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

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**End Semester Examination – Nov/Dec – 2017**

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| **Code :** | **17CE3003** | **Duration :** | **3hrs** |
| **Sub. Name :** | **APPLIED ELASTICITY AND PLASTICITY** | **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. | State the necessity for St.Venant’s compatibility equations | CO1 | 2 |
| b. | Why is stress at a point called a second order tensor? | CO1 | 2 |
| c. | Calculate the body forces for the given state of stresses at a point  P ( 1,2,3) σx = 20x3 + y3 τxy = z  σy = 30x3 + 200 τyz = x3  σz = 30y2 + 30z3 τzx = y2 | CO2 | 4 |
| d. | Develop the St.Venant Compatibility conditions | CO2 | 4 |
| e. | The state of stress at a particular point relative to the xyz coordinate system is given by the stress matrix     1. Find the stress invariants 2. Find the normal stress, shear stress and resultant stress on octoctahedral plane and 3. Find principal stresses and their directions | CO3 | 8 |
| (OR) | | | | |
| 2. | a. | Explain St.Venant’s Principle. | CO1 | 2 |
| b. | List the stress invariants. | CO1 | 2 |
| c. | What are the two types of formulation of elasticity problems? Formulate the Governing equations for any one type. | CO1 | 4 |
| d. | Prove that Principal stress problem is an Eigen value problem. | CO2 | 4 |
| e. | The displacement field components at a point are given by  U= - 0.0001 y2 + 0.0015 xyz ; V= 0.0002 x2y + 0.0003 x2z ;  W= 0.0015 xyz + 0.0002 x2yz.  Determine the strain tensor at a point P ( 2,-3,-1)  Find the principal strains and their directions. | CO3 | 8 |
| 3. | a. | Investigate what problem of plane stress is solved by the stress function:. | CO4 | 8 |
|  | b. | Analyze the disc with diametric loading. | CO5 | 6 |
|  | c. | For a plane strain problem, develop the equation  and a companion equation. | CO5 | 6 |
| (OR) | | | | |
| 4. | a. | A beam of narrow rectangular cross section is subjected to uniformly distributed load of q over the entire span. Assuming suitable stress function, derive expressions for stresses and displacements, if the beam is simply supported. | CO5 | 10 |
|  | b. | Determine the stress distribution in a curved bar subjected to pure bending. | CO4 | 8 |
|  | c. | Explain the use of Airy’s stress function. | CO4 | 2 |
|  |  |  |  |  |
| 5. | a. | Develop the equation for torsion of thin rectangle and sketch the shear flow in a channel section. | CO6 | 4 |
|  | b. | Develop the expression for angle of twist and shear stress for a thin walled closed non-circular section due to twisting moment and hence determine the shear stress and angle of twist for a hallow thin walled aluminum tube of rectangular cross section as shown in Fig subjected to a torque of 56.5kNm. Assume G =28Gpa | CO6 | 8 |
|  | c. | Develop the governing equations for analyzing torsional capacity and unit angle of twist for a thin walled two celled tube section. | CO6 | 8 |
| (OR) | | | | |
| 6. | a. | Sketch the torsional shear flow in a thin I section. | CO2 | 2 |
|  | b. | A two cell tube shown in Figure is subjected to a torque 10kN.m. Determine the shear stress in each part and angle of twist per metre length. Take G=80 GPa. | CO4 | 10 |
|  | c. | A thin-walled member 1.2 m long has the cross-section with uniform thickness 1mm shown in Fig. Determine the maximum torque which can be carried by the section if the angle of twist is limited to 10". What will be the maximum shear stress when this maximum torque is applied? For the material of the *G* = 80 GN/m2.  Radius 10 mm  40mm | CO4 | 8 |
| 7. | a. | State examples for beams on elastic foundation. | CO1 | 2 |
|  | b. | Develop the expression of an infinite beam resting on elastic foundation for BM, SF, deflection and rotation if it is subjected to udl for a short length. | CO6 | 10 |
|  | c. | A semi-infinite beam (100 mm wide and 50 mm deep) resting on elastic foundation is hinged at one end and a concentrated load 12 kN is applied at this end. Determine the maximum deflection and stresses in the beam. E = 90GPa. Poisson’s ratio = 0.3. modulus of elastic foundation = 8.4 MPa. | CO6 | 8 |
| (OR) | | | | |
| 8. | a. | Develop the expressions for maximum bending moment, deflection and shear force for a simply supported finite beam resting on elastic foundation and carrying udl. | CO6 | 10 |
|  | b. | Develop the expressions for maximum bending moment, deflection and shear force for a semi infinite beam resting on elastic foundation and carrying a concentrated moment at the finite end of the beam. | CO6 | 10 |
| 9. | | **Compulsory**: |  |  |
|  | a. | Explain Nadai’s Sand heap Analogy . | CO2 | 2 |
|  | b. | Develop the necessary equations and yield surface according to Von Mises yield criterion. | CO6 | 8 |
|  | c. | A thick cylinder of internal radius 15 cm and external radius 25 cm is subjected to an internal pressure” p” MPa.. If the yield stress for the cylinder material is 220 N/mm2. , determine the following   1. The pressure at which the cylinder will start yielding just at the inner surface. 2. The stresses when the cylinder has a plastic front radius of 20 cm and 3. The stresses when the entire cylinder has yielded.   Assume Von-Mises yield condition and a state of plane strain. | CO5 | 10 |

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