B. Tech. Sem – III (Civil Engg.) 2014 COURSE) (CBCS) : WINTER - 2018

SUBJECT: MECHANICS OF SOLIDS

Day: Friday
Date: 30/11/2018

Time: 10.00 AM TO 01.00 PM
Max Marks: 60

W-2018-2289

N.B.:

1) All Questions are **COMPULSORY.**
2) Figures to the right indicate **FULL** marks.
3) Assume suitable data if necessary.
4) Use of non programmable calculator is **ALLOWED.**
5) Draw neat and labeled diagrams **WHEREVER** necessary.

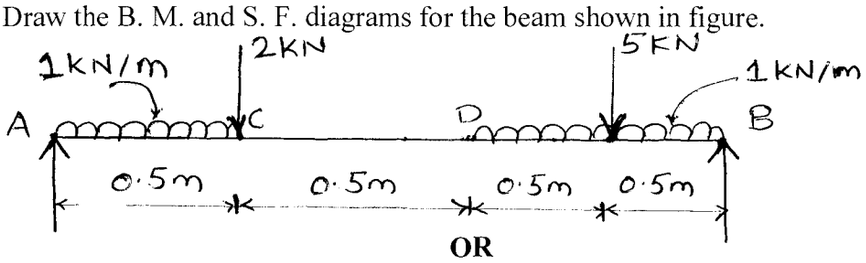
Q.1 **a)** State Hooke's Law and Derive an expression for the change in length of the bar of uniformly tapering circular section subjected to axial load 'p'. **(05)**

b) A bar of 12 mm diameter is tested on UTM and the following observations are noted. Gauge length = 200 mm, load at proportional limit = 20 kN, change in length at proportional limit = 0.2 mm, change in diameter at proportional limit = 0.0025 mm. Calculate the value of Poisson's ratio and Young's modulus. **(05)**

OR

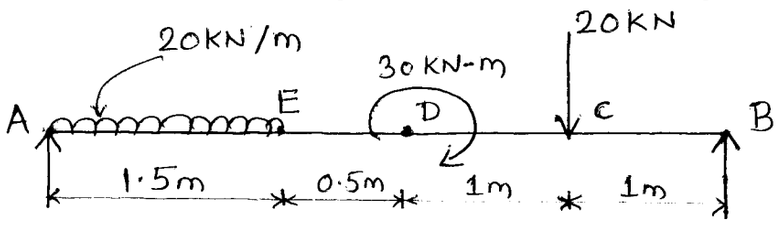
Q.1 A copper wire 20 mm^2 in cross section and steel wire 30 mm^2 in cross section both 1 m long are rigidly connected to plates on either side. They jointly share a load of 8 kN. Esteel = $20x10^5$ MPa and Ecopper = $1x10^5$ MPa. Find stresses produced in each material. **(10)**

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



OR

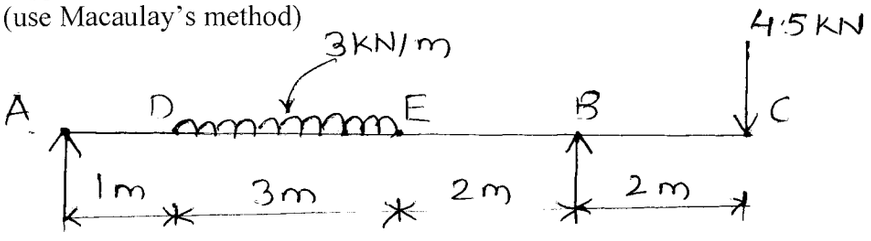
Q.2 Draw the S. F. and B. M. diagrams for the beam shown in figure. **(10)**



Q.3 State flexural formula with meaning of each term. Determine the maximum bending stress developed in a beam of rectangular cross- section 50 mm x 150 mm. When a bending moment of 600 N-m is applied about x-x axis. **(10)**

OR

Q.3 Determine the deflection at free end C for the overhanging beam ABC supported and loaded as shown in figure. Take E = 200GPa.I= 13.5 x 10^{-6} m^4 (use Macaulay's method) **(10)**



P.T.O.

Q.4 State shear stress formula with meaning of each term. A beam AB supported at it's ends has a span of 2 m and carries a u.d.l. of 200 kN/m over the entire span. The cross section of the beam is T- section, having flange width 125 mm flange thickness 25 mm, web thickness 25 mm and overall depth 200 mm. Calculate maximum shear stress in the beam and Draw shear stress distribution diagram. **(10)**

OR

Q.4 Calculate the maximum horse-power that can be transmitted by a circular shaft 6 cm in diameter running at 1200 rpm. The maximum allowable shear stress is 12 N/mm^2 Angle of twist per metre a length is 0.25^0. Take G= 0.8 x 10^5 N/mm^2. **(10)**

Q.5 What is middle Third Rule? A steel bar of rectangular section 40 mm x 50 mm pinned at each end is subjected to axial compression. The bar is 2 m long Determine the buckling load and the corresponding axial stress using Euler's formula. Also Calculate slenderness ratio if the proportional limit of the material is 200 N/mm^2. Take E = 2 x10^5 N/mm^2. **(10)**

OR

Q.5 A hollow C.I. column has 200 mm x 150 mm outside dimensions and 150 mm x 100 mm inside dimensions. Height of the column is 6 m; the column is fixed at both ends. If E = 1200 N/mm^2. Find buckling load by Euler's formula. Also find crippling load by Rankine's formula. If σ_c = 500N/mm^2 and α = 1/1600. **(10)**

Q.6 What is principle stresses and planes. At a point in a strained material, there is tensile stress of 80MPa upon a horizontal plane and a compressive stress of 40 MPa upon a vertical plane. There is also a shear stress of 48 MPa acting upon each of these planes. Determine the planes of maximum shear stress at the point along with it's magnitude. **(10)**

OR

Q.6 Define Equivalent Torque and Equivalent moment. A solid shaft of 60 mm diameter has to resist a bending moment of 450 kN.m accompanied by torque 360 kN.m. Calculate maximum principal stress induced in the shaft. Also calculate the maximum shear stress reduced. **(10)**

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