Code: 9D15103

M.Tech I Semester Supplementary Examinations August/September 2018

ADVANCED MECHANICS OF SOLIDS

(Machine Design)

(For students admitted in 2013, 2014, 2015 & 2016 only)

Time: 3 hours Max. Marks: 60

Answer any FIVE questions

All questions carry equal marks

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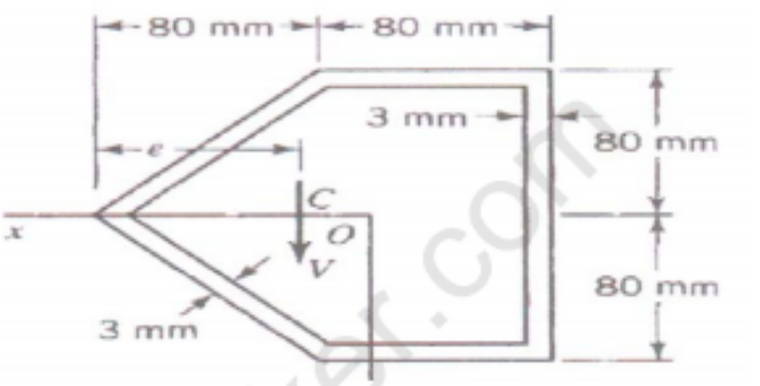
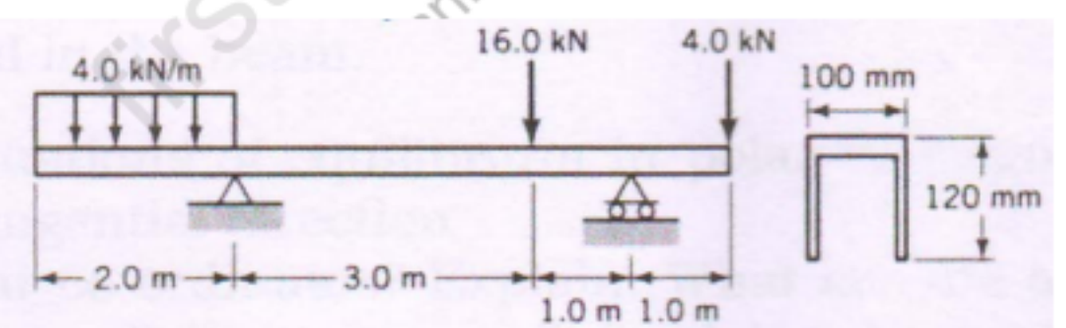
1 (a) What is shear centre and bending axis?

(b) A beam has the cross section shown in figure below. Locate the shear center for the cross section.

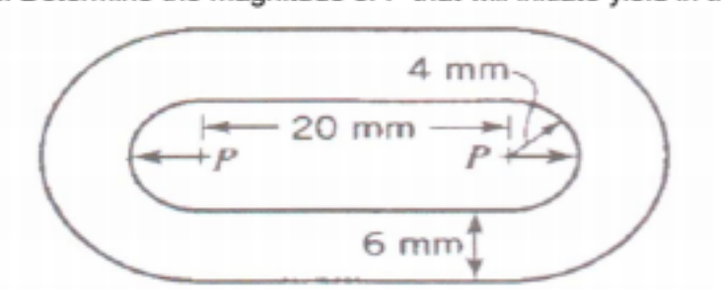


2 (a) Explain about beams subjected to nonsymmetrical bending.

(b) A double overhang beam has a cross section as shown in figure below. The vertical stems of the section are 10 mm thick and the horizontal flange is 20 mm thick. For the loads shown, determine the maximum values for the tensile and compressive stresses in the beam and their locations.



3 The link in figure has a circular cross section and is made of a steel having a yield stress of 250 MPa. Determine the magnitude of P that will initiate yield in the link.



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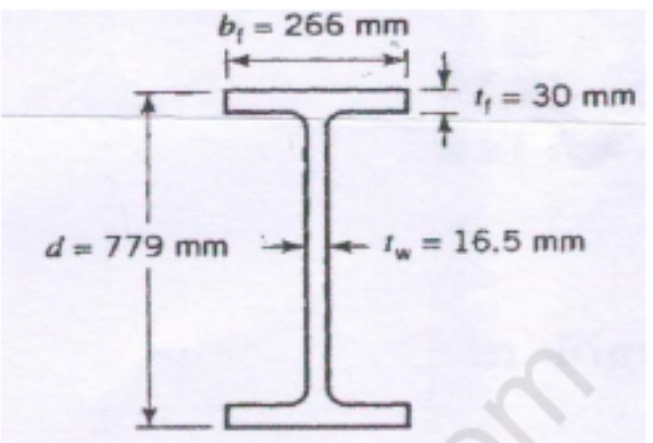
4 (a) What is elastic membrane analogy? Explain.

(b) The nominal dimensions of a steel wide-flange section (W760 X 220) are shown in figure. The beam is subjected to a twisting moment T = 5000 N/m. Determine the maximum shear stress and its location. Ignore the fillets and stress concentrations. Determine the angle of twist per unit length for the applied twisting moment.



5 A fatigue testing machine has two identical steel disks (E = 200 GPa and v = 0.29) rolling together. The identical disks have a radius of curvature of 40 mm and width h = 20 mm. For rolling without friction, a load P = 24.1 kN produces the following stresses: $\sigma_{max} = 1445\ MPa,\ \tau_{max} = 433\ MPa, and\ \tau_{oct\,(\max)} = 361\ MPa.$ Let the cylinders be subjected to a load P = 24.1 kN and be rotated at slightly different speeds so that the roller surfaces slide across each other. If the coefficient of sliding friction is 0.111, determine $\sigma_{max}\ (tension),\ \sigma_{max}\ (compression),\ \tau_{max}\ and\ \tau_{oct\,(\max)}$.

6 (a) Explain a plane stress and plane strain problem in rectangular coordinates with suitable example.

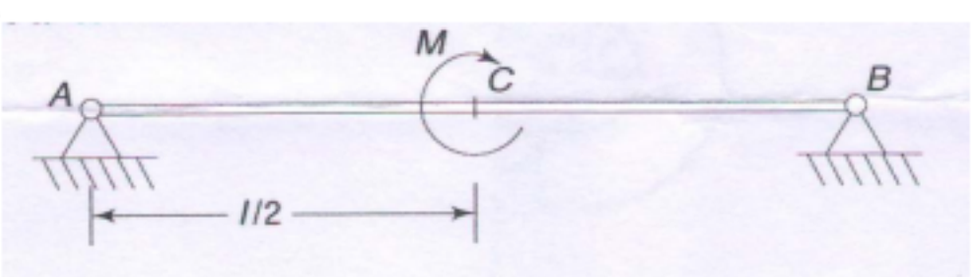
(b) A cantilever beam of length 3.0 m is carrying a uniformly distributed load of intensity $2\ kN/m$ over the entire span. If the cross section of the beam is circular of diameter 70 mm, find the maximum bending stress induced in the beam.

7 (a) Derive the equations of equilibrium in polar co-ordinates for radial direction & tangential direction.

(b) What are polar co-ordinates? Explain. What are the applications, in which polar co-ordinates are used? Explain why they are used and what are their advantages.

8 (a) What is the twist of beam of circular uniform cross section for three dimensional problems?

(b) Determine the rotation of point C of the beam under the action of a couple M applied at its centre.



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