B. TECH. SEM – III (CIVIL ENGG.) 2014 COURSE) (CBCS) :
SUMMER - 2018
SUBJECT: MECHANICS OF SOLIDS

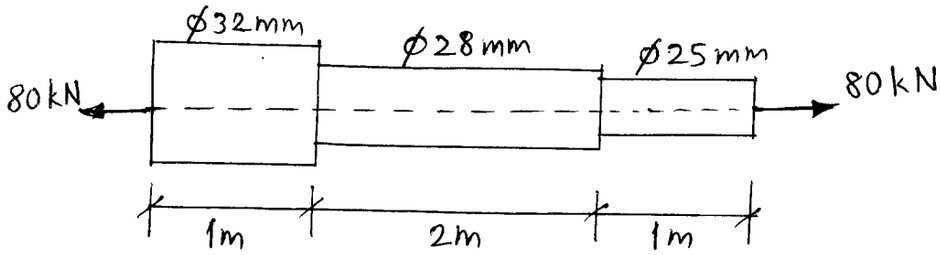
Day: **Thursday** **S-2018-2233** Time: **02.30 PM TO 05.30 PM**
Date: **24/05/2018** Max. Marks: 60

N.B.:

1) All questions are **COMPULSORY**.
2) Figures to the right indicate **FULL** marks.
3) Draw neat labelled diagrams **WHEREVER** necessary.
4) Assume suitable data if necessary.

Q.1 **a)** Show that elongation of a circular rod tapering uniformly from diameter 'd_1' from diameter 'd_2' in length 'L' is given by: $\delta_L = \frac{4PL}{\pi d_1 d_2 E}$. **(04)**

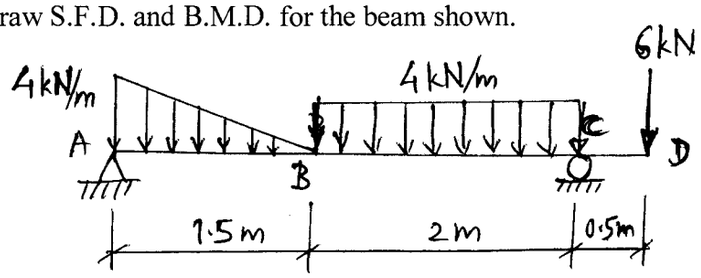
b) A 4m long steel bar is subjected to an axial pull of 80 kN as shown in fig. Find the elongation of the bar. Take E = 200 GPa. **(06)**



OR

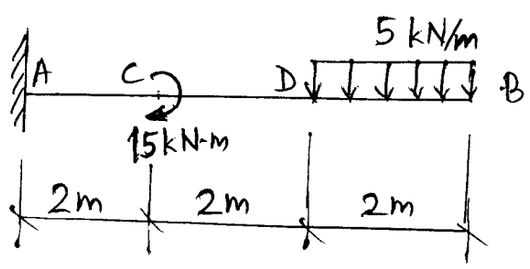
Q.1 A steel rod of 200 mm diameter is coaxially enclosed in a brass tube of 25 mm external diameter and 2 mm thickness. Both have 400 mm length. Determine the stress induced in each material and change in length if assembly is subjected to an axial compressive force of 50 kN. **(10)**

Q.2 Draw S.F.D. and B.M.D. for the beam shown. **(10)**



OR

Q.2 Draw neat S.F.D and B.M.D. **(10)**



P. T. O.

Q.3 Write the assumptions made in the flexure formula (Bending equation). Derive the bending formula with neat sketches. **(10)**

OR

Q.3 A simply supported beam of 10 m length carries loads of 30 kN, 20 kN and 60 kN at distances of 2m, 5m, and 9m respectively from its left hand support. Determine the position and amount of maximum deflection. **(10)**
Take $E = 200\ kN/mm^2$ $I = 700 \times 10^6 mm^4$.

Q.4 Cross section of a C.I. beam is a 'T' section with Flange = 150 mm × 50 mm, Web = 50 mm × 150 mm and total depth = 200 mm. This beam is simply supported at ends and carries a u.d.l. of 80 kN/m over the entire span. Draw shear stress diagram at the critical section. **(10)**

OR

Q.4 Write the assumptions made in torsional formula and derive the formula with the help of neat sketches. **(10)**

Q.5 **a)** Explain and prove middle third rule. **(05)**

b) A mild steel T-section having width of flange as 150 mm and uniform 10 mm thickness of flange and web with overall depth 150 mm is used as a strut 5 m long with both ends fixed. Determine by Rankine's formula, the safe load it can carry with a factor of safety of 3. **(05)**
Take $f_c = 330$ MPa and $\alpha = \frac{1}{7500}$.

OR

Q.5 Derive an expression for Euler crippling load when both the ends of the column are fixed. **(10)**

Q.6 Principal stresses at a point in a strained material are 80 MPa (tensile) and 40 MPa (compressive). Find the normal, tangential and resultant stress on a plane inclined at 20^0 to the axis of major principal plane. **(10)**

OR

Q.6 At a point in a strained material, the principal stresses are 200 MPa (comp) and 350 MPa (tensile). Determine the intensity of normal, tangential and resultant stresses on a plane inclined at 38^0 to the plane carrying 200 MPa stress. Use Mohr's circle (graphical) method. **(10)**

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