

Olusegun Agagu University of Science and Technology, Okitipupa.

Department of Mechanical Engineering

First Semester Test 2020/2021

Instruction: Answer all the questions

Time allowed: 2 hours

Subject Title/Code: Strength of Materials MEE 309

1. Show, by method of double integration, that the deflection of a symmetric uniform section beam of length L , carrying a point load P at the middle is given by

$$y = \frac{PL^3}{8EI}$$

Where E is the Young's modulus of elasticity of the material, and I is the relevant second moment of area of the cross section measured about the neutral axis.

2. Derive the expression for the second moment of area of a rectangular section of dimension $b \times d$ about the centroidal axis.
3. A solid circular shaft is to transmit 450 kW at 120 rev/min. Determine the diameter required if the shear stress in the shaft is not to exceed 85 MN/m².
4. A lift is supported by a wire rope of length 26 m and cross sectional area of 9×10^{-5} m². The maximum load the lift may carry is 70 kg. If the instantaneous stress due to the load being dropped is limited to 60 MN/m², determine the maximum height through which the load may be allowed to fall. $E = 200$ GN/m².
5. Derive an expression for the smallest load W , that would cause a strut of length L , to fail by buckling if the strut is pinned at both ends.

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