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

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**End Semester Examination – Nov/Dec – 2018**

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| **Code :** | **17CE2003** | **Duration :** | **3hrs** |
| **Sub. Name :** | **STRENGTH OF MATERIALS-I** | **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 steel bar containing three segment with varying cross sections (left segment AB with diameter of 45 mm, middle segment BC with diameter of 35 mm and right segment CD with diameter of 25 mm) is subjected to forces as shown in figure. Determine the total elongation of the bar. Assume the modulus of elasticity for steel material, Es=210Gpa | CO1 | 10 |
| b. | A load of 200 N is applied on a short concrete column 500mm x 500 mm. 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. Take E for steel as 2.1 x 105 N/mm2 and for concrete as 1.4 x 105N/mm2. | CO1 | 10 |
| (OR) | | | | |
| 2. | a. | At a point within a body subjected to two mutually perpendicular directions, the stresses are 80 N/mm2 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 an oblique plane inclined at an angle of 45o with the axis of minor tensile stress | CO1 | 15 |
| b. | A rectangular bar of cross sectional area 20000mm2 is subjected to an axial load of 28kN. Determine the normal and shear stresses on a section which is inclined at an angle of 30o with normal cross section of the bar. | CO1 | 5 |
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| 3. | a. | A beam of 10 m length is simply supported at its ends. It carries a uniformly distributed load of 20 kN/m run over the length of left half of its span, together with concentrated load of 20, 40 and 20 kN situated at 1.5, 2.5 and 5 m respectively from right hand support. Draw the bending moment and shear force diagrams for this beam and find out the magnitudeand position of the maximum bending moment taking place in this beam. | CO2 | 13 |
| b. | A cantilever of span 5m carries concentrated loads of 1kN at C and A 1m and 5m from the fixed end. It also carries a uniformly distributed load of 2kN/m over DC of span 2m, such that DA=3m. Draw the S.F.D and B.M.D. | CO2 | 7 |
| (OR) | | | | |
| 4. | a. | A rectangular beam 300 mm deep is simply supported over a span of 5 metres. Determine the uniformly distributed load per metre which the beam may carry, if the bending stress should not exceed 110N/mm2. Take I = 8 x 106N/mm2. | CO3 | 10 |
| b. | A rectangular beam 100 mm wide and 250 mm deep is subjected to a maximum shear force of 50 kN. Determine  i) Average shear stress ii) Maximum shear stress iii) Shear stress at a distance of 25 mm above neutral axis. | CO3 | 5 |
| c. | A leaf spring carries a central load of 3000 N. The leaf spring is to be made of 10 steel plates of 50 mm wide and 6mm thick. If the bending stress is limited to 150 N/mm2. Determine: i) Length of the spring ii) Deflection at the centre of the spring. Take E for steel as 2.1 x 105 N/mm2. | CO6 | 5 |
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| 5. | a. | List the assumptions made in the derivation of shear stress produced in a circular shaft subjected to torsion. | CO5 | 5 |
| b. | Determine the diameter of a solid shaft which will transmit 300 kW at 250 r.p.m. The maximum shear stress should not exceed 30 N/mm2 and twist should not be more than 1o in a shaft length of 2 m. Take modulus of rigidity of the material of the spring = 1x 105 N/mm2. | CO5 | 15 |
| (OR) | | | | |
| 6. |  | A closed coil helical spring has a stiffness of 10 N/mm. Its length when fully compressed, with adjacent coils touching each other is 40 cm. The modulus of rigidity = 0.8 x 105 N/mm2.   1. Determine the wire diameter and mean coil diameter if their ratio is 1/10 2. If the gap between any two adjacent coil is 0.2 cm, what maximum load can be applied before the spring becomes solid? 3. What is the corresponding maximum shear stress in the spring? | CO6 | 20 |
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| 7. |  | A beam of length 5 m is simply supported at its ends and carries two point loads of 38 kN and 20 kN at a 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. Given E = 2 x 105 N/mm2 and I = 85 x 106 mm4. Use Macaulay’s method. | CO4 | 20 |
| (OR) | | | | |
| 8. |  | A cantilever 3 m long carries a concentrated load of 10 kN at 2m from the fixed end and a load of 10 kN at the free end. Determine the deflection at the free end. Use conjugate beam method.  Assume E= 2x105 N/mm2, I=15x106 mm4. | CO4 | 20 |
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|  | | **Compulsory**: |  |  |
| 9. |  | Analyse the truss using method of joints and find the force in the members AB, AH, HG,HB, BC and BG | CO3 | 20 |