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CMR COLLEGE OF ENGINEERING & TECHNOLOGY
(UGC AUTONOMOUS)

Examination : B.Tech III Semester Supplementary Examinations July-2025
Course Name : Mechanics of Solids
Course Code : A403305
Branch : Mechanical Engineering
Date & Session : 01-07-2025 FN **Duration: 3 hours** **Max. Marks: 60**

(Note: Assume suitable data if necessary)

PART-A

Answer all TEN questions

Each question carries ONE mark.

10x1=10M

1. Define the terms elasticity and modulus of rigidity 1 M
2. Mention the different types of stresses and strains 1 M
3. Define Shear force and bending moment in beams. 1 M
4. What do you mean by point of contraflexure? 1 M
5. Mention the importance of shear stress in beams. 1 M
6. Explain the terms: Neutral axis and moment of resistance 1 M
7. Why are hollow shafts preferred over circular shafts? 1 M
8. Explain Mohr's circle for determining principal stresses. 1 M
9. Mention the stresses which are responsible for column failure. 1 M
10. Differentiate between struts and columns. 1 M

PART-B

Answer the following. Each question carries TEN Marks.

5x10=50M

- 11.A). (i) Find an expression for the total elongation of a uniformly tapering rectangular bar when subjected to an axial tensile load P. 5M
(ii) What is bulk modulus? Derive an expression for Young's modulus in terms of bulk modulus and Poisson's ratio. 5M

OR

11. B). Determine the value of Young's modulus and Poisson's ratio of a metallic bar of length 250 mm and breadth 30 mm and depth 20 mm when the bar is subjected to an axial compressive load of 240 kN. The decrease in length is given as 0.05 cm and increase in breadth is 0.002 cm. 10M
12. A). (i) Draw the shear force and bending moment diagrams for the cantilever beam of length L carrying a uniformly distributed load of w per m length over its entire length. 5M
(ii) Draw the S.F.D and B.M.D for a cantilever beam having span of 5 m subjected to point load of 10 kN at the free end. 5M

OR

12. B). Draw the shear force and bending moment diagram for a simply supported beam of length 10 m and carrying a uniformly distributed load of 10 kN/m for a distance of 5 m from the left end. Also calculate the maximum bending moment on the section. 10M

(P.T.O.)

13. A). (i) A timber beam of rectangular section is to support a load of 25 kN uniformly distributed over a length of 3.5 m when the beam is simply supported. If the depth of section is to be twice the breadth, and the stress in the timber is not to exceed 6 N/mm², find the dimensions of the cross sections. 5M
(ii) Explain the theory of simple bending. 5M

OR

13. B). A rectangular beam 110 mm wide and 245 mm deep is subjected to a maximum shear force of 50 kN. Determine: (i) Average shear stress. (ii) Maximum shear stress. (iii) Shear stress at a distance of 25 mm above the neutral axis. 10M
14. A). The direct stresses at a point across two perpendicular planes are 100 N/mm² and 50 N/mm². Find the normal, tangential and resultant stresses and its obliquity on a plane inclined at 30° with major principal plane also find principal stresses. 10M

OR

14. B). Explain Maximum principal stress theory and maximum principal strain theory. 10M
15. A). Derive the Torsion Equation: 10M

$$\frac{T}{J} = \frac{\tau}{r} = \frac{C\theta}{L}$$

OR

15. B). i) Find an expression for the maximum and minimum stresses when a rectangular column is subjected to a load which is eccentric to Y-Y axis. 5M
ii) A rectangular column of width 190 mm and of thickness 145 mm carries a point load of 240 kN at an eccentricity of 10 mm with respect to longitudinal axis. Determine the maximum and minimum stresses on the section. 5M

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CMR COLLEGE OF ENGINEERING & TECHNOLOGY
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Examination : B.Tech III Semester Supplementary Examinations July-2025
Course Name : Metallurgy & Material Science
Course Code : A403303
Branch : Mechanical Engineering
Date & Session : 03-07-2025 FN **Duration: 3 hours** **Max. Marks: 60**

(Note: Assume suitable data if necessary)

PART-A

Answer all TEN questions

Each question carries ONE mark.

10x1=10M

1. Define Space lattice. 1 M
2. What is unit cell? 1 M
3. What are different reactions in binary phase diagram? 1 M
4. Mention the classification of Equilibrium diagrams. 1 M
5. What is Isomorphous system? 1 M
6. Define hardenability. 1 M
7. What is tempering? 1 M
8. Define plasma hardening. 1 M
9. Differentiate between tool steel and Die steel. 1 M
10. List any two aluminum alloys. 1 M

PART-B

Answer the following. Each question carries TEN Marks.

5x10=50M

- 11.A). Explain different crystalline defects with neat sketch. 10M
- OR**
11. B). (i) Explain point defect and plane defect 5M
(ii) List out different types of Bravais lattice structures with their characteristics and examples. 5M
12. A). (i) Explain about Hume Rother's rules. 5M
(ii) Explain about the types of solid solution with neat sketch. 5M
- OR**
12. B). Draw a neat labeled Iron-Iron Carbide diagram and explain eutectic and eutectoid reaction in it. 10M
13. A). Explain any two heat treatment processes in detail. 10M
- OR**
13. B). What is Plain Carbon Steel? Also explain all type of plain carbon steel with the composition and specific application. 10M
14. A). Explain in detail about different types of carburizing methods. 10M
- OR**
14. B). Explain hardening and tempering process. 10M
15. A). Write the classification of copper alloys? Describe the importance of brass. 10M
- OR**
15. B). Write the classification of ceramics? Explain with examples. 10M

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**CMR COLLEGE OF ENGINEERING & TECHNOLOGY
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Examination : B.Tech III Semester Supplementary Examinations July-2025
Course Name : Thermodynamics
Course Code : A403304
Branch : Mechanical Engineering
Date & Session : 05-07-2025 FN **Duration: 3 hours** **Max. Marks: 60**

(Note: Assume suitable data if necessary)

PART-A

Answer all TEN questions

Each question carries ONE mark.

10x1=10M

1. What is meant by Quasi-static process? 1 M
2. What are the conditions for thermodynamic equilibrium? 1 M
3. State and explain First law of thermodynamics. 1 M
4. State Carnot's theorem and write its applications. 1 M
5. Write Clausius Clapeyron equation and its significance. 1 M
6. Draw the phase diagram on p-v diagrams with water as pure substance. 1 M
7. List out various psychrometric process. 1 M
8. State Avogadro's law of volume mixture. 1 M
9. Construct PV & TS diagram for otto and diesel cycles. 1 M
10. What are the various components used in VCR system? 1 M

PART-B

Answer the following. Each question carries TEN Marks.

5x10=50M

- 11.A). A fluid at a pressure of 3.5 bar, and with specific volume of 0.2 m³/kg, contained in a cylinder behind a Piston expands reversibly to a pressure of 0.8 bar according to a law $P = C/V^2$. Calculate the work done and heat transfer by the fluid on the piston. 10M

OR

11. B). Discuss the macroscopic and microscopic point of view of thermodynamics. 10M
12. A). Explain Joules experiment and state the first law of thermodynamics applied to a closed system undergone by a cyclic process. 10M

OR

12. B). A reversible heat engine working between two thermal reservoirs at the temperatures of 875 K and 315 K drives a reversible refrigerator which operates between the same 315 K reservoir and a reservoir at 260 K. The engine is supplied 2000 kJ of heat and the network output from the composite system is 350 kJ. Calculate the heat transfer to the refrigerator and the net heat interaction with the reservoir at 315 K temperature. 10M

13. A). Draw the P-V-T surface for water and discuss the triple point and critical point data on the diagram. 10M

OR

13. B). Explain the free expansion and throttling processes. Discuss its practical applications. 10M

(P.T.O.)

14. A). A perfect gas mixture consists of 3 kg of Nitrogen and 5 kg of carbon dioxide at a pressure of 3 bar and a temperature of 20 degrees centigrade. Calculate the mole fraction of each gas, the equivalent molecular weight of the mixture, the equivalent gas constant of the mixture, the partial pressure and partial volumes and the volume and density of the mixture. 10M

OR

14. B). A thermally insulated vessel contains 3 kg mole of H_2 and 1.5 kg mole of N_2 each at 1 bar $27^\circ C$ initially they are separated by a partition wall. Determine the change in entropy when the partition wall is removed and the two gases mix. 10M

15. A). Draw P-h and T-s chart for vapour compression refrigeration system and explain the principle of operation. 10M

OR

15. B). Compare the efficiency of the Otto, the Diesel and the dual cycle under the conditions of (i) equal compression ratio and heat input, (ii) constant maximum pressure and heat input. 10M

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**CMR COLLEGE OF ENGINEERING & TECHNOLOGY
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Examination : B.Tech III Semester Supplementary Examinations July-2025
Course Name : Fluid Mechanics & Hydraulic Machinery
Course Code : A401201
Branch : Mechanical Engineering
Date & Session : 08-07-2025 FN **Duration:** 3 hours **Max. Marks:** 60

(Note: Assume suitable data if necessary)

PART-A

Answer all TEN questions

Each question carries ONE mark.

10x1=10M

1. State Newton's Law of Viscosity. 1 M
2. Define the terms Specific volume & Specific gravity. 1 M
3. Define stream line and path line. 1 M
4. State the principle of momentum equation. 1 M
5. Define boundary layer separation. 1 M
6. Define Reynolds Number and what is its significance. 1 M
7. What is meant by draft tube? 1 M
8. How can you net head and gross head of Hydroelectric power plant? 1 M
9. Write about NPSH? 1 M
10. What is reciprocating pump and what are the applications of it? 1 M

PART-B

Answer the following. Each question carries TEN Marks.

5x10=50M

- 11.A). Explain the phenomenon of surface tension on the top surface of liquids. What are the examples of surface tension. 10M

OR

11. B). Differentiate between: 10M
(i) Absolute pressure and gauge pressure
(ii) Piezometer and simple manometer
(iii) U-tube differential manometer and inverted U-tube differential manometer.

12. A). A 300 mm diameter pipe conveying water branches into two pipes of diameter 250 mm and 200 mm and respectively. If the average velocities in the 300 mm and the 200 mm pipes be 2.5m/sec and 1 m/sec, calculate the velocity in the 250 mm pipe. 10M

OR

12. B). Derive the Bernoulli's equation from the Euler's equation and state the assumptions made in the derivation of Bernoulli's equation. 10M

13. A). Explain how the boundary layer separation takes place when the fluid moves over a curved surface. 10M

OR

13. B). A horizontal venturimeter with inlet and throat diameters are 40cm and 36cm respectively is used to measure the flow of water. The reading of differential manometer connected to the inlet and the throat is 28 cm of mercury. Determine the rate of flow. Take $C_d = 0.98$. 10M

(P.T.O..)

14. A). What is the importance of a draft tube in a Francis turbine? Discuss different types of draft tubes. 10M

OR

14. B). A turbine is to operate under a head of 30 m at 250 rpm. The discharge is $10.5 \text{ m}^3/\text{sec}$. If the efficiency is 85%, determine (i) Power generated, (ii) The specific speed of the turbine, (iii) Type of turbine, (iv) Performance under a head of 25 m. 10M

15. A). Explain the principle and working of a Centrifugal pump with a neat sketch. 10M

OR

15. B). A double acting reciprocating pump having piston area 0.1m has a stroke of 0.30m long. The pump is discharging 2.4 m^3 of water per minute at 45 rpm through a height of 10 m. Find the slip of the pump and power required to drive the pump. 10M
