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

CLASS: B. TECH   SEMESTER : III
BRANCH: MECH/PIE   SESSION : MO/2023

SUBJECT: ME205 STRENGTH OF MATERIALS

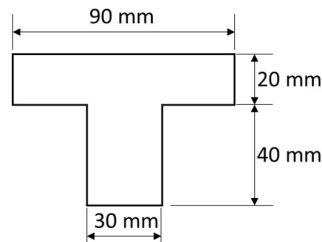TIME: 3 Hours   FULL MARKS: 50
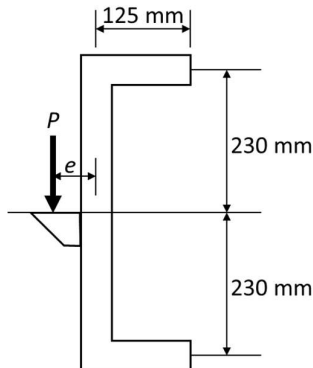
INSTRUCTIONS:
1. The question paper contains 5 questions each of 10 marks and total 50 marks.
2. Attempt all questions.
3. The missing data, if any, may be assumed suitably.
4. Before attempting the question paper, be sure that you have got the correct question paper.
5. Tables/Data hand book/Graph paper etc. to be supplied to the candidates in the examination hall.

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Q.1(a) Derive expressions for the normal and shear stresses on an inclined plane for plane   [5]   1   Understand
stress condition given by $\sigma_x, \sigma_y,$ and τ_{xy}.

Q.1(b) The stress condition on the outer surface of a body is given by,   [5]   1   Apply
$\sigma_x = 50\ MPa, \sigma_y = -10\ MPa, and\ \tau_{xy} = 40\ MPa$.   Determine   the   orientation   of
principal planes and the values of principal stresses.

Q.2(a) Derive an expression for the shear stress in a beam of rectangular cross section.   [5]   2   Apply

Q.2(b) A machine part is acted upon by the 3 kN.m bending moment. The cross section is   [5]   2   Analyze
shown in Figure. Knowing that Young's modulus *E* = 165 GPa, determine the maximum
tensile and compressive stresses in the machine part.

Q.3(a) What do you understand by buckling of a column? Derive an expression for Euler   [5]   3   Understand,
Buckling load (P_{cr}).   Apply

Q.3(b) A cantilever beam of length *L* is acted upon by a point load at a distance of *L*/2 from   [5]   3   Apply
the fixed end. Find the deflection at the free end. Take *EI* as a constant.

Q.4(a) Derive an expression for stress distribution due to bending moment in a curved beam.   [5]   4   Apply

Q.4(b) A channel section is being used for a cantilever beam that supports a load *P* at the   [5]   4   Evaluate
free end. Centerline dimensions for the channel are shown in Figure. All metal in the
channel section is 12 mm thick. Assume that all of the section is effective in resisting
flexural stresses and that only the web resists vertical shearing stresses, locate the
shear center (*e*) of the section with respect to the center of the web.

Q.5(a) Derive expressions for Hoop stress and Longitudinal stress in thin cylinders.   [5]   5   Understand

Q.5(b) A thick cylinder of 100 mm internal radius and 150 mm external radius is subjected to   [5]   5   Analyze
an internal pressure of 60 MPa and an external pressure of 30 MPa. Determine the
hoop and radial stresses at the radius of 120 mm.

::::: 23/11/2023 E:::::