BIRLA INSTITUTE OF TECHNOLOGY, MESRA, RANCHI
(END SEMESTER EXAMINATION)

CLASS: B.TECH **SEMESTER : III**
BRANCH: CIVIL **SESSION : MO/18**

SUBJECT: CE3001 STRENGTH OF MATERIALS

TIME: 3.00 HOURS **FULL MARKS: 60**

INSTRUCTIONS:
1. The question paper contains 7 questions each of 12 marks and total 84 marks.
2. Candidates may attempt any 5 questions maximum of 60 marks.
3. The missing data, if any, may be assumed suitably.
***4*. Before attempting the question paper, be sure that you have got the correct question paper.**
5. Tables/Data hand book/Graph paper etc. to be supplied to the candidates in the examination hall.

Q.1(a) Explain principal stresses for plane stress problems. [2]
Q.1(b) Differentiate between plane stress and plane strain problems. [4]
Q.1(c) For the given state of stress, determine the normal and shearing stresses after the element shown has been rotated through 25° clockwise. [6]

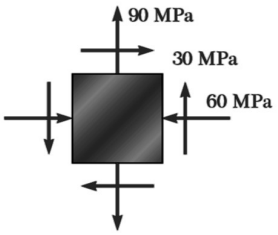

Figure 1:

Q.2(a) Describe neutral surface with neat sketch when a beam is subjected to pure bending. [4]
Q.2(b) Determine the largest couple M that can be applied to the beam shown, the allowable stress is 120 MPa in tension and 150 MPa in compression. [8]

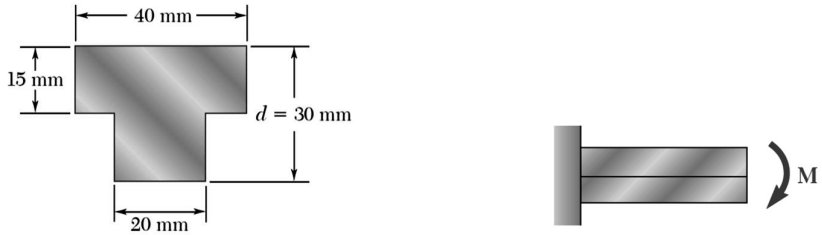

Figure 2

Q.3(a) Draw shear stress distribution for a thin walled C-Section. [2]
Q.3(b) Determine the depth h and the width b of the beam, knowing that $L = 2\,m$, $P = 40\,kN$, $\tau_{max} = 960\,kPa$,and $\sigma_{max} = 12\,MPa$. [10]

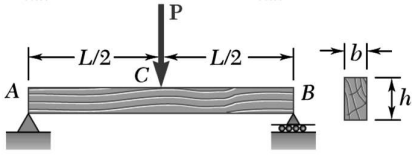

Figure 3:

Q.4(a) Use the moment-area theorems to determine the slope at A and displacement at C for beam shown in Figure 4. EI is constant. [6]
Q.4(b) Use the conjugate-beam method to determine the slope at A and displacement at C for beam shown in Figure 4. EI is constant. [6]

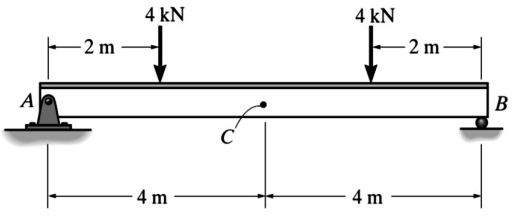

Figure 4:

Q.5(a) Draw SFD and BMD for the following beam: [6]

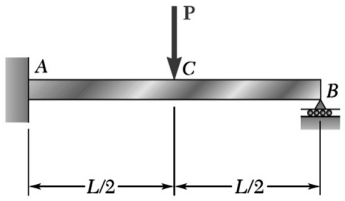

Figure 5:

Q.5(b) Draw SFD and BMD for the following fixed beam: [6]

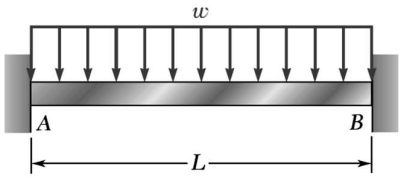

Figure 6:

Q.6(a) Knowing that each of the shafts AB, BC, and CD consists of a solid circular rod, determine the shaft in which the maximum shearing stress occurs and the magnitude of that stress. [2+4]

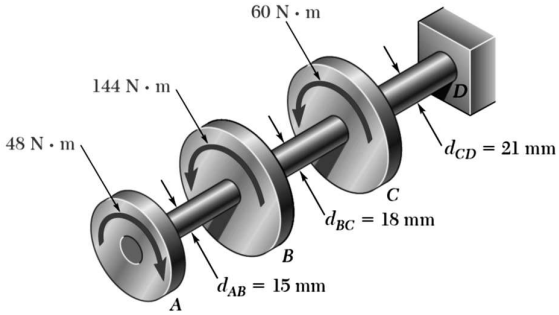

Figure 7:

Q.6(b) A torque $T = 750\ kN.m$ is applied to the hollow shaft shown that has a uniform 8-mm wall thickness. Neglecting the effect of stress concentrations, determine the shearing stress at points a and b. [6]

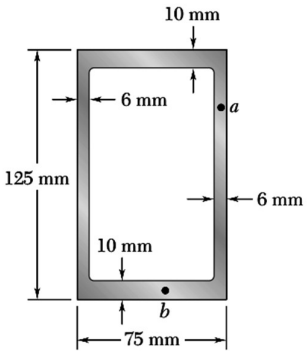

Figure 8:

Q.7(a) Derive strain energy for axial loading. [4]

Q.7(b) Determine the critical load for a square and a circular column each having cross sectional area of $1000mm^2$ and having length of $1.5m$. Consider both ends hinged. Use E=200 GPa. [8]

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