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311007

B. Tech. III Sem. (Main) Exam., Dec. - 2019

Mechanical Engineering

3ME4-07 Mechanics of Solids

Time: 3 Hours **Maximum Marks: 160**

Instructions to Candidates:

Part – A: *Short answer questions (up to 25 words) 10 × 3 marks = 30 marks. All ten questions are compulsory.*

Part – B: *Analytical/Problem Solving questions 5 × 10 marks = 50 marks. Candidates have to answer five questions out of seven.*

Part – C: *Descriptive/Analytical/Problem Solving questions 4 × 20 marks = 80 marks. Candidates have to answer four questions out of five.*

Schematic diagrams must be shown wherever necessary. Any data you feel missing may suitably be assumed and stated clearly. Units of quantities used/calculated must be stated clearly.

Use of following supporting materials is permitted during examination. (Mentioned in form No. 205)

1. NIL 2. NIL

PART - A

Q.1 Explain Poisson's ratio. [3]

Q.2 What is thermal stress? [3]

Q.3 Define section modulus. [3]

Q.4 Write the flexural formula for members subjecting bending. [3]

Q.5 Write the equations for principal stresses, for a member subjecting σ_1, σ_2 as two mutually perpendicular planer normal stress & τ, as shear stress in that plane. [3]

Q.6 Write down names of any three theories of failure. [3]

Q.7 Write the equation of induced torsional shear stress in a shaft having diameter 'd' and torque applied is T. [3]

Q.8 Explain slenderness ratio related to column. [3]

Q.9 What is cantilever beam? [3]

Q.10 Write down the equation for hoop or circumferential stress for thin cylinder. [3]

PART – B

Q.1 Derive the expression for elongation of circular rod due to self-weight, when it is hanged at one end. [10]

Q.2 A steel rod having 30mm diameter and 300mm long is subjected to tensile force 'P' acting axially. The temperature of the rod is then raised through 80°C and the total extension measured is 0.35mm. Calculate the value of 'P'. Take $E_s = 200GN/M^2$ and $\alpha_s = 12\times10^{-6}$ per °C. [10]

Q.3 The intensity of loading in a simply supported beam of 8m span varies gradually from 2kN/m at one end to 6kN/m at the other end. Draw the shear force and bending moment diagrams. [10]

Q.4 Show that at a plane, in a material subjected to two dimensional stress, the sum of the normal components of stresses on any two mutually perpendicular plane is constant. [10]

Q.5 A solid shaft of 100mm diameter is to transmit 120 kW at 100rpm. Find the maximum intensity of shear stress induced and the angle of twist for a length of 8 meter. [10]

Q.6 Describe Euler's theory for columns, including various assumptions and applications. [10]

Q.7 Explain various stresses developed in a thin cylindrical cell subjected to internal fluid pressure. [10]

PART – C

Q.1 Briefly explain various elastic constants. Derive expression for inter-relation of various elastic constants. [8+12=20]

Q.2 Derive an expression for shear stress distribution in a solid circular section. [20]

Q.3 At a point in a material under stress, intensity of resultant stress on a certain plane is 50 MN/m^2 (tensile) inclined at 30° to the normal of that plane. The stress on a plane at right angles to this has a normal tensile component of intensity of 30 MN/m^2.

Draw the Mohr's circle for above configuration of stresses and find –

(il) Principal stress & principal plane orientation.

(ii) Maximum Shear stress & its orientation. [10+5+5=20]

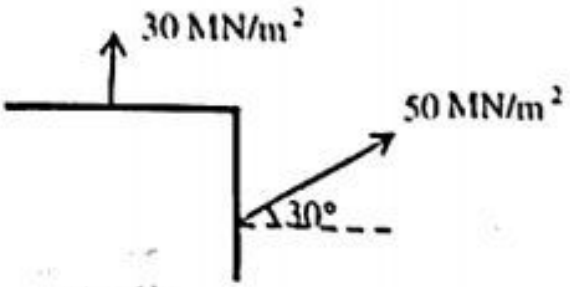

Fig.(1)

Q.4 Two shafts of same materials and same length are subjected to the same torque. If the first shaft is of a solid circular section and the second shaft is of hollow circular section whose internal diameter is 2/3 of the outside and in each shaft, maximum shear is same, then compare the weight of two shaft (calculate weight ratio). [20]

Q.5 A cantilever beam of 100mm width and 200mm depth is loaded as shown in figure, Find the slope and deflection at the free end A. Take $E=2.1\times10^8$ kN/m^2. [20]