Reg. No. \_\_\_\_\_\_\_\_\_\_\_\_



**End Semester Examination – Nov / Dec – 2019**

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| **Code :** | **17ME2005** | **Duration :** | **3hrs** |
| **Sub. Name :** | **MECHANICS OF SOLIDS** | **Max. Marks :** | **100** |

**ANSWER ALL QUESTIONS (5 x 20 = 100 Marks)**

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| **Q. No.** | **Sub Div.** | **Questions** | **Course**  **Outcome** | **Marks** |
| 1. | a. | State Hooke’s law. | CO1 | 2 |
| b. | A brass bar having a cross-sectional area of 1000 mm2, is subjected to axial forces as shown in *Fig*. Find the total elongation of the bar. Take E = 1.05x105 N/mm2. | CO1 | 10 |
| c. | A rod is 3 m long at a temperature of 15° C. Find the expansion of the rod when the temperature is raised to 95° C. If this expansion is prevented, find the stress induced in the material of the rod. Take  E = 1x105 N/mm2 and α = 0.000012 / °C. | CO2 | 8 |
| **(OR)** | | | | |
| 2. | a. | Define Poisson’s ratio. | CO1 | 2 |
| b. | Metallic bar of 250 mm x 100 mm x 5 mm is loaded as shown in *Fig*. Find the change in volume. Take E = 2 x 105 N/mm2 and Poisson's ratio 0.25. Also find the change that should be made in the 4 MN load, in order that there should be no change in the volume of the bar. | CO2 | 18 |
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| 3. | a. | Mention different types of beams and loads. | CO3 | 4 |
| b. | Cantilever 1.5 m long is loaded with a uniformly distributed load of 2 kN/m run over a length of 1.25 m from the free end. It also carries a point load of 3 kN at a distance of 0.25 m from the free end. Draw shear force and bending moment diagrams. | CO3 | 16 |
| **(OR)** | | | | |
| 4. | a. | What do you mean by point of contraflexure? | CO3 | 2 |
| b. | Draw shear force and bending moment diagrams for the beam which is loaded as shown in *fig*. Determine the points of contraflexure within the span of AB. | CO3 | 18 |
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| 5. | a. | Define the term neutral axis. | CO4 | 2 |
| b. | An I section shown in *fig* is simply supported over a span of 12 m. If the maximum permissible bending stress is 80 N/mm2, what concentrated load can be carried at a distance of 4 m from right end support? | CO4 | 18 |
| **(OR)** | | | | |
| 6. |  | A hollow shaft, having an internal diameter 40 % of its external diameter, transmits 562.5 kW power at 100 rpm. Determine the external diameter of the shaft if the shear stress not to exceed 60 N/mm2 and the twist in a length of 2.5 m should not exceed 1.3°.  Assume maximum torque = 1.25 mean torque and modulus of rigidity = 9 x 104 N/mm2. | CO4 | 20 |
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| 7. | a. | Define the terms Principal plane and Principal stresses. | CO5 | 2 |
| b. | A rectangular block of material is subjected to a tensile stress of 80 N/mm2 on one plane and a tensile stress of 40 N/mm2 on the plane at right angle to the former. Each of the above stresses is accompanied by shear stress of 50 N/mm2 and that associated with former tensile stress tends to rotate the block anticlockwise. Find:  (i) The direction and magnitude of principal stresses,  (ii) Magnitude of greatest shear stress. | CO5 | 18 |
| **(OR)** | | | | |
| 8. | a. | Name the important theories of failure. | CO5 | 2 |
| b. | At a certain point in a strained material, the intensities of stresses on two planes at rightangles to each other are 50 N/mm2(tensile) and 20 N/mm2(compressive). They are accompanied by shear stress of magnitude 30 N/mm2. Find using Mohr’s circle, the location of the principal planes and evaluate the principal stresses. | CO5 | 18 |
|  | | **Compulsory**: |  |  |
| 9. |  | A beam of length 6 m is simply supported at its ends and carries two point loads of 48 kN and 40 kN at distance of 1m and 3 m respectively from the left support. Find (i) Deflection under each load, (ii) Maximum deflection, (iii) The point at which maximum deflection occurs. Take E = 2 x 105 N/mm2 and I = 85 x 106 mm4. | CO6 | 20 |