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



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

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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. | Explain elastic limit. | CO1 | 2 |
| b. | A tie bar has enlarged ends of square cross section 60 mm x 60 mm as shown in Figure. If the middle portion of the bar is also of square section, find the size and length of the middle portion, if the stress there is 140 MN/m2, the total extension of the bar is 0.14 mm. Take Young’s modulus E = 200 GN/m2. | CO1 | 18 |
| **(OR)** | | | | |
| 2. | a. | Define principle stresses and principle plane. | CO1 | 2 |
| b. | At a point in an elastic material under strain, there are normal stresses and shear stress acting as shown in Figure. Find the principal stresses and maximum shear stress and their orientations using Mohr’s circle. | CO1 | 18 |
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| 3. | a. | StateHooke’slaw. | CO1 | 2 |
| b. | A simply supported beam 6 m long carries uniformly distributed loads of 4 kN/m over a length of 2 m from right end and 6 kN/m over a length of 2 m from left end as shown in Figure. Draw shear force and bending moment diagram and maximum bending moment. | CO2 | 18 |
| **(OR)** | | | | |
| 4. | a. | Explain about simply support with an example. | CO2 | 2 |
| b. | A simply supported beam 8 m span is loaded with point loads of 4, 10 and 7 kN at distance of 1.5, 4 and 6 m from left end as shown in Figure. Draw shear force and bending moment diagram. | CO2 | 18 |
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| 5. | a. | State the assumptions made in theory simple bending. | CO3 | 2 |
| b. | An I-section beam has two flanges of each 100 mm wide and 20 mmthick and web 120 mm high and 20 mm thick. If the section is subjected to a bending moment of 10 kNm, find the values of maximum bending stress. | CO3 | 18 |
| **(OR)** | | | | |
| 6. | a. | Define point of contra flexure. | CO3 | 2 |
| b. | Calculate the maximum slope and deflection of a simply supported beam carrying a uniformly distributed load of 20 kN/m over its entire span of 8 m. Take E=210kN/mm2 and I= 360x106 mm4. | CO3 | 18 |
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| 7. |  | A shaft composed of segments AC, CD, and DB is fastened to rigid supports and loaded as shown in Figure. For bronze, G = 35 GPa; for aluminum, G = 28 GPa, and for steel, G = 83 GPa. Determine the maximum shearing stress developed in each segment (G – Shear modulus). | CO4 | 20 |
| **(OR)** | | | | |
| 8. |  | A shaft is transmitting 97.5 kW at 180 r.p.m. If the allowable shear stress in the material is 60 MPa and the shaft is not to twist more than 1° in a length of 3 meters, find the suitable diameter for the shaft. Take shear modulus G = 80 GPa. | CO4 | 20 |
|  | | **Compulsory**: |  |  |
| 9. | a. | Define spring stiffness. | CO5 | 2 |
| b. | Differentiate between close coiled and open coiled helical springs. | CO5 | 2 |
| c. | A close-coiled helical spring is to have a stiffness of 900 N/m in compression with a maximum load of 45 N and a maximum shearing stress of 120 N/mm2. The solid length of the spring (i.e. coil touching) is 45 mm. Find the wire diameter, mean coil radius and number of coils, Shear modulus G = 40000 N/mm2. | CO5 | 16 |