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



**End Semester Examination – Nov/Dec– 2017**

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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. | Find the minimum diameter of a steel wire, which is used to raise a load of 4000N if the stress in the rod is not to exceed 95MN/m2. | CO1 | 4 |
| b. | The ultimate stress for a hollow steel column which carries an axial load of 2.0MN is 500N/mm2. If the external diameter of the column is 225 mm, determine the internal diameter. Take the factor of safety as 3. | CO4 | 6 |
| c. | A bar od 40 mm diameter is subjected to a pull of 70kN .the measured extension on gauge length of 250 mm is 0.1 mm and change in diameter is 0.005mm. Calculate i. Young’s modulus ii. Poisson’s ratio iii. Bulk modulus | CO2 | 8 |
| d. | State Hooke’s law. | CO4 | 2 |
| **(OR)** | | | | |
| 2. | a. | Tension test carried on a specimen resulted in the observations given below.  Diameter of the specimen = 30mm  Length of the specimen = 350 mm  Extension under a load of 20 kN= 0.050 mm  Load at yield point = 130 kN  Maximum load = 210 kN  Length of the specimen after failure = 425 mm  Neck diameter = 21.5mm  Evaluate i.Young’s modulus ii.Yield point iii. Ultimate stress iv. Percentage of elongation v.Safe stress adopting a factor of safety of two. | CO2 | 10 |
| b. | Anmild steel flat 3m long 150mm wide and 15mm thick carries an axial tensile load of 150 kN. Ifthe value of Poisson’s ratio for mild steel is 0.3,Find i. increase in length ii. Decrease in width and thickness iii. Volumetric strain iv. Change in volume. Take E =200 kN/mm2 . | CO2 | 10 |
| 3. | a. | List the various types of beams. | CO4 | 2 |
|  | b. | Derive the relationship between rate of loading, shear force and bending moment. | CO4 | 6 |
|  | c. | 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 |
| **(OR)** | | | | |
| 4. | a. | Name the different types of supports given to structures. List the reactions offered by the different types of supports. | CO4 | 4 |
|  | b. | Portray the bending moment and shear force diagram of a simply supported beam of span L carrying udl of w/m throughout its span. | CO2 | 3 |
|  | c. | Explain the sign conventions for the shear force and bending moment in general. | CO4 | 3 |
|  | d. | A cantilever of length 2 m carries a UDL of 1.5 kN/m run over whole length and point load of 2 kN at distance of 0.5 m from the free end. Draw the shear force and bending moment diagram for the cantilever. | CO2,  CO3 | 10 |
| 5. | a. | Define Section Modulus. Derive the expression for section modulus of a hollow circular section with external diameter ‘D’ and internal diameter ‘d’. | CO1, CO4 | 5 |
|  | b. | Give any two assumptions of theory of simple bending. | CO4 | 2 |
|  | c. | A beam is simply supported and carries a UDL of 50 kN/m run over the whole span. The section of the beam is rectangular having depth as 500 mm. if the maximum stress in the material of the beam is 120N/mm2 and moment of inertia of the section is 7 x 108 mm4, find the span of the beam | CO2, CO3 | 5 |
|  | d. | A flitched beam consists of a wooden joist 150mm wide and 300 mm deep strengthened by a steel plate 12mm thick and 300 mm deep on either side of a joist. If the maximum stress in the wooden joist is 7N/mm2, find the corresponding maximum stress attained in steel. Find also the moment of resistance of the composite section. Take E for steel is 2 x 105 N/mm2 and for wood is 1 x 105 N/mm2 | CO2, CO3 | 8 |
| **(OR)** | | | | |
| 6. | a. | A beam of cross section of an isosceles triangle is subjected to a shear force of 40 kN at a section where base width is 200 mm and height 600 mm. Determine the horizontal shear stress at the neutral axis. | CO1 | 4 |
|  | b. | Define simple bending. State any four assumptions of theory of simple bending. | CO4 | 6 |
|  | c. | A beam of I section is having an overall depth of 500mm and overall width as 190mm. the thickness of flanges is 25mm whereas the thickness of the web is 15mm. the moment of inertia about N.A is given as 6.45 x 108 mm4. If the section carries a shear force of 40 kN, calculate the maximum shear stress. Also sketch the shear stress distribution across the section | CO1, CO3 | 10 |
| 7. | a. | Give the expression for finding the power transmitted by torque “T”. | CO4 | 2 |
|  | b. | A close coiled helical spring is to have a stiffness of 910 N/m incompression, with a maximum load of 45N 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 |
|  | c. | Define the term “polar modulus”. Give the value of polar modulus for a solid circular section with diameter ‘d’. | CO4 | 3 |
| **(OR)** | | | | |
| 8. | 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 60 N/mm2. Take the value of modulus of rigidity=8x104 N/mm2. | CO2, CO3 | 15 |
|  | | **Compulsory** |  |  |
| 9. | a. | Define the term Principal planes and principal stresses | CO1 | 4 |
|  | b. | Find the diameter of the circular bar which is subjected to an axial pull of 200 kN , if the maximum allowable shear stress on any section is 60N/mm2. | CO1, CO3 | 4 |
|  | b. | Two planes AB and BC which are at right angles carry shear stress of 14.5 N/mm2. These planes also carry tensile stress of 80 N/mm2 and compressive stress of 55 N/mm2 respectively. Determine i. Direction of principal plane. ii. The magnitude of the principal stresses iii.Maximum shear stress | CO1, CO3 | 12 |

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