill. Explain with sketch horizontal axis wind mill. **(10 Marks)**

b. Explain with neat sketch Savonius and derricus types of vertical axis wind turbines. **(10 Marks)**

OR

6 a. With a neat sketch explain fixed dome type biogas plant. **(10 Marks)**

b. What are the problems associated in bio-gas production. **(10 Marks)**

Module-4

7 a. With a neat sketch explain Hydel power plant. **(10 Marks)**

b. With a neat sketch explain use of : i) Hydrographs ii) Flow duration curves. **(10 Marks)**

OR

8 a. With the help of diagram, explain two basin systems in tidal power harnessing. **(10 Marks)**

b. List the advantages and disadvantages of tidal plants. **(10 Marks)**

Module-5

9 a. Describe the closed cycle OTEC system with the help of diagram. **(10 Marks)**

b. What are the problems associated with OTEC. **(10 Marks)**

OR

10 a. With a neat sketch explain dry steam based geothermal power plant. **(10 Marks)**

b. List the advantages and disadvantages geo-thermal energy. **(10 Marks)**

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