



**OR**

12. B). A simply supported beam of 3 m span carries two loads of 5 kN each at 1 m and 2 m from the left hand support. Draw the shear force and bending moment diagrams for the beam. 10M
13. A). An I-section beam 350 mm×150 mm has a web thickness of 10 mm and a flange thickness of 20 mm. The beam is simply supported over a span of 4 m. Determine the uniformly distributed load per meter length which the beam can carry, if the bending stress should not exceed 150 MPa. 10M

**OR**

13. B). State the assumptions made in theory of simple bending. Draw the bending stress and shear stress profiles for a hollow circular beam section. 10M
14. A). A point is subjected to tensile stresses of 200 MPa and 150 MPa on two mutually perpendicular planes and an anticlockwise shear stress of 30 MPa. Determine by any method the values of normal and shear stresses on a plane inclined at 60 degrees with the minor tensile stress. 10M

**OR**

14. B). A shaft is designed based on maximum distortion energy theory as the criteria of failure and factor of safety of 2. The material used is 30C8 steel with yield strength of 310 MPa. The shaft is subjected to an axial load of 40 kN. Determine the maximum torque that can be applied to the shaft before yielding. Diameter of shaft is 20 mm. 10M
15. A). State the assumptions made in theory of torsion and derive torsion equation. 10M

**OR**

15. B). Derive Rankine's formula and explain how it overcomes the limitations of Euler's theory. 10M

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**R22**



**CMR COLLEGE OF ENGINEERING & TECHNOLOGY**  
(UGC AUTONOMOUS)

**Examination** : B.Tech III Semester Regular & Supplementary Examinations Nov/Dec-2025  
**Course Name** : Metallurgy & Material Science  
**Course Code** : A403303  
**Branch** : Mechanical Engineering  
**Date & Session** : 26-11-2025 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 unit cell. 1 M
2. Name any two types of dislocations. 1 M
3. Define eutectic reaction. 1 M
4. What does a binary phase diagram represent? 1 M
5. Define martensite. 1 M
6. What is the difference between annealing and normalizing? 1 M
7. What is the purpose of thermo-mechanical treatment? 1 M
8. State one advantage of martempering over conventional hardening 1 M
9. Define an alloy. 1 M
10. State one advantage of composites over metals 1 M

**PART-B**

Answer the following. Each question carries TEN Marks.

5x10=50M

- 11.A). Discuss the types of defects in solids and their impact on the physical and mechanical properties of materials. 10M

**OR**

11. B). Describe various strengthening mechanisms (grain boundary, solid solution, strain hardening, precipitation). 10M

12. A). Sketch and explain the schematic representation of substitutional and interstitial solid solution. 10M

**OR**

12. B). Construct a schematic iron-carbon diagram and label all transformations and phases. 10M

13. A). What is annealing? Explain the various types of annealing in detail. How do they influence the mechanical properties of steels? 10M

**OR**

13. B). Discuss the tempering process. Why is tempering essential after hardening? 10M

14. A). Define Surface hardening? Explain the purpose and various surface hardening methods with neat sketches? 10M

**OR**

14. B). Explain the principle, process, and applications of flame hardening and induction hardening. 10M

(P.T.O.)

15. A). Explain various copper and its alloys in terms of composition, mechanical properties, and applications. 10M

**OR**

15. B). Define composite materials. Discuss their classification with examples. 10M

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13. A). i) Define the terms critical point and triple point. 5M  
ii) Steam initially at 1.5 MPa, 300°C expands reversibly and adiabatically in a steam turbine to 40°C. Determine the ideal work output of the turbine per kg of steam. 5M

**OR**

13. B). i) Find the saturation temperature, latent heat of vaporization, entropy during evaporation of steam at 10 bar. 5M  
ii) Show that for an ideal gas, the slope of a constant volume line on the T-s diagram is more than that of a constant pressure line. 5M

14. A). i) Write the Vander Waals equation of state. How does it differ from the ideal gas equation of state. 5M  
ii) A mixture of ideal gases consists of 3 kg of Nitrogen and 5 kg of carbon dioxide at a pressure of 300 kPa and a temperature of 20°C. Find (a) the mole fraction of each constituent (b) equivalent molecular weight of the mixture. 5M

**OR**

14. B). i) Define Dry bulb temperature, wet bulb temperature and dew point temperature. 5M  
ii) Atmospheric air at 1.0132 bar has a dry bulb temperature of 32°C and wet bulb temperature of 26°C. Compute (a) The partial pressure of water vapor, (b) The specific humidity. 5M

15. A). Derive the air standard efficiency of Diesel cycle and draw P-V and T-S diagrams. 10M

**OR**

15. B). Derive the expression for air standard efficiency of Brayton cycle. 10M

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R22



**CMR COLLEGE OF ENGINEERING & TECHNOLOGY**  
(UGC AUTONOMOUS)

Examination : B.Tech III Semester Regular & Supplementary Examinations Nov/Dec-2025  
 Course Name : Fluid Mechanics & Hydraulic Machinery  
 Course Code : A401201  
 Branch : Mechanical Engineering  
 Date & Session : 01-12-2025 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

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|-----|--|-----|
| 1.  | What are the units of viscosity and kinetic viscosity?                           | 1 M |
| 2.  | Define specific gravity and specific volume.                                     | 1 M |
| 3.  | Distinguish uniform and non-uniform flow.  | 1 M |
| 4.  | Write the continuity equation in differential form for 3D flow.                  | 1 M |
| 5.  | What is the formula for loss of head due to sudden contraction of pipe( $h_c$ )? | 1 M |
| 6.  | What do you mean by boundary layer thickness?                                    | 1 M |
| 7.  | What is the condition for the maximum efficiency of Pelton wheel, $u = ?$        | 1 M |
| 8.  | What is governing of a turbine?  | 1 M |
| 9.  | Write the formula for monometric head( $H_m$ ) of a centrifugal pump.            | 1 M |
| 10. | In a single acting reciprocating pump, the work done per second is _____?        | 1 M |

**PART-B**

Answer the following. Each question carries TEN Marks.

5x10=50M

- 11.A). Enunciate newton's law of viscosity. Explain the importance of viscosity in fluid motion. Also discuss the effect of temperature on viscosity of water and that of air. 10M

**OR**

11. B). Explain the working principle of U-tube manometer and differential manometer with neat sketches. 10M

12. A). i) Discuss the terms Path line, Stream line, Streak line and steam tube. 4M  
 ii) State the momentum equation. How will you apply momentum equation for determining the force exerted by a flowing liquid on a pipe bend. 6M

**OR**

12. B). What is Euler's equation of motion? How will you obtain Bernoulli's equation from it? 10M

13. A). i) Discuss the relative merits and demerits of venturi meter with respect to orifice meter. 5M  
 ii) Compare Pitot tube and Flow nozzle. 5M

**OR**

13. B). i) Briefly explain about minor losses in pipes. 5M  
 ii) What do you understand by: Total drag on a body, resultant force on a body, co-efficient of drag and co-efficient of lift. 5M

(P.T.O.)

14. A). A Kaplan turbine runner is to be designed to develop 9100kW. The net available head is 5.6m. If the speed ratio = 2.09, flow ratio = 0.68, overall efficiency = 86% and the diameter of the boss is 1/3 the diameter of the runner. Find the diameter of runner, its speed and the specific speed of the turbine. 10M

**OR**

14. B). A turbine develops 500kW power under a head of 100 metres at 200 rpm. What would be its normal speed and output under a head of 81 metres? 10M

15. A). A centrifugal pump delivers water against a net head of 14.5 metres and a design speed of 1000 r.p.m. The vanes are curved back to an angle of 30° with the periphery. The impeller diameter is 300 mm and outlet width is 50 mm. Determine the discharge of the pump if manometric efficiency is 95%. 10M

**OR**

15. B). A single acting reciprocating pump running at 50 r.p.m, delivers 0.01m<sup>3</sup>/s of water. The diameter of the piston is 200 mm and stroke length 400 mm. Determine:  
i) The theoretical discharge of the pump  
ii) Co-efficient of discharge  
iii) Slip and % of slip of the pump. 10M

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