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



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

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| **Code :** | **18ME2032** | Duration : | **3hrs** |
| **Sub. Name :** | **MECHANICS OF SOLIDS** | Max. marks : | **100** |

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| **Q. No.** | **Questions** | **Course Outcome** | **Marks** |
|  | **PART-A(10X1=10 MARKS)** | | |
| 1. | The internal resistance the body offers to meet the external force is called \_\_\_\_\_. | CO1 | 1 |
| 2. | The unit of stress in S.I. unit is \_\_\_\_\_. | CO1 | 1 |
| 3. | Define Poission’s ratio. | CO3 | 1 |
| 4. | Give the relation between E (modulus of elasticity) , C (modulus of rigidity) and K (Bulk modulus of elasticity). | CO2 | 1 |
| 5. | Bending moment at the supports in case of simply supported beams is always \_\_\_\_. | CO4 | 1 |
| 6. | A \_\_\_\_\_ load is one which is considered to act at a point. | CO4 | 1 |
| 7. | Mention the different types of supports. | CO4 | 1 |
| 8. | The line of intersection of neutral layer on the cross-section of a beam is called \_\_\_\_\_\_\_\_\_\_\_\_\_\_. | CO5 | 1 |
| 9. | Write the torsion equation. | CO5 | 1 |
| 10. | Define Torsional rigidity. | CO5 | 1 |

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|  | **PART B (6 X 3= 18 MARKS)** | | |
| 11. | A square steel rod 20mmx20mm in section is to carry an axial load (compressive) of 100kN. Calculate the shortening in a length of 50mm. E=2.14x108 kN/m2. | CO1 | 3 |
| 12. | If the strain in three mutually perpendicular directions are ex ,ey and ez ,then what is the value of volumetric strain? | CO3 | 3 |
| 13. | Differentiate moment and couple. | CO4 | 3 |
| 14. | Draw the bending moment and shear force diagram of a simply supported beam of 6 m span carrying a point load of 10kN at its mid-span. | CO5 | 3 |
| 15. | The maximum torque transmitted by the shaft of 150 mm diameter under a maximum  shear stress of 45 N/mm2 is\_\_\_\_\_\_\_\_\_. | CO5 | 3 |
| 16. | The principal stresses at a point in a material across two perpendicular planes are 80 N/mm2 and 40 N/mm2 . Find the normal and tangential stress at a plane, inclined at 20° with the major principal plane. | CO6 | 3 |

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|  | **PART C (6 X 12= 72 MARKS)**  **(Answer any five Questions from Q.no 17 to 23. Q.No 24 is a Compulsory Question)** | | | |
| 17. | a. | A copper flat measuring 60 mm \* 30 mm is brazed to another 60 mm \* 60 mm mild steel flat as shown in figure. if the combination is heated through 120°C, determine: (i) the stress produced in each of the bar (ii) shear force which tends to rupture the brazing (iii) shear stress.  Take, Ec =110 GN/m2, Es = 220 GN/m2, αc = 18.5 x 10-6per °C, αs = 12 x 10-6per °C, length of each flat = 400mm. | CO2 | 12 |
| 18. | a. | A C.I. Flat, 300 mm long and of 30 mm \* 50 mm uniform section, is acted upon by the following forces uniformly distributed over the respective cross-section; 25 kN in the direction of length(tensile); 350 kN in the direction of width (compressive); and 200 kN in the direction of thickness (tensile). Determine the change in volume of the flat. Take E = 140 GN/m2 and m = 4. | CO3 | 12 |
| 19. | a. | Draw the Shear force and Bending moment diagrams for the beam shown in the figure indicating principal values. | CO4 | 12 |
| 20. | a. | A rectangular beam 300 mm deep is simply supported over a span of 4 m. Determine the uniformly distributed load per metre which the beam may carry, if the bending stress should not exceed 120 N/m2. Take I = 8 x 106 mm4. | CO5 | 6 |
| b. | A beam is simply supported and carries a uniformly distributed load of 40 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 120 N/mm2 and the moment of inertia is 7 x 108mm4, find the span of the beam. | CO5 | 6 |
| 21. | a. | A hollow shaft, having an internal diameter 40% of its external diameter, transmits 562.5 kW power at 100 r.p.m. Determine the external diameter of the shaft if the shear stress is not to exceed 60 N/mm2 and the twist in a length of 2.5 m should not exceed 1.3 degrees. Assume maximum torque = 1.25 mean torque and modulus of rigidity as  9 x 104 N/mm2. | CO5 | 12 |
| 22. | a. | A simply supported beam loaded with point load and uniformly distributed load is shown in figure. Draw the Shear force and Bending moment diagrams | CO4 | 12 |
| 23. | a. | A member LMNP is subjected to point loads as shown in figure below. Calculate: (i) force P necessary for equilibrium (ii) Total elongation of the bar. Take E = 210 GN/m2. | CO1 | 8 |
| b. | For a given material, Young’s modulus is 110 GN/m2 and shear modulus is 42 GN/m2. Find the bulk modulus and lateral contraction of a round bar of 37.5 mm diameter and 2.4 m long when stretched 2.5 mm. | CO3 | 4 |
|  | **Compulsory:** | | | |
| 24. | a. | At a point within a body subjected to two mutually perpendicular directions, the stresses are 80 N/mm2 tensile and 40 N/mm2 tensile. Each of the above stresses is accompanied by a shear stress of 60 N/mm2. Determine the normal stress, shear stress and resultant stress on a oblique plane inclined at an angle of 45° with the axis of minor tensile stress. | CO6 | 12 |