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



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

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| **Code :** | **18AE2005** | **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. | Define stress. | CO1 | 1 |
| 2. | Define Poisson’s ratio. | CO1 | 1 |
| 3. | List the types of supports. | CO2 | 1 |
| 4. | Define shear force in a beam. | CO2 | 1 |
| 5. | The slope at the middle of a simply supported beam is \_\_\_\_\_\_. | CO3 | 1 |
| 6. | Define neutral axis in beam. | CO2 | 1 |
| 7. | Write the polar moment of inertia for solid circular shaft. | CO4 | 1 |
| 8. | The value of the shear stress at the center of the shaft subjected to torque is \_\_\_\_\_\_\_\_. | CO4 | 1 |
| 9. | List the various types of springs. | CO5 | 1 |
| 10. | Define stiffness. | CO5 | 1 |

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| **PART – B (6 X 3 = 18 MARKS)** | | | |
| 11. | Draw the stress-strain curve for steel material and indicate the salient points. | CO1 | 3 |
| 12. | Explain point of contraflexure. | CO2 | 3 |
| 13. | State assumptions in the theory of simple bending. | CO3 | 3 |
| 14. | Define torsional rigidity. | CO4 | 3 |
| 15. | Define resilience. | CO5 | 3 |
| 16. | Principal stress theory is not suitable for ductile materials. Justify the statement. | 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. | If the block as shown in figure is subjected to a centrally applied force of 600 kN, determine the average normal stress in the material. | | CO1 | 4 |
| b. | Determine the change in length, width and thickness of a steel bar which is 4 m long, 30 mm wide and 20 mm thick when it is subjected to an axial pull of 30 kN in the direction of length. Young’s modulus E = 2x105 N/mm2 and Poisson’s ratio = 0.3. Also find the volumetric strain. | | CO1 | 8 |
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| 18. |  | Draw the shear force and bending moment diagram for the beam shown in figure. | | CO2 | 12 |
| 19. |  | A beam of 8 m long is supported at A and B as shown in figure. It is loaded with a point loads of 4, 10 and 7 kN at points C, D and E respectively. If E = 200x106 kN/m2 and I = 10x10-6 m4 , determine deflection at the point C and D. | | CO3 | 12 |
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| 20. |  | A circular shaft is required to transmit 200 kW at 300 rpm. Find a suitable diameter for the shaft, if the permissible shear stress in the shaft is 65 kN/m2 and the angle of twist is not to exceed 10 in a length of 3 m. Take shear modulus G = 100 GPa. | | CO4 | 12 |
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| 21. |  | A helical spring, in which the mean diameter of the coil is 12 times the wire diameter, is to be designed to absorb 300 Nm of energy with an extension of 150 mm. The maximum shear stress is not to exceed 140 MN/m2. Determine the mean diameter of the helix, diameter of the wire and the number of turns. Also find the load with which an extension of 50 mm could be produced in the spring. Take shear modulus G = 80 GPa. | | CO5 | 12 |
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| 22. |  | At a point in a strained material, the state of stress is as shown in figure. Determine both theoretically and graphically (Mohr’s circle) (i) principal stresses, (ii) location of principal planes and (iii) maximum shear stress and its location. | | CO1 | 12 |
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| 23. |  | A load of 2 MN is applied on a short concrete column 500 mm x 500 mm in section. The column is reinforced with four steel bars of 10 mm diameter one in each corner. Find the stresses in the concrete and steel bars and the change in length of the column. Take Es = 210 GPa, Ec = 14 GPa. | | CO1 | 12 |
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|  | **Compulsory:** | | | | |
| 24. | a. | | The principal stresses at a point in an elastic material are 100 N/mm2 (tensile), 100N/mm2(tensile) and 50 N/mm2(compressive). If the stress at elastic limit in simple tension is 200 N/mm2, determine whether the failure of materials will occur according to maximum principal stress theory. If not, determine the factor of safety. | CO1 | 4 |
| b. | | The principal stresses at a point in an elastic material are 200 N/mm2 (tensile), 80 N/mm2 (tensile) and 50 N/mm2 (compressive). If the stress at elastic limit in simple tension is 200 N/mm2, determine whether the failure of materials will occur according to maximum principal strain theory.  Question No.24 from Module 6 | CO2 | 8 |