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



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

|  |  |  |  |
| --- | --- | --- | --- |
|  |  |  |  |
| **Code :** | **18ME3017** | **Duration :** | **3hrs** |
| **Sub. Name :** | **ADVANCED STRESS ANALYSIS** | **Max. marks :** | **100** |

**ANSWER ANY FIVE QUESTIONS (5 x 16 = 80 Marks)**

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **Q. No.** | **Sub Div.** | | **Questions** | **Course**  **Outcome** | **Marks** |
| 1. | a. | | Define plane stress. | CO1 | 2 |
| b. | | 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. | CO1 | 14 |
|  |  | |  |  |  |
| 2. | a. | | Explain Castigliano’s second theorem. | CO2 | 2 |
| b. | | For the structure shown in figure use Castigliano’s method to determine the vertical deflection of point C. All members have a cross- sectional area of 200 mm2; members 1,2,4 and 5 are of length 1 metre and members 3,6 and 7 are of length 1.4142 metre. E=210 GPa. | CO2 | 14 |
|  |  | |  |  |  |
| 3. |  | | A steel tube 1.4 m long has the cross section as shown in figure. The tube is transmitting a torque of 300 N-m. Determine the average shear stress in each wall and the angle of twist of the tube. E = 210 GPa and ν = 0.29. | CO3 | 16 |
|  |  | |  |  |  |
| 4. |  | | i) Determine the shear center O of a channel section of uniform thickness ( as shown in figure), knowing that b=80 mm, h=120 mm and t = 4 mm. (assume no twist)  ii) determine the distribution of the shearing stresses caused by a 8 kN vertical downward shear **V** applied at the shear center O. | CO4 | 16 |
|  |  | |  |  |  |
| 5. | a. | | Derive the equations for σr and σθ of a pressurized non-rotating axially symmetric thick cylinder. | CO5 | 10 |
| b. | | An aluminium cylinder (Ea =70 MPa, νa=0.33) with an outer diameter of 140 mm and inner diameter of 100 mm is to be press-fitted over a stainless-steel cylinder (Es =200 MPa, νs=0.3) with an outer outer diameter of 100.2 mm and inner diameter 40mm. Determine (i) the interface pressure p, and (ii) the maximum stresses in the cylinders. | CO5 | 6 |
|  |  | |  |  |  |
| 6. |  | | A single horizontal force P of magnitude 1200 N is applied to end D of lever ABD. Knowing that AB of the lever has a diameter of 30 mm, determine (i) the normal and shearing stresses on an element located at point H and having sides parallel to the x and y axes, (ii) the principal planes and principal stresses at point H. | CO1 | 16 |
|  |  | |  |  |  |
| 7. | a. | | Define Castigliano’s first theorem | CO2 | 2 |
| b. | | Use Castiqliano’s first theorem to determine the cable forces of the symmetric structure shown in figure. The length, area, and modulus of cable 1 are L1, A1, and E1 , cable 2 are L2, A2, and E2, and cable 3 are L3, A3, and E3. The materials are linear.  Take A1,A2 and A3 = 20 mm2  L1 = 1 m, E1= E2= E3= 200GPa and load at C= 4000N | CO2 | 14 |
|  | | | | | |
| **COMPULSORY QUESTION (1 x 20 = 20 Marks)** | | | | | |
| 8. | |  | (a) Derive the equations for σx and σy andτxy  considering contact pressure (p) acting over an infinitesimal surface area t dy1. (b) determine the stress distribution for a constant pressure of p(y1) = p0 in the region –a ≤ y ≤ a as shown in figure. | CO6 | 20 |