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B.M.S. College of Engineering, Bengaluru-560019

Autonomous Institute Affiliated to VTU

April 2024 Semester End Main Examinations

Programme: B.E. **Semester: III**
Branch: Industrial Engineering and Management **Duration: 3 hrs.**
Course Code: 22IM3PCMAM **Max Marks: 100**
Course: Materials and Mechanics

Instructions: 1. Answer any FIVE full questions, choosing one full question from each unit.
2. Missing data, if any, may be suitably assumed.

Important Note: Completing your answers, compulsorily draw diagonal cross lines on the remaining blank pages. Revealing of identification, appeal to evaluator will be treated as malpractice.

UNIT - I

1 a) Define Solid Solution. Explain the types of Solid Solutions. **08**

b) Two metals A and B are used to form an alloy containing 75%A and 25%B. A melt at 650˚C and B at 450˚C. When alloyed together, A and B do not form any compound or intermediate phase. The solid solubility of metal A in B and B in A are negligible. The metal pair forms a eutectic at 40%A and 60%B which solidifies at 300˚C. Assume the liquidus and solidus lines to be straight. Draw the phase diagram for the alloy series and find **12**

a) The temperature at which the alloy starts and completes solidification
b) The percentage of eutectic and pure metal in the alloy at room temperature.
c) The amount of liquid phase and its composition at 400˚C

OR

2 a) Draw Iron Carbon Equilibrium diagram and label all the phase fields with temperatures. What is Invariant reaction? Explain four invariant reactions associated with the Iron-Carbon diagram. Draw the microstructure of 0.8%carbon along its solidification. **14**

b) Explain the effects of alloying elements on steels. **06**

UNIT - II

3 a) Define Composite material. Give their classifications. **06**

b) List the advantages, disadvantages and applications of composite materials. **08**

c) Explain Top down and Bottom Up manufacturing process of Nano materials **06**

UNIT - III

4 a) Draw the Stress-strain diagram for mild steel bar and explain the significance of the following properties. **10**

i)Proportionality limit

ii) Elastic limit

iii) Yield strength

iv) Ultimate strength

v) Breaking point.

b) The following data pertains to a tension test conducted in laboratory: **10**

i) Diameter of specimen = 25mm

ii) Gauge length of specimen = 200m

iii) Extension under a load of 20kN = 0.04 mm

iv) Load at yield point = 150kN

v) Maximum load = 225kN

vi) Breaking load or Load at failure = 120kN

vii) Length of specimen after failure = 275 mm

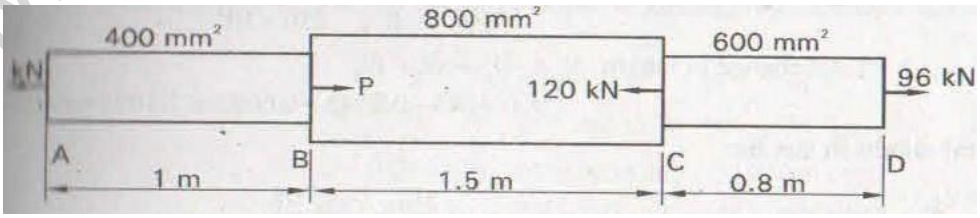
viii) Neck diameter = 18.25 mm

Determine: i) Young's modulus ii) Yield stress iii) Ultimate stress iv) Breaking stress v) True breaking stress vi) Percentage elongation vii) Percentage reduction in area. viii) Safe stress adopting a factor of safety of 2.5

OR

5 a) Derive an expression for Total Elongation and stress in a uniformly tapering circular or round section bar with usual notations. **05**

b) A steel bar ABCD of varying sections is subjected to the axial forces as shown in fig below. Find the value of P necessary for equilibrium, if E=210kN/mm^2, determine i) stress in various segments ii) Total elongation of bar iii) Total strain in the bar(assume missing data suitably). **10**

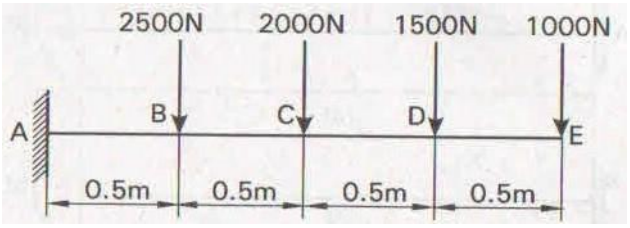


c) Derive an expression for elongation due to self-weight. **05**

UNIT - IV

6 a) Explain with diagram i) Simply supported beam ii) Fixed or Built in beam iii) Overhanging beam iv) Continuous beam v) Cantilever beam. Give practical applications of each of the beam. **10**

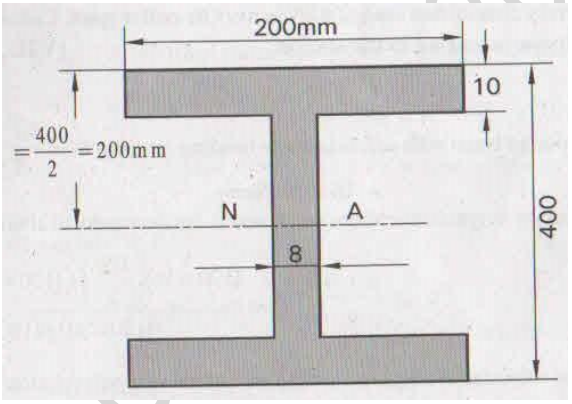
b) A cantilever beam of length 2m carries point loads as shown in figure below. Find the reactions at the fixed end and draw the shear force and bending moment diagrams for the cantilever beam **10**



UNIT - V

7 a) Derive an expression for Bending Equation with suitable Assumptions and notations. **10**

b) The cross-section of a beam is as shown in figure below. If permissible stress is 150N/mm^2 , find its moment of resistance. Compare it with equivalent section of the same area for a square section. **10**



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