Hall Ticket No | | | | | | | | | | | Question Paper Code: AMEB11

INSTITUTE OF AERONAUTICAL ENGINEERING

(Autonomous)

B.Tech IV Semester End Examinations (Regular/Supplementary) - July, 2021

Regulation: R18

MATERIALS AND MECHANICS OF SOLIDS

Time: 3 Hours **(ME)** **Max Marks: 70**

Answer FIVE Questions choosing ONE question from each module
(NOTE: Provision is given to answer TWO questions from any ONE module)
All Questions Carry Equal Marks
All parts of the question must be answered in one place only

MODULE – I

1. (a) Differentiate between slip and twinning deformations using neat sketches. **[7M]**
   (b) Iron has a BCC crystal structure with an atomic radius of 0.124 nm. Its atomic weight is 55.85g/mol. Calculate and compare its theoretical density with the experimental value which is $7.87 g/cm^3$. **[7M]**

2. (a) Explain clearly how the Miller indices are designated to the crystallographic planes. **[7M]**
   (b) Determine the linear atomic density in [110] direction in the cooper crystal lattice in atoms per mm. copper is FCC and has a lattice constant of 0.351. **[7M]**

MODULE – II

3. (a) Explain in detail Hume Rothery's rule for substitutional solid solution. **[7M]**
   (b) Mention the different types of cast irons. How do they differ with respect to composition and structure? **[7M]**

4. (a) Differentiate between interstitial solid solution and substitutional solid solution **[7M]**
   (b) Explain the phase rule. Discuss it with examples. **[7M]**

MODULE – III

5. (a) Explain stress and strain diagram for mild steel. Indicate salient points and define them **[7M]**
   (b) At a point in a stressed body the normal stresses are $83 N/mm^2$ (tensile) on a vertical plane and $27.5 N/mm^2$ (compressive) on a horizontal plane. A shearing stress of $41.4 N/mm^2$ acts at this point. Determine and show on a sketch the principal stress and the maximum shearing stress at this point. **[7M]**

6. (a) What are elastic constants? Derive the relation between E, K and G. **[7M]**
   (b) A metallic bar $250mm * 100mm * 50mm$ is loaded as shown in Figure 1. Find the change in volume. Take $E = 200 kN/mm^2$ and Poisson's ratio=0.25. Also find the change that should be made in the 4000kN load, in order that there should be no change in the volume of the bar. **[7M]**

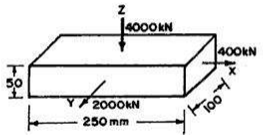

Figure 1

MODULE – IV

7. (a) Derive bending equation of simple beams and write any two assumptions in the theory of simple bending. **[7M]**

   (b) A circular steel pipe of external diameter 60 mm and thickness 8 mm is used as a simply supported beam over an effective span of 2 m. If permissible stress in steel is $150N/mm^2$, determine the maximum concentrated load that can be carried by it at mid span. **[7M]**

8. (a) Determine the section modulus for rectangular beam and hollow rectangular beam. **[7M]**

   (b) The unsymmetric I-section shown in Figure 2 is the cross-section of a beam, which is subjected to a shear force of 60 kN. Draw the shear stress variation diagram across the depth. **[7M]**

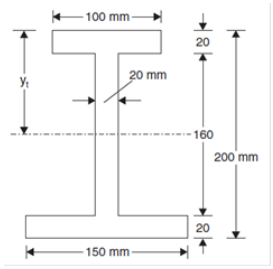

Figure 2

MODULE – V

9. (a) Explain various methods to compute deflection of cantilever beam. **[7M]**

   (b) Determine the moment of inertia of the section, shown in Figure 3, about its centroidal axes **[7M]**

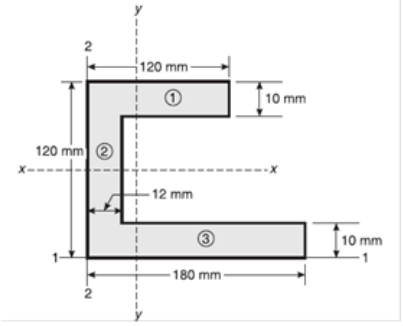

Figure 3

10. (a) Determine the moment of inertia of the triangular lamina. **[7M]**

    (b) A simply supported beam of span 6 m is subjected to uniformly distributed load of $24kN/m$ for a length of 2m from left support. Find the deflection at the centre, maximum deflection and slopes at the ends and at the centre. Take EI $= 20 * 10^6 Nm^2$ **[7M]**

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