(Pages : 2) **682**

Reg. No. : .....

Name : .....

First Semester M.Tech. Degree Examination, March 2014
(2008 Scheme)
Mechanical (Machine Design)
MDC – 1003 : MECHANICS OF MATERIALS

Time : 3 Hours Max. Marks : 100

Instruction : *Answer* ***any five*** *questions.* ***All*** *questions carry* ***equal*** *marks.*

1. a) Derive the stress transformation equations in 2 dimensions.

   b) The following stress distribution has been derived for a component :

   $\sigma_{xx} = 3x^2 - 3y^2 - z$; $\sigma_{yy} = 3y^2$; $\sigma_{zz} = 3x + y - z + \frac{1}{4}$;

   $\tau_{xy} = z - 6xy - \frac{3}{4}$; $\tau_{yz} = 0$; $\tau_{zx} = x + y - \frac{3}{2}$

   Evaluate whether the equilibrium condition is satisfied in the absence of body forces.

2. a) Derive the general equations for the six components of strains from the displacement function u, v, w in Cartesian co-ordinates.

   b) The stress components at a point are given by : $\sigma_{xx} = 150$ kPa ; $\sigma_{yy} = -210$ kPa ; $\sigma_{zz} = 110$ kPa ; $\tau_{xy} = 220$ kPa ; $\tau_{yz} = 140$ kPa ; $\tau_{zx} = -130$ kPa. Determine the strain components at this point if $E = 199 \times 10^6$ kPa and $v = 0.25$.

3. a) Show that $\Phi = (q/8c^3).\{x^2(y^3 - 3c^2y + 2c^3) + y^3(2c^2 - y^2)\}$ is an acceptable stress function and hence find the stress field it represents.

   b) Derive the Generalized Hooke's Law.

P.T.O.

4. a) Describe the concept of torsion in thin walled sections.

   b) Estimate the shear stress and total angle of twist of a thin walled circular cylinder of outer diameter 125 mm and 5 mm thickness. The steel tube is 0.4 m long and is transmitting a torque of 2 Knm. E = 200 GPA and poisons ratio is 0.3.

5. a) Explain the propagation concept of longitudinal waves in prismatic bars.

   b) A body of 15 mm radius is resting in a spherical seat of 50 mm diameter. They support a load of 45 KN. Both the ball as well as supporting surface material has a E of 200 GPA and poisons ratio of 0.28. Calculate the contact pressure and also the maximum shear stress generated in the element.

6. a) Describe the differential equation for a thin rectangular plate.

   b) A rectangular plate of thickness t is subjected to a uniformly distributed load of w Kn/m. Establish the Navier solution for this problem.