



UF-6147

B. E. - II (Sem. II) (Civil) Examination

May / June - 2012

Mechanics of Solids

Time : 3 Hours]

[Total Marks : 100

Instructions : (1)

नीचे दशांशों में निशानीवाणी विगतो उत्तरवाही पर अवश्य लखवी.  
Fillup strictly the details of signs on your answer book.

Name of the Examination :  
B. E. - 2 (SEM. 2) (CIVIL)

Name of the Subject :  
MECHANICS OF SOLIDS

Subject Code No. : 6 1 4 7 Section No. (1, 2,.....): NIL

Seat No. :  
[ ] [ ] [ ] [ ] [ ] [ ]

Student's Signature

- (2) Figures to the right indicate full marks.
- (3) Assume suitable data if necessary.
- (4) All dimensions are in mm
- (5) If data is not given assume  $E = 2 \times 10^5$  MPa.

- 1 (a) Draw SFD and BMD for following Fig. 1 and if possible find point of contra flexure. 10

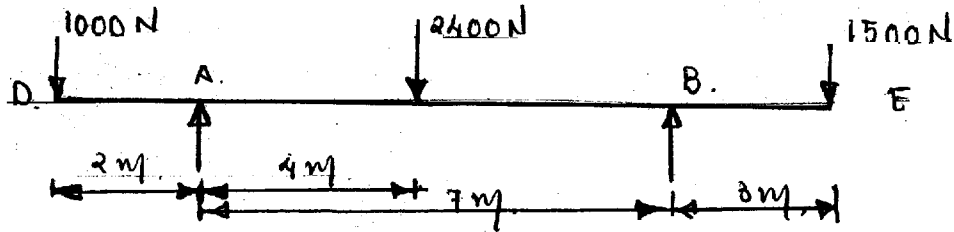


fig. 1

- (b) Derive  $q = \frac{FA\bar{y}}{Zb}$  with usual notations. Also write assumptions made in pure bending theory. 10

OR

- (b) Explain following terms : 10  
Poisson ratio, Modulus of rigidity, bulk modulus, modulus of elasticity, thermal stress, lateral strain, point of inflection, sagging moment, hogging moment, linear strain.

2 Attempt any three :

30

- (i) An aluminium rod is rigidly attached between a steel rod and bronze rod as shown in fig. 2. Axial loads are applied at position indication. Find max. value of  $P$  that will not exceed a stress in steel of 140 MPa in aluminium of 90 MPa, and in bronze of 100 MPa.

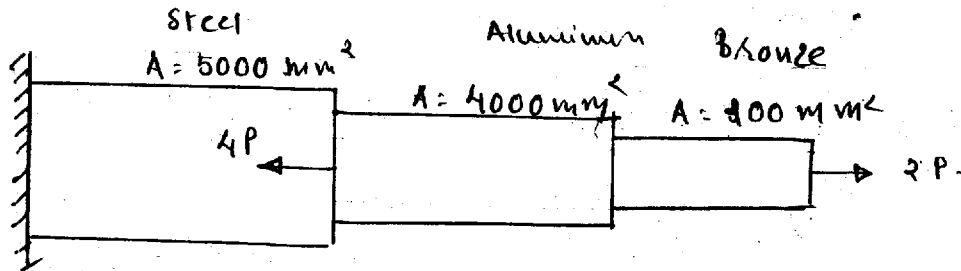


Fig-2

- (ii) A rectangular beam of size  $200 \times 300 \text{ mm}$  is strengthened by steel plate of 10 mm thickness covering entire width of wooden section at a top and bottom. Find moment carrying capacity of composite section. If allowable stresses in wooden and steel are 20 MPa and 100 MPa. take modulus ratio as 10.
- (iii) A steel beam of I section is 600 mm deep. Each flange is 250 mm wide and 25 mm thick. The web is 15 mm thick. The beam section is subjected to shear force of 500 kN. Determine shear stress distribution for beam section (i) when web is vertical.
- (iv) A beam 3.0 m long is simply supported at the two ends and carries a point load of 40 kN at the center and longitudinal axial tensile load of 100 kN. If section of beam is 300 mm wide and 450 mm deep. Find the maximum and minimum stress at the mid span section of beam. Neglecting self wt, of beam.

3 (a) State assumptions made in Euler's theory for Long Columns. 5

- (b) A solid round bar 60 mm in diameter and 3m long is used as strut. One end of the strut is fixed while other end is hinged. Find the safe compressive load for this strut using euler's formula. Assume  $E = 200 \text{ GN/m}^2$  and factor of safety = 3. 5

- 4 Attempt any two :
- (a) Calculate the thickness of the metal required for a cast iron main 800 mm in diameter for water at a pressure head of 100 m if the maximum permissible tensile stress is  $20 \text{ MN/m}^2$  and weight of water is  $10 \text{ kN/m}^3$ . **10**
- (b) An unknown weight falls through 10 mm on a collar rigidly attached to the lower end of a vertical bar 3m long and  $600 \text{ mm}^2$  in cross section. If the maximum instantaneous extension is 2 mm, what are the corresponding stress and the value of unknown weight ? **10**
- (c) A steel bar 1500 mm in length is subjected to a pull such that the maximum stress is equal to  $120 \text{ N/mm}^2$ . Its cross section area is  $200 \text{ mm}^2$  over a length of 950 mm and for the middle 550 mm length the sectional area is  $100 \text{ mm}^2$ . If  $E = 2 \times 10^5 \text{ N/mm}^2$ , calculate strain energy stored in the bar. **10**
- 5 Attempt any two :
- (a) Explain any two : **10**
- (i) Ductility
  - (ii) Toughness
  - (iii) Hardness
  - (iv) Brittleness
  - (v) Fatigue
- (b) A solid circular steel shaft of length 4 m transmits 300 kW power at 450 rpm. If the allowable shearing stress is limited to 70 MPa and allowable angle of twist is 0.045 radian determine the diameter required for this shaft. Take  $G = 80 \text{ GPa}$ . **10**
- (c) A hollow cast iron column rigidly fixed at one end and pin jointed at the other end has 150 mm outer diameter and 120 mm inner diameter. Its length is 6m and  $E = 90 \text{ GN/m}^2$ . Calculate the critical load of this column by Euler's Formula. **10**