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B.Tech.
(SEM III) THEORY EXAMINATION 2017-18
MECHANICS OF SOLIDS

Time: 3 Hours ***Total Marks: 70***

Note: 1. Attempt all Sections. If require any missing data; then choose suitably.

SECTION A

1. Attempt *all* questions in brief. 2 x 7 = 14

a. What are principal planes and principal stresses?
b. Define Resilience, proof resilience and modulus of resilience.
c. What are the different methods of finding slope and deflection of cantilever
d. What Do you understand by the term Torsional Rigidity
e. What is Shear center?
f. What do you understand by the term "Buckling" of columns
g. What is the difference between Thin and Thick cylinder

SECTION B

2. Attempt any *three* of the following: 7 x 3 = 21

a. A beam of uniform section, 10m long ,is simply supported at its ends. It carries point loads of 150KN and 65KN at a distance 2.6m and 5.5m respectively from the left end, Calculate
(i) The maximum deflection (ii) Deflection under each load.

b. Determine the internal and external diameter of a hollow shaft whose internal diameter is 0.6 times external diameter and transmits 120kw at 210rpm and the allowable stress is limited to 75MPa.If a bending moment of 2800Nm is applied to the shaft, find the speed at which the shaft must rotate to transmit the same power for the same value of maximum shear stress.

c. A mild steel hallow column, having 100mm external diameter, 40 mm thick and 4 m long. Determine crippling load using Rankin's formula, when both end fixed? Take σ_c=320N/mm^2 and Rankine constant α=1/7500.?

d. Derive an expression for maximum principal stress in a thick cylindrical shell subjected to internal pressure only.

e. For a tube having E=2×10^5 N/mm^2 and μ=0.3 the hoop stress at the inner surface is twice internal pressure. find the thickness of the wall if internal radius is 60mm

SECTION C

3. Attempt any *one* part of the following: 7 x 1 = 7

(a) Derive Euler's equation for long column having its both end built in.

(b) Derive expression of deflection angular rotation and stresses in case of open coil helical spring subjected to axial load. Calculate what % the axial extension is underestimated if the inclination of the coil of the coil is neglected for a spring in which $\alpha=25°$. Assume n and R remain same

4. Attempt any *one* part of the following: 7 x 1 = 7

(a) What is shear centre? Channel section has flanges $b*t_1$ and web $h*t_2$. Determine position of its shear center.

(b) A 60mm×40mm×6mm unequal angle is placed with longer leg vertical and used as a beam. It is subjected to a bending moment of 12 KN-cm acting in the vertical plane through the Centroid of the section. Determine the max bending stress induced in the section.

5. Attempt any *one* part of the following: 7 x 1 = 7

(a) At a point in a material under stress, the intensity of the resultant stress on a certain plane is 50MPa (tensile) inclined at 30^0 to the normal of that plane. The stress on a plane at right angle to this has a normal tensile component of intensity of 30MPa find:
(i) The resultant stress on the second plane.
(ii) The principal planes and stresses.
(iii) The plane of maximum shear and its intensity.

(b) Explain different theories of failure along with their graphical representation

6. Attempt any *one* part of the following: 7 x 1 = 7

(a) A crane hook is of trapezoidal c/s having inner side 80mm, outer side 300mm and depth 120mm. the radius of curvature of inner side is 80 mm. if a load of 100 kN is applied to the hook passing through the center of curvature, determine the maximum tensile and compressive stresses at the critical cross section

(b) Determine the dimensions of hollow shaft with a diameter ratio of 3:4, which is to transmit 60KN at 200rpm. The maximum Shear stress is limited to 70 MN/mm^2 and angle of twist is 3.8° in a length of 4m. G=80 GPa.

7. Attempt any *one* part of the following: 7 x 1 = 7

(a) Write down the assumption in Lame's theory and also derive its equation for thick shell.

(b) Find the Euler's buckling load of a long column length L subjected compressive load P when one end of column are fixed and other is hinged. Take EI Constant.