**Hall Ticket Number: 20ME303**

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| **II/IV B.Tech (Regular) DEGREE EXAMINATION** | | | |
| **March, 2022** | **Mechanical Engineering** | | |
| **Third Semester** | **Strength of Materials** | | |
| **Time:** Three Hours | | **Maximum: 7**0 Marks | |
| *Answer Question No.1 compulsorily.* | | | (14X1 = 14 Marks) |
| *Answer ONE question from each unit.* | | | (4X14=56 Marks) |

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| 1. | a) | | Define Shear Stress and Shear Strain. | CO1 |  |
|  | b) | | State the relationship between E and G. | CO1 |  |
|  | c) | | Define factor of safety. | CO1 |  |
|  | d) | | A solid shaft of 150 mm diameter is used to transmit torque. Compute the maximum torque transmitted by the shaft if the maximum shear stress induced in the shaft is 45 N/mm2 | CO2 |  |
|  | e) | | When will be the BM maximum in a beam ? | CO2 |  |
|  | f) | | What is polar moment of inertia a solid shaft having diameter d? | CO2 |  |
|  | g) | | What are the assumptions of theory of simple bending ? | CO3 |  |
|  | h) | | Define Bending Stress. | CO3 |  |
|  | i) | | State Mohr’s Moment-Area theorems for finding slopes and deflections. | CO3 |  |
|  | j) | | List three methods of finding out slopes and deflections | CO3 |  |
|  | k) | | What is effective length in a column. | CO4 |  |
|  | l) | | Give the expression for major principal stress in a two dimensional system | CO4 |  |
|  | m) | | Write an expression for crippling load of a column when one end of the column is fixed and other end is hinged. | CO4 |  |
|  | n) | | What is Mohr’s circle of stresses? | CO4 | 1M |
| **Unit - I** | | | | | |
| 2. | a) | Derive the expression for extension of a bar of tapering cross-section with diameters D and d. | | CO1 | 8M |
|  | b) | What are the different types of stresses? Define elastic constants E,G and K. | | CO1 | 6 M |
| **(OR)** | | | | | |
| 3. | a) | A brass tube of 80 mm outside diameter 70mm internal diameter completely encloses a steel bar of 40 mm diameter. The composite system measures 400 mm in length and carries an axial thrust which induces a thrust equal to 50 N/mm2 in the brass tube. Determine: (i) stress developed in steel bar; (ii) magnitude of compressive force and (iii) change in length of composite bar. Take ES = 210 GPa and EBr = 105 GPa. | | CO1 | 9M |
|  | b) | A circular rod of diameter 10mm and 200mm long is subjected to a tensile force 40 kN. The modulus of steel may be taken as 200 kN/mm2 . Find stress, strain and elongation of the bar due to applied load. | | CO1 | 5M |
| **Unit - II** | | | | | |
| 4. | a) | State the assumptions in Torsional analysis. Write the Torsional equation and indicate the various terms with suitable units | | CO2 | 7M |
|  | b) | A solid circular shaft of length 4 m transmitting 1.0 MW at 4000 rpm. Determine the shaft diameter, assuming the maximum allowable shear stress is 100 N/mm2 and G = 65 GPa for the material. | | CO2 | 7M |
| **(OR)** | | | | | |
| 5. | a) | Draw the shear force and bending moment diagram of a simply supported beam having effective span of 6m, when it is subjected to an uniformly distributed load of 10 kN/m in the middle portion of length 2m and a concentrated load of 60 kN at a distance of 2 m from the left support. | | CO2 | 9M |
|  | b) | State the relationship between load, shear force and bending moment. | | CO2 | 5M |
| **Unit - III** | | | | | |
| 6. | a) | Derive the simple bending equation. | | CO3 | 14M |
| **(OR)** | | | | | |
| 7. | a) | Determine slope at the left support and deflection under the load and also the maximum deflection of a simply supported beam of length 6m,which is carrying a point load of 5 KN at a distance of 3m from the left end .Take E=2x105 N/mm2 and I=1x108 mm4 . | | CO3 | 7M |
|  | b) | A beam 6 meters 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 exceeding 10 ,find the deflection at the centre of the beam. | | CO3 | 7M |
| **Unit - IV** | | | | | |
|  | b) | At a point within a body subjected to two mutually perpendicular directions, the stresses are 60 N/mm2 tensile and 30 N/mm2 tensile. Each of the above stresses is accompanied by a shear stress of 40 N/mm2. Determine normal stress and shear stress oriented at an angle 20o from the 60 N/mm2 tensile stress direction. | | CO4 | 14M |
| **(OR)** | | | | | |
| 9. | a) | A column of timber section 20cm x 25 cm is 5m long with both ends being fixed. If the Young’s modulus for timber =17.5 kN/mm2, determine:   1. Crippling load and 2. Safe load for the column if factor of safety=3 | | CO4 | 7M |
|  | b) | Derive the expression for crippling load when the column is pinned at both the ends | | CO4 | 7M |

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