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

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**End Semester Examination – Nov/Dec – 2018**

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| **Code :** | **17AE2004** | **Duration :** | **3hrs** |
| **Sub. Name :** | **SOLID MECHANICS** | **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. | A brass bar, having cross-sectional area of 1000 mm2, is subjected to axial forces as shown in figure. Find the total elongation of the bar.Take E= 1.05 x 105 N/mm2. | CO1 | 15 |
| b. | A rod, which tapers uniformly from 10 mm diameter to 20 mm diameter in a length of 400 mm is subjected to an axial load of 5000N. If E =2.1 x 105 N/mm2. Find the extension of the rod. | CO1 | 5 |
| (OR) | | | | |
| 2. | a. | A steel bar is placed between two copper bars, each having the same area and length as steel bar at 20oC. At this stage, They are rigidly connected together at both the ends. When the temperature is raised to 320oC, the length of the bars increases 1.5 mm. Determine the original length and final stresses in the bars. The modulus of elasticity of steel and copper are 220 GPa and 110 GPa, coefficient of thermal expansion of steel and copper are 0.000012 per oC and 0.0000175 per oC . | CO1 | 15 |
| b. | Find the modulus of elasticity for a rod, which tapers uniformly from 30 mm to 15 mm diameter in a length of 350 mm. The rod is subjected to an axial load of 5.5 kN and extension of the rod is 0.025 mm. | CO1 | 5 |
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| 3. | a. | Evaluate shear force and Bending moment of the beam shown in figure and Draw the Shear force and Bending moment diagrams. | CO2 | 10 |
| b. | Derive the relation between the modulus of elasticity and the modulus of rigidity. | CO1 | 10 |
| (OR) | | | | |
| 4. | a. | Evaluate shear force and Bending moment of the beam shown in figure and Draw the Shear force and Bending moment diagram. | CO2 | 10 |
| b. | Young’s modulus and Shear modulus of the round bar are 110 GPa and 42 GPa. Find the Bulk modulus and lateral contraction of a round bar of 37.5 mm diameter and 2.4 m length when stretched 2.5 mm. | CO1 | 10 |
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| 5. |  | A beam of length 8 m is simply supported at its ends. It carries a uniformly distributed load of 40 kN/m as shown in figure. Determine the deflection of the beam at its mid-point and also the position of maximum deflection and maximum slope. Take E = 2 x 105 N/mm2 and I = 4.3 x 108 mm4. | CO3 | 20 |
| (OR) | | | | |
| 6. |  | A simply supported beam of length 4 m carries a point load of 3 kN at a distance of 1 m from each end. If E = 2 x 105  N/mm2  and I =103 mm4 for the beam shown in figure. Determine the slope at each end, each load and deflection under each load and center of the beam. | CO3 | 20 |
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| 7. |  | A rectangular block of material is subjected to a tensile stress of 110 N/mm2 on one plane and a tensile stress of 47 N/mm2 on the plane at right angles to the former. Each of the above stress is accompanied by a shear stress of 63 N/mm2 and that associated with the former tensile stress tends to rotate the block anticlockwise shown in figure. Find the direction and magnitude of each of the principal stress and magnitude of the greatest shear stress. | CO1 | 20 |
| (OR) | | | | |
| 8. |  | The tensile stresses at a point across two mutually perpendicular planes are 120 N/mm2  and 60 N/mm2 . Using Mohr’s circle method determine the normal, tangential and resultant stresses on a plane inclined at 30o to the axis of the minor stress. | CO1 | 20 |
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|  | | **Compulsory**: |  |  |
| 9. | a. | Briefly explain the types of mechanical joints with neat diagrams and its merits and demerits. | CO6 | 10 |
| b. | A closely coiled helical spring is to carry a load of 500 N. Its mean coil diameter is to be 10 times that of the wire diameter. Calculate these diameters if the maximum shear stress in the material of spring is to be 80 N/mm2. | CO5 | 10 |