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



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

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| **Code :** | **18ME2012** | Duration : | **3hrs** |
| **Sub. Name :** | **STRENGTH OF MATERIALS** | Max. marks : | **100** |

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| **Q. No.** | **Questions** | **Course Outcome** | **Marks** |
|  | **PART-A(10X1=10 MARKS)** | | |
| 1. | Write an equation relating Young’s modulus and rigidity modulus. | 2 | 1 |
| 2. | What is the maximum range of Poisson’s ratio? | 1 | 1 |
| 3. | State a practical example of a cantilever beam. | 5 | 1 |
| 4. | Recollect the formulae of the maximum bending moment of a simply supported beam with a point load at its mid span | 5 | 1 |
| 5. | A shaft of diameter 10 mm is subjected to a torque Nmm , what will be value of torque if the diameter is doubled provided both shafts have the same allowable shear stress? | 6 | 1 |
| 6. | At neutral axis what is the value of shear stress for a rectangular section. | 4 | 1 |
| 7. | State the formulae for torque in hollow section. | 3 | 1 |
| 8. | When is Macauley’s method preferred? | 3 | 1 |
| 9. | What are the types of springs? | 1 | 1 |
| 10. | Hoop stress can be caused only by internal pressure (True (or) False) | 2 | 1 |

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|  | **PART B (6 X 3= 18 MARKS)** | | |
| 11. | An alloy specimen has a modulus of elasticity of 120 GPa and modulus of rigidity of 45 GPa. Determine the Poisson’s ratio of the material. | 1 | 3 |
| 12. | Define shear force and bending moment and state the relationship between shear force and bending moment. | 2 | 3 |
| 13. | Distinguish between close and open coil helical springs. | 3 | 3 |
| 14. | State Maxwell’s reciprocal theorems. | 4 | 3 |
| 15. | In a hollow circular shaft of outer and inner diameter of 20cm and 10cm respectively, the shear stress is not to exceed 40N/mm2. Find the maximum torque which the shaft can transmit safely. | 6 | 3 |
| 16. | A cylinder of internal diameter 2.5m and thickness 5cm contains a gas. If the tensile stress in the material is not to exceed 80N/mm2, determine the internal pressure of the gas. | 6 | 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. | 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. | 3 | 12 |
| 18. | a. | Draw the shear force and bending moment diagrams for the beam shown in fig. Also determine the maximum bending moment.  F  E  A  B  D  C  1 m  2 m  2 kN/m  1 m  1 m  1 m  1 kN  4 kN | 5 | 12 |
| 19. | a. | A simply supported beam is having an I cross-section has a top flange of 100 mm x 30 mm, web of 30 mm x 120 mm and bottom flange of 120 mm x 50 mm is loaded with a U.D.L over its entire 8 m span. Determine the magnitude U.D.L if maximum permissible bending stress in tension is limited to 30 MN/m2 and in compression to 45 MN/m2. Also compare the maximum bending stresses setup in the section. | 1 | 12 |

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| 20. | a. | A beam of length 6 m is simply supported at its ends and carries two point loads of 48 kN and 40 kN at distance of 1 m and 3 m respectively from the left support. Find (i) Deflection under each load, (ii) Maximum deflection, (iii) The point at which maximum deflection occurs. Take E = 2 x 105 N/mm2 and I = 85 x 106 mm4. | 5 | 12 |
| 21. | a. | A hollow shaft of diameter ratio 3/8 (internal dia to outer dia) is to transmit 375kW at 100rpm. The maximum troque being 20% greater than the mean. The shear stress is not to exceed 60N/mm2 and a twist in a length of 4m is not to exceed 2°. Calculate its internal and external diameter which would satisfy the above conditions. Assume modulus of rigidity as 85×103 N/mm2. | 6 | 12 |
| 22. | a. | A member ABCD is subjected to point loads P1,P2,P3 and P4 as shown in figure. Calculate the force P3 necessary for equilibrium if P1 = 120kN, P2= 220kN and P4=160kN. Determine also the net change in the length of the member. Take E=200GN/m2. | 4 | 12 |
| 23 | a. | For the state of plane stress shown in figure, i) construct Mohr’s circle ii) determine the principal planes iii) determine the principal stresses  iv) determine the maximum shearing stress and corresponding normal stress. | 3 | 12 |
|  | **Compulsory:** | | | |
| 24. | a. | A cylindrical vessel whose ends are closed by rigid flange plates, is made of steel plate of 3mm thick. The length of internal diameter of the vessel are 50cm and 25 cm respectively. Determine the longitudinal and hoop stress in the cylindrical shell due to internal fluid pressure of 3N/mm2 , also calculate the increase in length, diameter and volume of the vessel. Take E=2×105N/mm2 and Poison’s ratio = 0.3. | 6 | 12 |