

**Government College of Engineering, Aurangabad**  
(An Autonomous Institute of Government of Maharashtra)

**M.E. (Structural Engineering- Full Time & Part Time) Examination**  
End Semester Examination Nov/Dec. 2016

**AM-541: THEORY OF ELASTICITY AND PLASICITY**

**28 NOV 2016**

Time: Three Hours

Max. Marks: 60

“Verify the course code and check whether you have got the correct question paper”

N.B:-

1. Question No. ONE is compulsory and solve any FOUR questions from Q.nos.2 to 7
2. Figures to the right indicates full marks
3. Assume suitable data if necessary and state clearly
4. Use of non-programmable calculator is allowed

**Q.No.1 Solve ANY FOUR questions from the following Questions (12 Marks)**

- i) Explain octahedral stress
- ii) Show whether Airy's stress function satisfies both the equilibrium equation
- iii) What are stress invariants?
- iv) Express the equilibrium equations in polar co-ordinates.
- v) Explain briefly St. Venant's Approach for torsion
- vi) Write a short note on Von-Mises yield criteria

**Q. No. 2.** The displacement field in a body is specified as

$$\begin{aligned}u &= x^3 + 3y^3 \\v &= 3y^2 = 4x \\w &= 0\end{aligned}$$

Determine stress and strain components at a point whose coordinates are (2, 3).

Take  $E = 2 \times 10^5$  MPa and Poisson ratio is 0.30 (12 Marks)

**Q. No.3.** Determine the following are Airy's stress function and examine the stress

distribution represented by them. (12 Marks)

- i)  $\Phi = Ax^2 + By^2$
- ii)  $\Phi = Ax^3$
- iii)  $\Phi = A(x^4 - 3x^2y^2)$

**Q. No.4.** Derive the equations of equilibrium of a two dimensional stress system in Cartesian coordinate system. (12 Marks)

**Q. No.5** A hollow thin walled brass tube has an equilateral triangular section, the mean length of the side of the triangle is 125 mm and thickness of the wall is 3 mm. If the tube is subjected to a twisting moment of  $2 \times 10^4$  Nmm, find the maximum shearing stress and the angle of twist per unit length .  
( 12 Marks)

**Q. No.6** The state of stress at a point is given by  $\sigma_x = 70$  MPa,  $\sigma_y = 120$  MPa and  $\tau_{xy} = 35$  MPa. If the yield strength for the material is 125 MPa, check whether yielding will according to i) Tresca's yield criteria  
(ii) Von Misses yield criteria  
( 12 Marks)

**Q. 7** A steel bolt is subjected to a bending moment of 200 NM and torque of 120 NM. If the yield stress in tension for the bolt material is  $250 \text{ MN/m}^2$ , Determine the diameter of the bolt according to (i) Tresca's yield criteria  
(ii) Von Misses yield criteria  
( 12 Marks)