



Manipal Institute of Technology, Manipal





IV SEMESTER B.TECH (CIVIL ENGINEERING) END SEMESTER EXAMINATIONS, MAY 2016

SUBJECT: STRENGTH OF MATERIALS [CIE 3283] Open Elective-1

REVISED CREDIT SYSTEM

Time: 3 Hours

MAX. MARKS: 50

Instructions to Candidates:

- ✤ Answer ALL the questions.
- ✤ Missing data may be suitable assumed.
- **1A.** Draw the SFD and BMD for the beam loaded as shown in **Figure 1A**. Mark the salient **5** points.
- **1B.** Explain the following i) Sagging and hogging bending moment ii) Section modulus and polar modulus.
- 1C. A hollow square section with outer and inner dimensions of 50 mm and 40 mm 2 respectively is used as a cantilever of span 1 m. How much concentrated load can be applied at the free end of the cantilever, if the maximum bending stress is not to exceed 35 MPa.
- 2A. A Timber beam of rectangular section and span of 3.6 m is simply supported. If the depth 5 of section is to be twice the breadth, and the stress in the timber is not to exceed 7 N/mm², find the dimensions of the cross-section.
 i) To support a load of 20 kN at the centre.
 ii) A uniformly distributed load of 20 kN/m.
- 2B. An I- section beam 350mm x 150 mm is as shown in the Figure 2B. If the shear force 5 acting on the section is 40 kN, Plot the shear stress variation across the depth of the section.
- **3A.** Obtain the relationship between slope, deflection and radius of curvature. **5**
- **3B.** Prove that hollow shaft is stiffer than a solid shaft of same material, length and weight. **2**
- **3C.** A cantilever AB 2 m long is carrying a load of 20 kN at free end and 30 kN at a distance **3** 1 m from the free end. Find the slope and deflection at the free end. Take E= 200 GPa and $I= 150 \times 10^6$ mm⁴.



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- **4A.** Determine the diameter of a solid shaft which will transmit 90 kW at 160 r.p.m. Also determine the length of the shaft if the twist must not exceed 1° over the entire length. The maximum shear stress is limited to 60 N/mm². Take the value of modulus of rigidity = 8×10^4 N/mm².
- 4B. The stresses at a point of a machine component are 150 MPa and 50 MPa both tensile. Find the intensities of normal, shear and resultant stresses on a plane inclined at an angle of 55° with the vertical. Also find the magnitude of the maximum shear stress in the component.
- **4C.** Briefly explain the steps involved in the Construction of Mohr's circle
- **5A.** A thin cylindrical vessel of 1000 mm diameter and 3000 mm length has a metal wall of thickness 10 mm. It is subjected to an internal fluid pressure of 3 N/mm². Find the circumferential and longitudinal stresses in the wall. Determine the changes in the length, diameter and volume of the cylinder. Also find the maximum shear stress in the cylinder. Assume $E= 2.1 \times 10^5$ N/mm² and Poisson's ratio 0.3.
- **5B.** A hollow cast iron column whose external diameter is 200 mm, thickness 20 mm and 4 m **5** length is fixed at both ends. Calculate the safe load by Rankine's formulae using a factor of safety of 2.5. Find the ratio of the Euler's to Rankine's loads. Take $E = 1 \times 10^5 \text{ N/mm}^2$ and Rankine's constants $\alpha = 1/1600$ and $\sigma_c = 550 \text{ N/mm}^2$.

