B. TECH. SEM - III (CHEMICAL ENGG.) 2014 COURSE) (CBCS)
: SUMMER - 2018
SUBJECT: STRENGTH OF MATERIALS

Day: **Tuesday** Time: **02.30 PM TO 05.30 PM**
Date: **22/05/2018** **S-2018-2225** 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)** Define: factor of safety, volumetric strain, ultimate stress, elastic limit. **(04)**

b) Calculate change in length of the steel rod (E = 200 GPa). Shown in fig. 1. **(06)** Assume cross sectional areas of portions AC and CD to be 500 mm^2 and 250 mm^2 respectively.

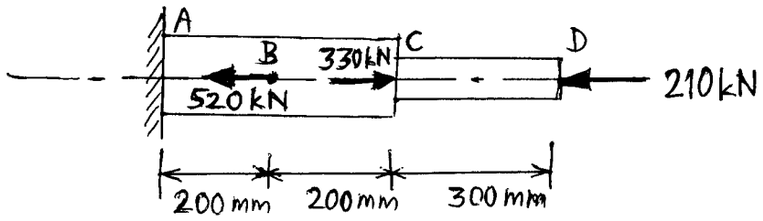


Fig. 1

OR

Q.1 A rigid bar is kept in horizontal position at shown in fig. 2. Determine stress induced in the vertical members. Assume E_s = 200 GPa, E_c = 100 GPa, A_s = 60mm^2, Ac = 30mm^2. **(10)**

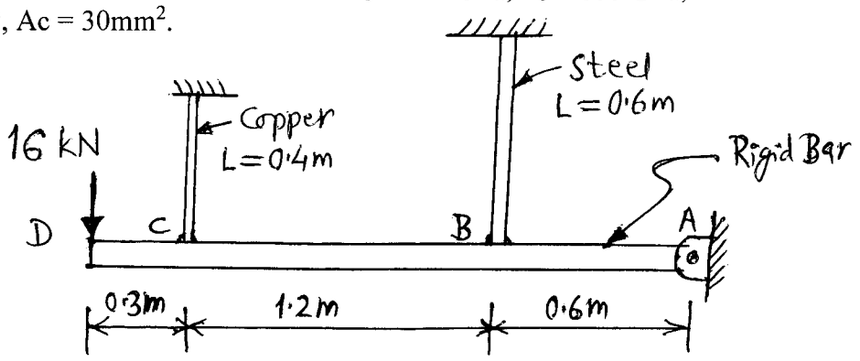


Fig. 2

Q.2 **a)** Write the differential equations forms of the relationships between: **(04)**

i) Shear force and Bending moment
ii) Intensity of loading and shear force.

Also define point of contraflexure.

b) Draw proportionate S.F.D and B.M.D for the beam shown in fig. 3 show all calculations and salient values in the diagrams. There is an internal hinge at point C and a simple support at point D. Locate point of contraflexure, if any. **(06)**

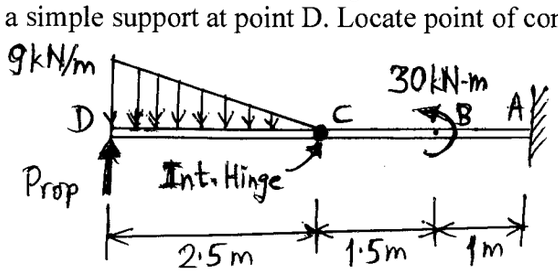


Fig. 3

P. T. O.

OR

Q.2 Draw neat S.F.D. and B.M.D for the beam shown in fig. 4. Show all salient features and locate points of contralfexure. Show all calculations clearly. **(10)**

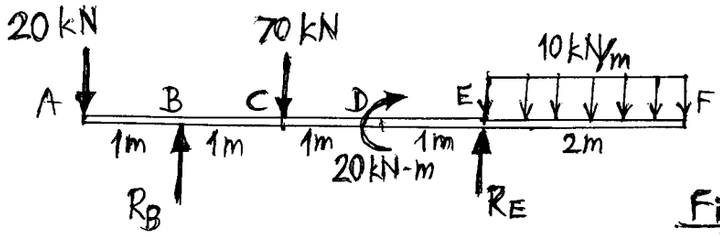


Fig. 4

Q.3 a) Write the bending formula (flexure formula) with usual notations. State meaning and SI units of all 6 symbols in the equation. **(04)**

b) A beam of length L is simply supported at its ends. If there is a uniformly distributed load 'w' per m on the entire beam, obtain maximum deflection and slopes at the supports using McCaulay's method, with the help of relevant diagrams. **(06)**

OR

Q.3 A beam AB and its hollow rectangular section are shown in fig.5. Calculate the maximum bending stresses at the top and bottom fibers at section X-X. **(10)**

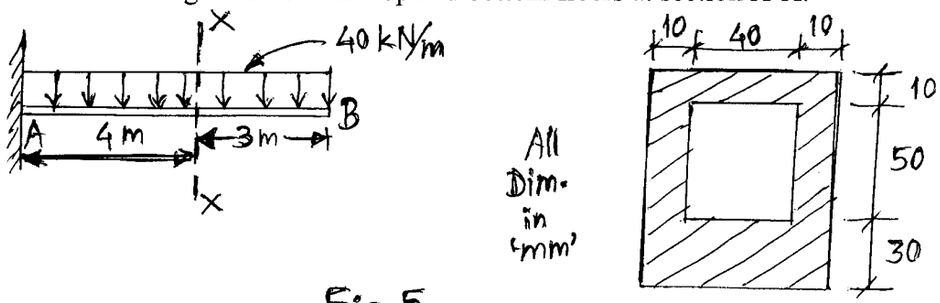


Fig. 5

Q.4 a) Draw proportionate and neat shear stress diagrams for following section: **(04)**
i) Solid circular ii) Hollow rectangular
iii) 'T' shaped section

b) A hollow steel shaft transmits 20 kW power when rotating at 150 rpm. If total angle of twist in 5m length is 3^0 and maximum allowable shear stress is 60MPa, determine outer and inner diameters of the shaft. Assume G= 80 GPa. **(06)**

OR

Q.4 A simply supported beam of 2 m length carries a u.d.l. of 140kN/m over entire span. Cross section of the beam is a 'T' section with overall depth of 160 mm, flange width 120 mm and flange as well as web thickness of 20 mm each. Considering maximum shear force in the beam, calculate shear stresses at important layers in the cross section. Draw neat shear stress distribution diagram, showing all salient values. **(10)**

Q.5 State four assumptions made in Euler's theory of long columns. With the help of a relevant sketch, derive formula for Euler crippling load for a column with both ends hinged. **(10)**

OR

Q.5 A hollow circular column (E= 200GPa) of actual length 2.4m has one end fixed and other end free. Using following data, find ratio of crippling loads by Euler and Rankine's formulas: **(10)**

i) inner and outer diameter 36 mm and 40 mm,

ii) Yield stress $\sigma_C = 310 MPa$,

iii) Rankine's constant = $\frac{1}{7500}$

Q.6 a) Two timber pieces are glued together with an inclined joint as shown in fig. 6. Find maximum axial force 'P' the member can carry knowing that maximum allowable stresses for the joint are 8MPa in tension and 5MPa in shear. **(06)**

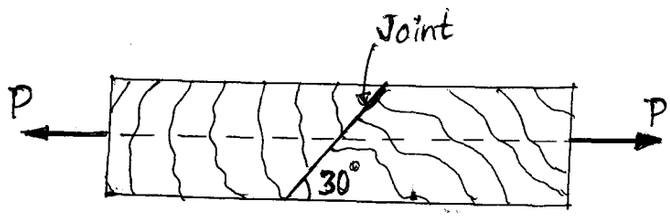
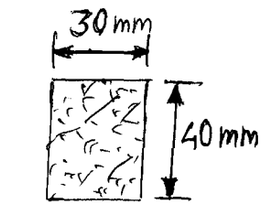


Fig. 6



Cross Section of Member

b) Draw Mohr's circles for: **(04)**

i) An element subject to equal like normal stresses of 40 MPa on orthogonal faces,

ii) An element subjected to pure shear with shearing stresses of 30 MPa.

OR

Q.6 For the state of plane stress shown in fig. 7, determine: **(10)**

i) Principal stresses and locate corresponding planes,

ii) Maximum shearing stresses and locate corresponding planes.

Use Graphical (Mohr's Circle) method.

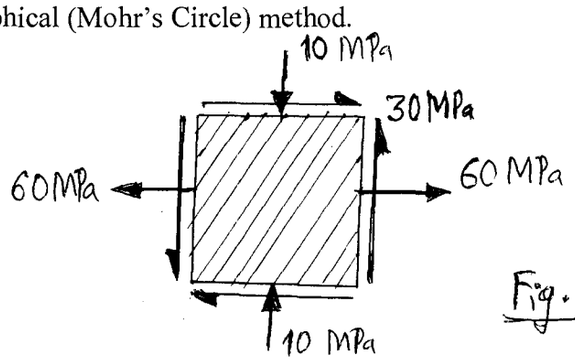


Fig. 7

* * * *