3E1621

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3E1621

B. Tech. III Semester (Main/Back) Examination-2014

Civil Engineering

3CE1 Strength of Materials-I

Time : 3 Hours

Maximum Marks : 80
Min. Passing Marks : 24

Instructions to Candidates:

*Attempt any **five** questions, selecting **one** question from **each** unit. All questions carry **equal** marks. (Schematic diagrams must be shown wherever necessary. Any data you feel missing suitably be assumed and stated clearly. Units of quantities used/calculated must be stated clearly.)*

Unit - I

1. a) Draw the neat Labelled stress strain diagram of mild steel and differentiate between the term proportional limit and "elastic limit". How does the yield strength of brittle material is determined from its stress strain curve? **(3+1+2)**

b) A compound bar consists of a solid circular rod of steel of diameter 20 mm rigidly fitted into a copper tube of internal diameter 20mm and thickness 5mm as shown in fig.1 If this composite bar is subjected to a load of 100kN, find the stresses developed in the steel and copper. Take $E_s = 2\times10^5$ N/mm². and $E_c = 1.2\times10^5$ N/mm². **(10)**

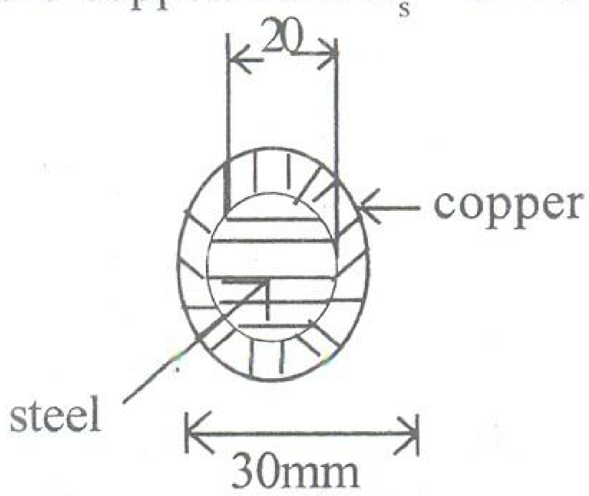


Fig.1

OR

1. a) A tapering rod has diameter d_1 at one end and it tapers uniformly to a diameter d_2 at the other end ($d_1 > d_2$) in a length L. If modulus of elasticity of the material of rod is E find its change in length when subjected to an axial tensile force P. **(8)**

b) A prismatic bar ABCD of diameter 10mm is subjected to different axial forces as shown in fig.2: Calculate the net change in length of the bar AD. Take E = 200 kN/mm². **(8)**

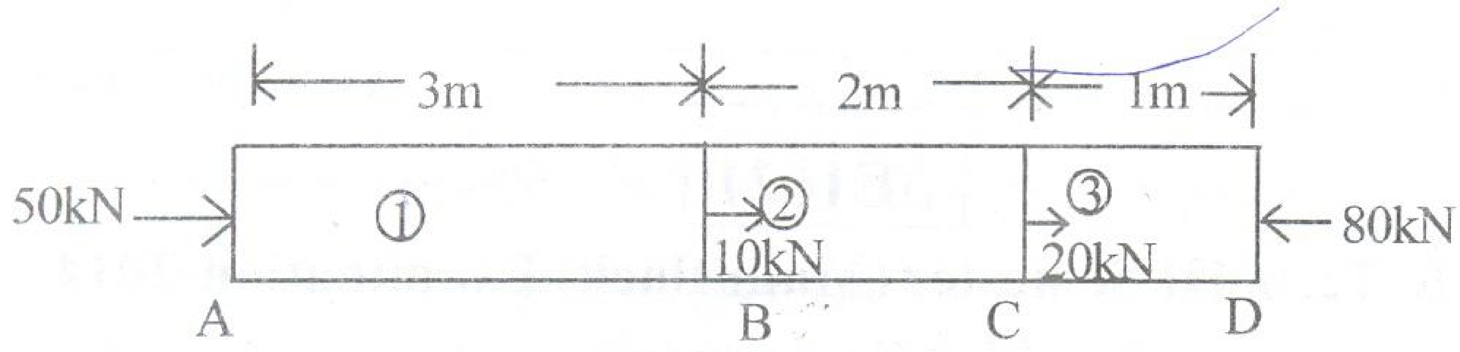


Fig. 2

Unit - II

2. a) Describe parallel axis theorem for determining moment of inertia of a section Also define "radius of gyration". **(4+2)**

b) At a certain point within a strained material, the two normal stresses acting on two mutually perpendicular planes are 60MPa (tensile) and 30 MPa (compressive). Find the shear stress on the planes (τxy) if maximum principal stress is limited to 100 MPa (Fig.3) **(10)**

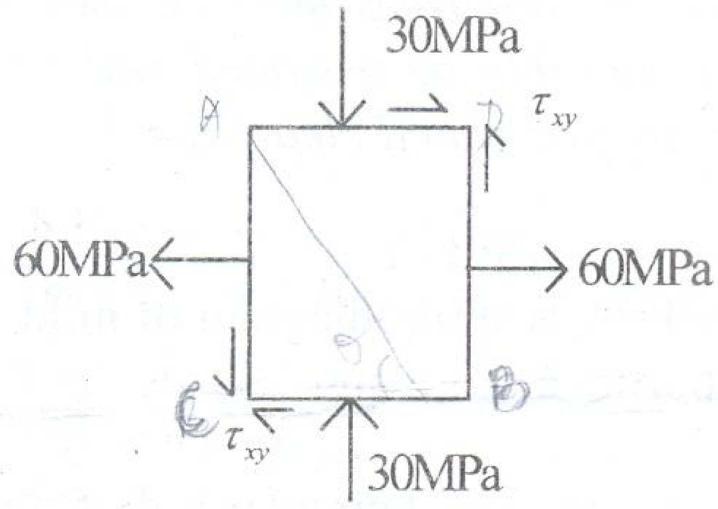


Fig.3

OR

2. Determine the second moment of area of an I-section (shown in fig.4) about its centroidal axes xx and yy. **(16)**

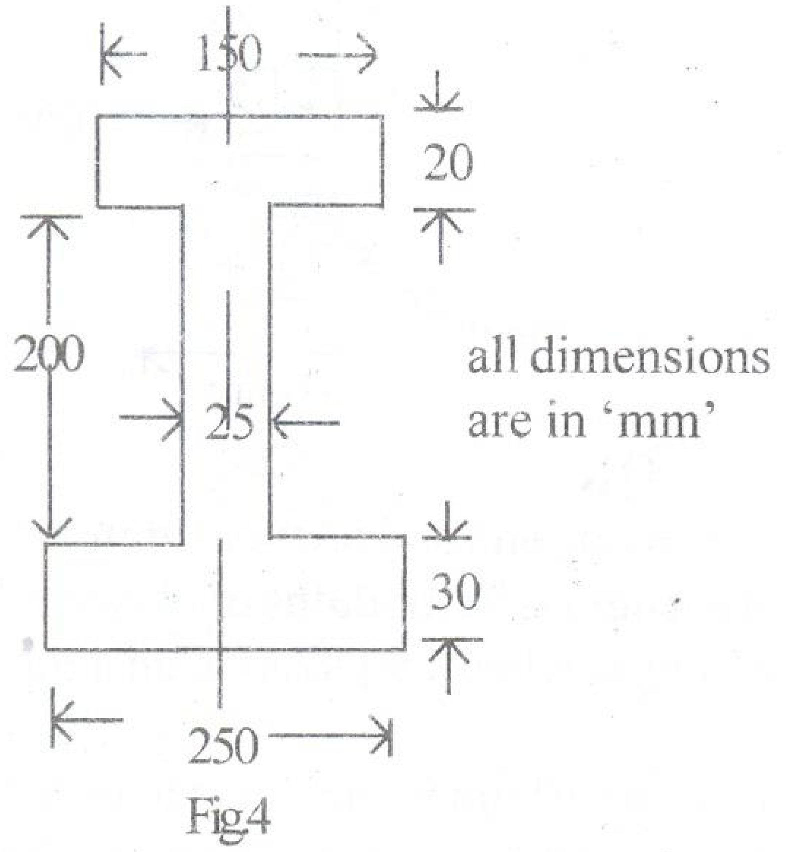


Fig4

Unit - III

3. a) Describe the assumptions used in the analysis of thin cylinders. **(4)**
   b) Describe Euler's theory and its limitations. **(6)**
   c) A thin cylindrical shell is 3m long and is having 1m internal diameter and 15mm thickness. Calculate the maximum intensity of shear stress induced. If it is subjected to internal fluid pressure of 1.5 N/mm^2. **(6)**

OR

3. a) A steel bar of rectangular cross. Section 30×40 mm pinned at each end is subjected to an axial compressive load. The bar is 1.75 m long. Determine the buckling load and corresponding stress using Euler's formula. Take E = 200 GPa. **(10)**
   b) Define the term "Kern" of the section of a column. Also describe the middle third rule for eccentrically loaded compressive members. **(6)**

Unit - IV

4. Draw the bending moment and shear force distribution diagrams for the beam shown in Fig. 5. Indicate the values of S.F. and B.M. at all critical locations. Also give the value of maximum shear force and maximum +Ve and -Ve bending moments and their locations.
   Determine the points of contraflexure. **(5+5+2+4)**

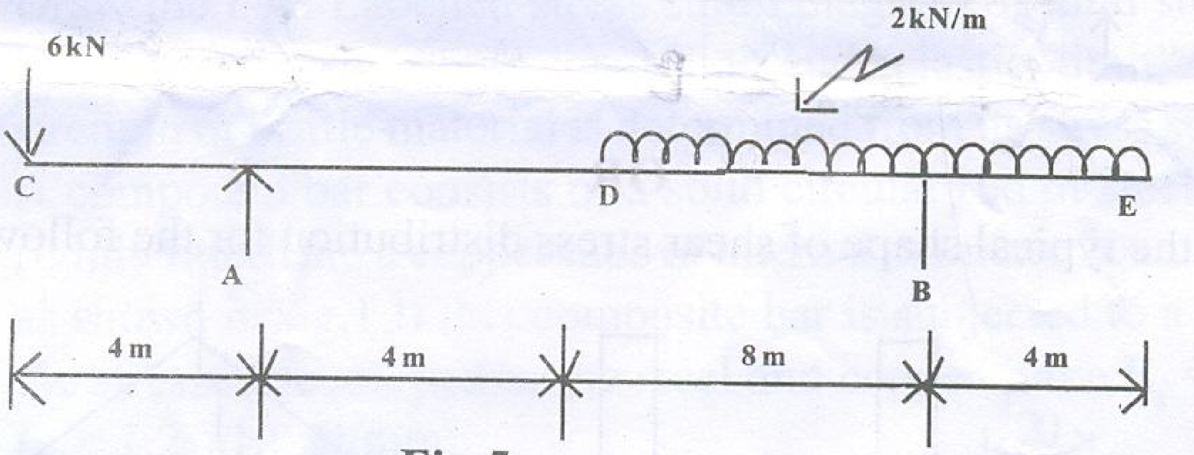


Fig.5

OR

4. The shear force diagram for a overhanging beam is shown in Fig.6. Draw the loading diagram and bending moment diagram. Find the magnitude of maximum bending moment and locate the point of contraflexure. **(16)**

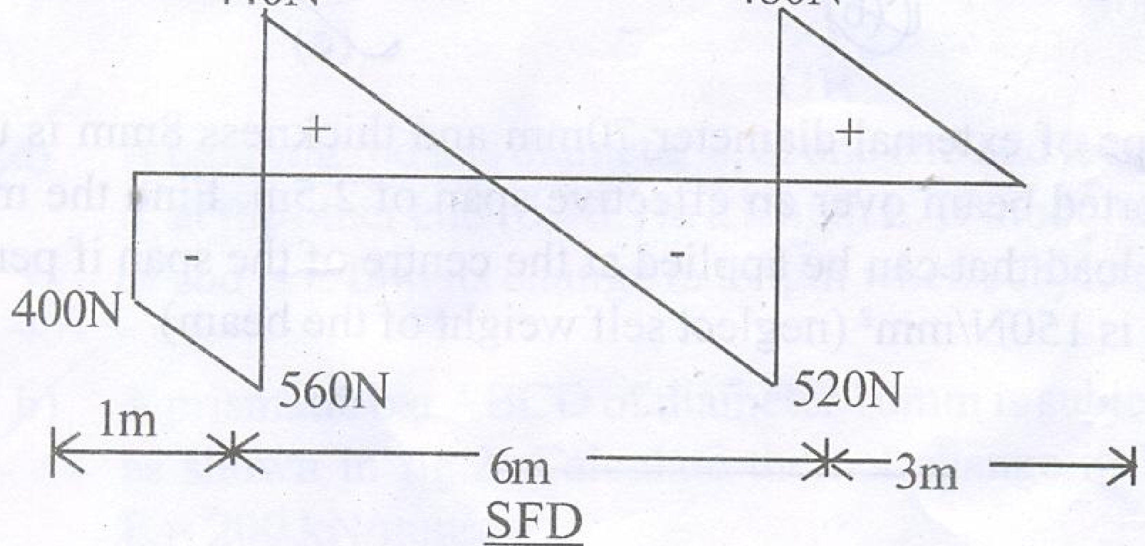


Fig.6

Unit - V

5. a) Write the assumptions used in bending theory. **(4)**

b) A flitched beam (shown in fig.7) is subjected to a shear force of 100 kN. Determine the shear stress distribution if after converting the flitched beem section into equivalent steel section, equivalent moment of inertia is $39.79\times10^6 mm^4$ Take modular ratio m = 15.0 **(12)**

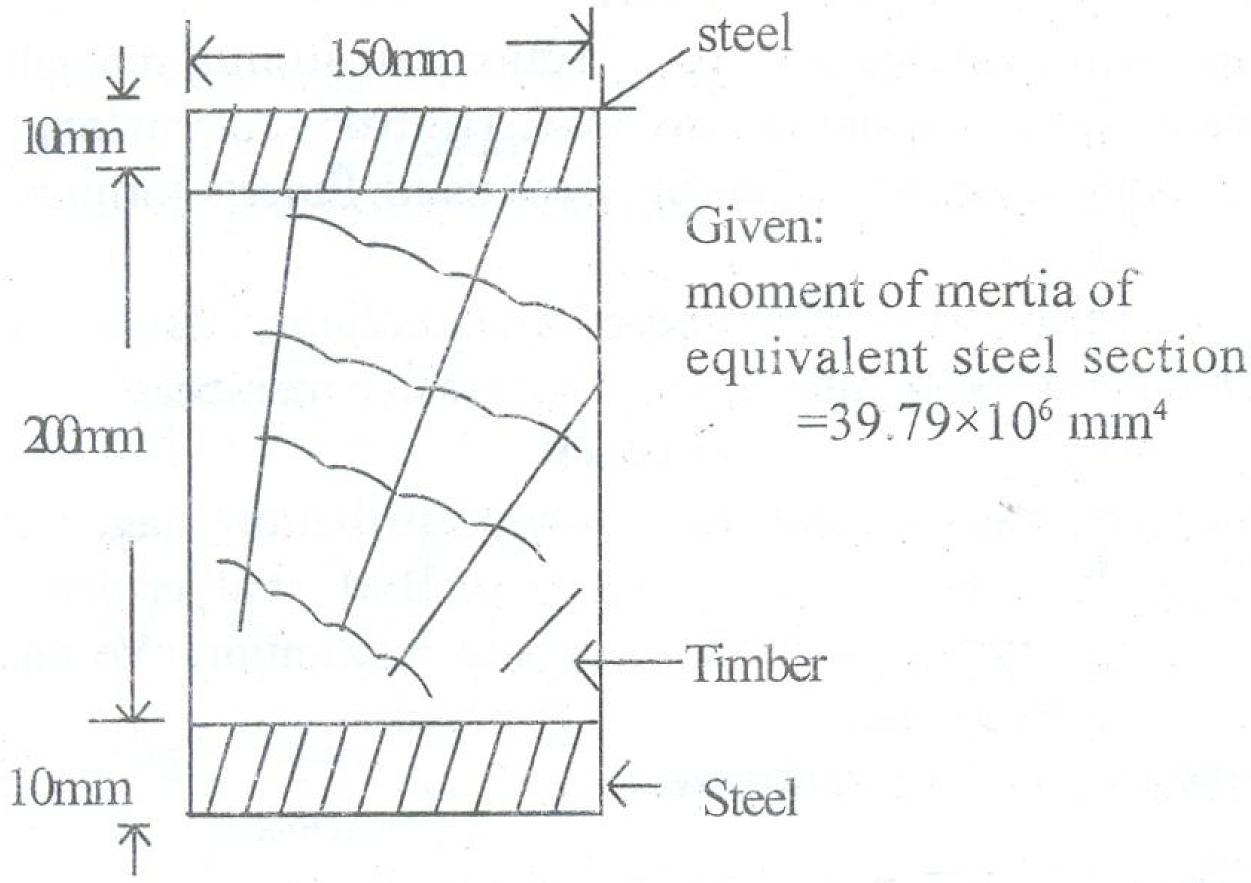
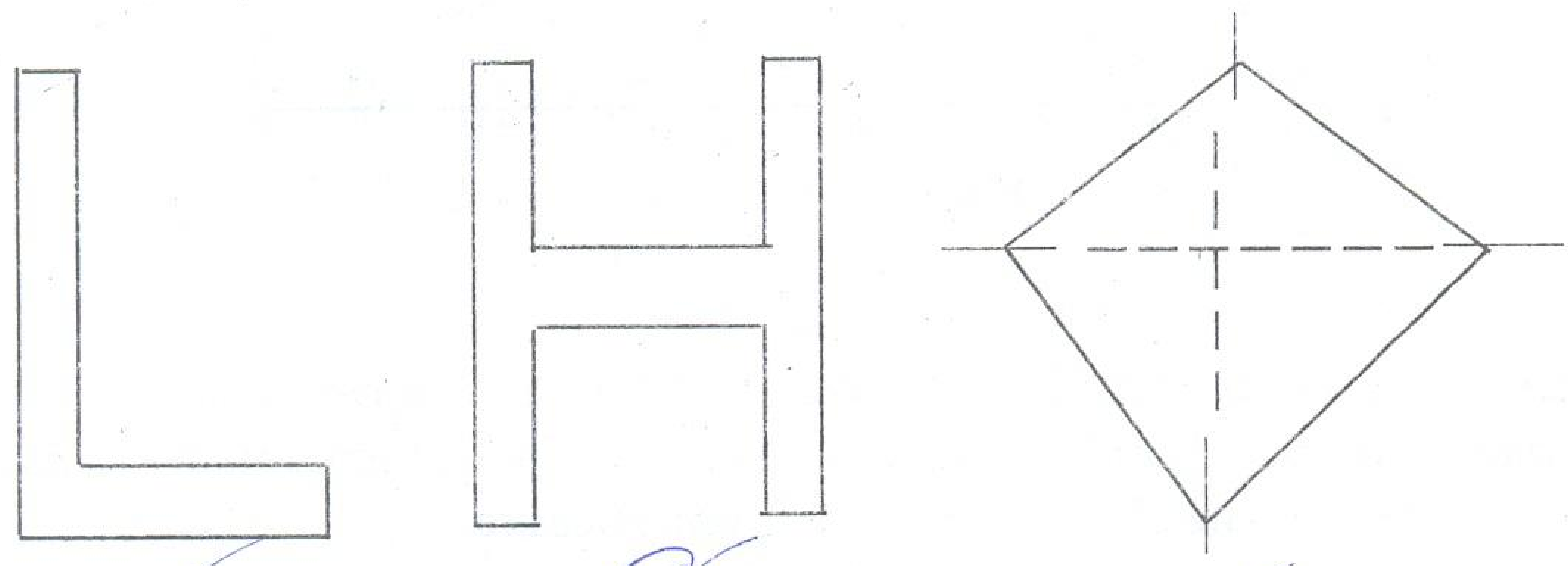


fig.7

OR

5. a) Draw the typical shape of shear stress distribution for the following sections. **(6)**



(a) (b) (c)

b) A circular pipe of external diameter 70mm and thickness 8mm is used as a simply supported beam over an effective span of 2.5m. Find the maximum concentrated load that can be applied at the centre of the span if permissible stress in tube is $150 N/mm^2$ (neglect self weight of the beam) **(10)**