# 17311

**14115**

**3 Hours / 100 Marks** Seat No. | | | | | | | | |

*Instructions* – (1) All Questions are *Compulsory*.

(2) Answer each next main Question on a new page.

(3) Illustrate your answers with neat sketches wherever necessary.

(4) Figures to the right indicate full marks.

(5) Assume suitable data, is necessary.

(6) Use of Non-programmable Electronic Pocket Calculator is permissible.

(7) Mobile Phone, Pager and any other Electronic Communication devices are not permissible in Examination Hall.

**Marks**

**1.** a) **Solve any SIX of the following :** **12**

(i) State parallel axis theorem along with it's expression.

(ii) Find radius of gyration of circle of diameter d.

(iii) Define creep.

(iv) State Hookes Law along with the expression.

(v) List any two assumptions made in Euler's theory of long column.

(vi) What are the limitations of Euler's theory of column.

(vii) Define resilience along with it's expression.

P.T.O.

**Marks**

(viii) Differentiate between gradual load and suddenly applied load with respect to

(1) Stress produced

(2) Example

b) **Solve any <u>TWO</u> of the following :** **8**

(i) State four assumptions made in theory of pure bending.

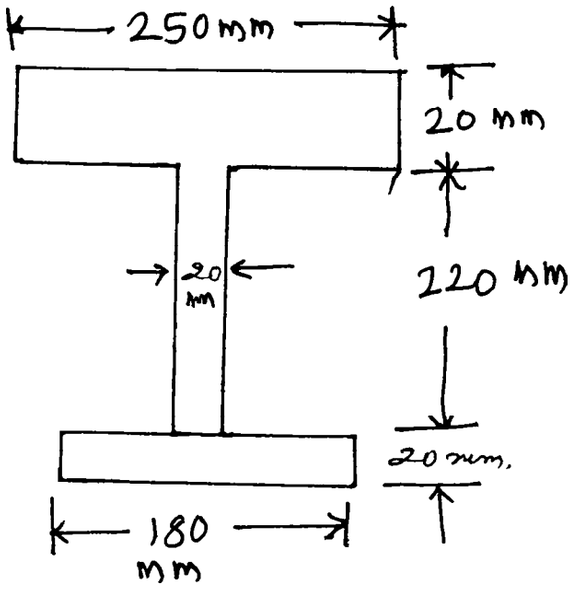
(ii) (1) Give shear stress equation and meaning of each term used in it.

(2) Draw shear stress diagram for 'T' section. Showing important points on it.

(iii) A column having diameter 200 mm and length 3 m. Both end of column is hinged. Find Euler's crippling land. Take E = $2 \times 10^5$ MPa.

**2. Solve any <u>TWO</u> of the following :** **16**

a) Determine M.I. about X-X and Y-Y axis as shown in Fig. No. 1.




**<u>Fig. No. 1</u>**

**Marks**

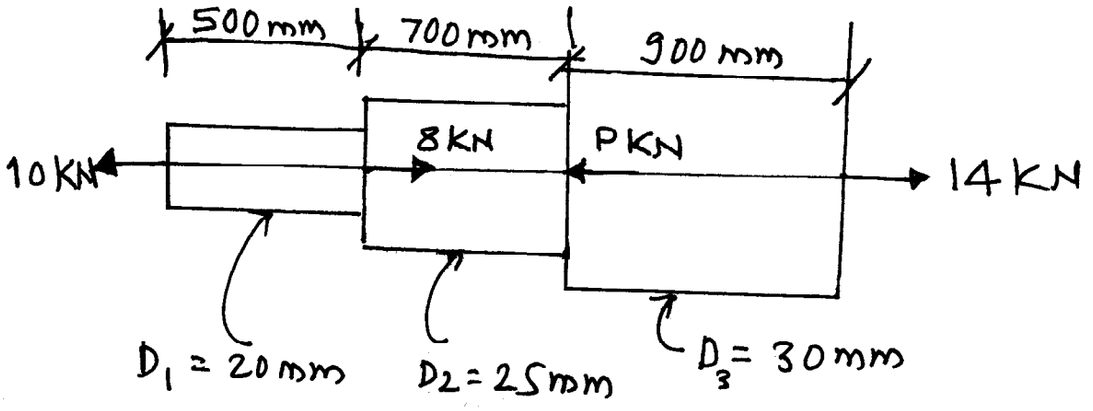
b) A built up column section is made of an I-section having flanges 80 × 10 mm and web of 160 × 10 mm with one flange plate 80 × 10 mm rivetted to each of the flanges. Find minimum radius of gyration.

c) (i) Calculate polar M.I. of semi circle having 60 mm diameter Also calculate minimum radius of gyration. Diameter is parallel to y-y axis.

(ii) Draw stress strain curve for mild steel under tensile landing and define limit of proportionality and elastic limit.

**3. Attempt any <u>TWO</u> of the following :** **16**

a) Determine the magnitude of 'P' for equillibrium and total elongation of the bar shown in Fig. No. 2,
Take E = 210 GPa. Also calculate minimum stress induced.




**<u>Fig. No. 2</u>**

b) A R.C.C. column 450 mm diameter is reinforced with 6 bars of 16 mm diameter. Find the safe land that the column can carry. If permissible stresses in concrete and steel are 5 N/mm$^2$ and 125 N/mm$^2$ respectively.

Take $E_c = 0.14 \times 10^5$ N/mm$^2$, $E_s = 2.1 \times 10^5$ N/mm$^2$

**Marks**

c) (i) State the relation between E, G and K.

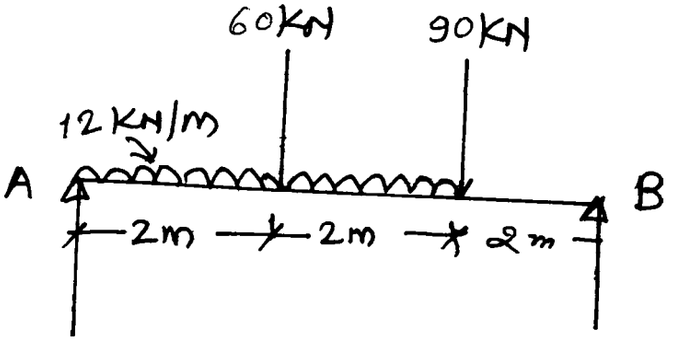
(ii) A circular rod of 100 mm diameter and 600 mm long is subjected to a tensile load of 900 KM. Determine modulus of rigidity and bulk modulus, if poisson's ratio is 0.30. If modulus of elasticity is 210 KN/mm$^2$. Find linear strain.

**4. Solve any <u>TWO</u> of the following :** **16**

a) A Steel bar 20 mm wide, 15 mm thick and 3 m long is subjected to an axial pull of 30 KN, If E = 2 × $10^5$ N/mm$^2$ and $\mu$ = 0.30 calculate alternations in length, width and thickness of the bar. Also find volumetric strain and charge in volume.

b) A steel rod 30 mm in diameter when subjected to a pull of 60 KN shows elongation of 0.09 mm over a gauge length of 200 mm and change in diameter as 0.039 mm. calculate all the three elastic modulus.

c) Draw S.F. and B.M. diagrams of the beam as shown in Fig. No. 3.

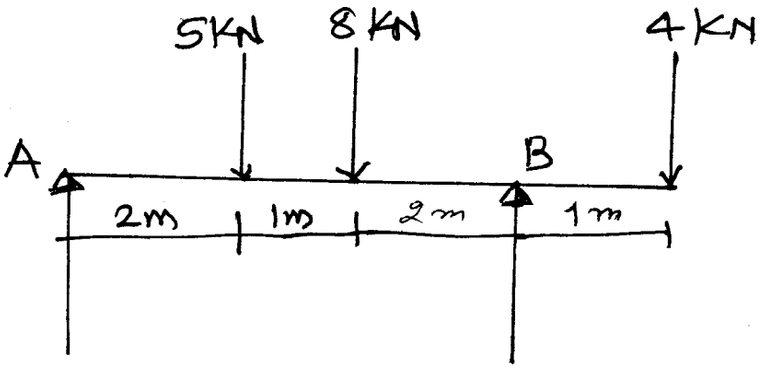



**<u>Fig. No. 3</u>**

**Marks**

**5. Attempt any <u>TWO</u> of the following :** **16**

a) Draw SFD and BMD for the beam as shown in Fig. No. 4.




**<u>Fig. No. 4</u>**

b) (i) Define shear force and bending moment and give its sign convention.

(ii) Draw the SFD and BMD for cantilever beam of 6 m length, fixed at point 'A' and free at point 'B'. It carries a point load of 10 KN at free and UDL of 5 KN/m over entire span of the beam.

c) (i) A timber beam 150 mm wide and 300 mm deep is simply supported over a span of 4 m. It carries a UDL of 15 Km/m over entire span of the beam. Find maximum. bending stress induced in the section. Draw stress diagram.

(ii) A timber beam is of circular c/s of 100 mm diameter. The maximum shear stress produced at a section is 100 $N/mm^2$. Find the average shear stress produced. Also state the shear stress induced at the face of the beam.

**Marks**

**6. Attempt any <u>TWO</u> of the following :** **16**

a) A symmetrical I-section has two flanges each of 150 mm × 30 mm and a vertical web of 300 mm × 20 mm shear force at a section is 100 KN. Calculate maximum and average shear stress across the section. $I_{xx} = 2 \times 10^8$ mm$^4$.

b) Using Euler's theory calculate the limiting value of slenderness ratio for which it is not valid for long columns. Take $E = 2 \times 10^5$ mpa. $\sigma c = 320$ N/mm$^{2.}$

c) A weight of 2 KN is dropped on to a coller at the lowest end of a vertical bar 2 m long and 28 mm in diameter. Calculate the height of drop. It maximum instantaneous stress is not be exceed 120 N/mm$^2$. Find elongation if $E = 2 \times 10^5$ N/mm$^2$.

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