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B.Tech. (Mechanical)

Strenght of Materials-I (BTME-301)

Paper ID- A1138

Time allowed: 3hrs Max. Marks: 60

Instruction to Candidates:

1) Section- A is compulsory consisting of **ten** questions carrying two marks each.
2) Section-B contains five questions carrying **five** marks each and students have to attempt any **four** questions.
3) Section-C contains three questions of **ten** marks each and students have to attempt any **two** questions.

Section-A

Q. 1

(i) What is slenderness ratio? State the limitations of the Euler's formula.
(ii) Differentiate between the centroid and centre of gravity of a lamina.
(iii) What is practical application of the quantity "moment of inertia".
(iv) What is the radius of gyration of an area and what is the practical use of it?
(v) Define the moment of Inertia of an area about an axis lying in the plane of the area.
(vi) Write the assumptions made in theory of bending.
(vii) Show the shear stress variation in rectangular and I-section.
(viii) What is Torsional rigidity and Polar modulus?
(ix) How failure of the short and long columns takes place?
(x) What is crippling load?

Section-B

Q. 2 A compound bar consists of a circular rod of steel of diameter 25 mm rigidly fitted into a copper tube of internal diameter 25 mm and thickness 5 mm. If the bar is subjected to a load of 150 kN, find the stresses developed in the two materials.

Q. 3Two principal stresses at a point in a bar are 200 N/mm^2 (tensile) and 100 N/mm^2 (compressive). Determine the resultant stress in the magnitude and direction on a plane inclined at 60^0 to the axis of the major principal stress. Also determine the maximum intensity of the shear stress.

Q. 4 Draw the shear force and the bending moment diagrams for a 1.75 meter long cantilever beam carrying a uniform distributed load of 1200 N/m run over a length of 1.2 meter from the fixed end.

Q. 5 A timber beam of 0.3 m depth and symmetrical section is simply supported over a span of 8m. What uniformly disctributed load (including its own weight) it can carry if the maximum permissible stress is 8 N/mm^2. The moment of inertia of the section of the beam is 450×10^6 mm^4. Find the maximum bending stress and the radius of curvature at section 1 m from a support. Modulus of elasticity for timber = 12.6×10^3 N/mm^2.

Q. 6 A solid circular shaft transmits 70 kW power at 150 rpm. Calculate the shaft diameter if the twist in the shaft is not to exceed 1 degree in 2 meter length of the shaft and the shear stress limited to 70×10^6 MPa. Take modulus of rigidity = 100×10^9 MPa.

Section C

Q. 7 A load of 300 kN is applied on a short concrete column of 250 mm × 250 mm. The column is reinforced by the steel bars of total area 5600 mm^2. If the modulus of elasticity for the steel is 15 times that of the concrete, find the stressesn in concrete and steel. If the stress in the concrete should not exceed 4 N/mm^2, find the area of the steel required so that the column may support a load of 600 kN.

Q. 8 Compare the strength of the solid circular column of diameter 200 mm and the hollow circular column of same cross sectional area and thickness 30 mm. The other parameters are same for both the sections.

Q. 9 A 4 m long simply supported wooden beam at its ends is carrying a point laod of 7.25 kN at its centre. The cross sectional area of the beam is 140 mm wide and 240 mm deep. If $E = 6 \times 10^3$ MPa. Find the deflection at the centre using the double integration method.

End