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



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

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| **Code :** | **16AE2001** | **Duration :** | **3hrs** |
| **Sub. Name :** | **STRUCTURAL 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 1000mm2, is subjected to axial force as shown in fig. below.  20kNN  50 kN  80kN  10kN    600mm 1m 1.2 m  Find the total elongation of the bar. Take E=1.05×105 N/mm2 | CO1 | 10 |
| b. | A rod of 4 m long is subjected to an axial pull of 30kN. Find the minimum diameter of the rod if the permissible stress is limited to 200×106 N/m2. Also determine the elongation. Take E=200 kN/mm2. | CO1 | 10 |
| (OR) | | | | |
| 2. |  | A steel rod of 30 mm diameter passes centrally through a copper tube of 60 mm external diameter and 50 mm internal diameter. The tube is closed at each end by rigid plates of negligible thickness. Calculate the stress developed in copper and steel when the temperature of the assembly is raised by 60 ̊ C.  Take E for steel = 2×105 N/mm2 , E for copper =1×105 N/mm2  α for steel = 12×10-6/ ̊C and α for s copper = 12×10-6/ ̊C | CO1 | 20 |
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| 3. | a. | Derive an expression for the stresses on an oblique plane of a rectangular body, when the body is subjected to a simple shear stress. | CO1 | 10 |
|  | b. | A body is subjected to direct stresses in two mutually perpendicular directions. Determine graphically the resultant stress on an oblique plane when the stresses are unequal and unlike. | CO1 | 10 |
| (OR) | | | | |
| 4. | a. | Derive the equation of bending with suitable assumptions. | CO2 | 10 |
|  | b. | The principal stresses at a point in an elastic material are 100 N/mm2(tensile),  80 N/mm2(tensile) and 50 N/mm2(compressive).If the stress at the elastic limit in simple tension is 200 N/mm2,determine whether the failure of material will occur according to maximum principal stress theory. If not, then determine the factor of safety. | CO2 | 10 |
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| 5. |  | Draw shear force and bending moment diagram for the following beam. | CO2 | 20 |
| (OR) | | | | |
| 6. | a. | Draw shear force and bending moment diagrams for a cantilever beam of length 2m carries a uniformly distributed load of 1.5kN/m run over the whole length and a point load of 2kN at a distance of 0.5m from the free end. | CO2 | 10 |
|  | b. | Draw shear force and bending for the simply supported beam given below | CO2 | 10 |
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| 7. | a. | A cantilever of length 5 metre carries a uniformly distributed load of 15 kN per metre length over the entire length. If the moment of inertia of the beam =7.95×107mm4 and value of young’s modulus E=1×105 N/mm2 , determine the deflection at the free end. | CO4 | 10 |
|  | b. | A beam 4m long, simply supported at its ends, carries a point load W at its centre. If the slope at the ends of the beam is not to exceed 1 ̊, find the deflection at the centre of the beam. | CO4 | 10 |
| (OR) | | | | |
| 8. | a. | A beam of length 6m is simply supported at its ends and carries two point loads of 48kN and 40kN at a distance of 1m and 3m respectively from the left support.Find:   1. deflection under each load 2. maximum deflection 3. the point at which maximum deflection occurs.   Given E=2×105N/mm2 and I=85×106 mm4 | CO4 | 20 |
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|  | | **Compulsory**: |  |  |
| 9. |  | A hollow shaft of diameter ratio 3/8 is required to transmit 588 kW at 110 rpm. The maximum torque exceeds the mean by 20%. The shear stress is limited to 63 N/mm2 and the twist should not be more than 0.0081 rad. Calculate the external diameter required satisfying both the conditions. Take G=84GPa, Length=3m. | CO3 | 20 |