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

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

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| **Code :** | **14CE2002** | **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. | Draw the stress- strain diagram of mild steel. Explain salient points. | CO1 | 5 |
| b. | An Aluminum bar, having cross sectional area of 1000 mm2, is subjected to axial forces as shown in fig 1.    **Fig.1**  Find the elongation of the bar. Take E = 1.05 x 105 N/mm2. | CO1 | 15 |
| (OR) | | | | |
| 2. |  | A steel rod of 10mm diameter passes centrally though a copper tube of external diameter 40 mm and internal diameter of 20 mm and length 2.5m. The tube is closed at the ends by 20 mm thick steel plates. The plates and the tube are held tightly by tightening of nuts from the ends of the steel rod and length of the tube is reduced by 0.0004m. If the assembly is heated uniformly to a temperature of 600C, find the stresses in the steel rod and copper tube.  Take young’s modulus for steel and copper are 210 GPa and 100 GPa respectively. Coefficient of expansion of steel and copper are 12 x 10-6 /0C, 17.5 x 10-6 /0C. | CO1 | 20 |
|  |  |  |  |  |
| 3. |  | The principle stresses at a point in a body are 100 MN/m2 (tensile) and 60 MN/m2 (compressive). Determine the normal stress and the shear stress on a plane inclined at 50˚ to the axis of the major principal stress. Also determine the maximum intensity of shear stress in the material at that point. | CO3 | 20 |
| (OR) | | | | |
| 4. | a. | Define the terms principal planes and principal stresses | CO1 | 4 |
| b. | Explain in detail the theories of failure   1. Maximum principal stress theory 2. Maximum principal strain theory 3. Maximum shear stress theory 4. Maximum shear strain energy theory | CO4 | 16 |
|  |  |  |  |  |
| 5. | a. | Draw the shear force and bending moment diagrams of a simply supported beam carrying udl of ‘w’ per meter throughout its span of ‘L’ meter. | CO2, CO3 | 4 |
| b. | Derive the general relationship between shear force and bending moment at any section of a beam. | CO3 | 4 |
| c. | Draw the shear force and bending moment diagrams for the beam shown in figure. Also determine the maximum bending moment. | CO3 | 12 |
| (OR) | | | | |
| 6. | a. | Name the types of beams based on support conditions. | CO4 | 2 |
| b. | Define the term “point of contraflexure”. | CO4 | 2 |
| c. | Draw shear force and bending moment diagrams for a cantilever beam with point load (W) at the free end, the length of the beam is ‘L’. | CO3 | 4 |
| d. | A simply supported beam of length 10m, carries a point load of 30kN and 80kN at a distance of 3m and 7m from the left end. Draw SFD and BMD for the simply supported beam. | CO3 | 12 |
|  |  |  |  |  |
| 7. | a. | Recall the relationship between torque, polar moment of inertia and shear stress. | CO4 | 2 |
| b. | Give any three assumptions of theory of torsion. | CO4 | 3 |
| c. | Determine the diameter of a solid steel shaft which will transmit 90kW at 160rpm. 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 70 N/mm2. Take the value of modulus of rigidity=8x104 N/mm2. | CO2, CO3 | 15 |
| (OR) | | | | |
| 8. | a. | A close coiled helical spring is to have a stiffness of 910 N/m in compression, with a maximum load of 55N and maximum shearing stress of 120 MPa. The solid length of the spring is 45mm. Find the wire diameter, mean coil radius and number of coils. Modulus of rigidity = 40GPa. | CO2, CO3 | 15 |
| b. | Define the term “polar modulus”. Give the value of polar modulus for a solid circular section with diameter ‘d’. | CO4 | 5 |
|  | | **Compulsory**: |  |  |
| 9. |  | A simply supported beam of I – section having a top flange of 30 mm x 5 mm, web of 35 mm x 5 mm and the bottom flange of 30 mm x 5 mm spans two supports 2m apart. Determine the total load uniformly distributed on the entire span that the beam could carry in addition to a concentrated load of 8 kN at 1 m from left end in order that extreme fiber stress is limited to 750 N/mm2. | CO3 | 20 |