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Total Number of Pages: 01

M.Tech.
GEPE102

1st Semester Back Examination 2017-18
THEORY OF ELASTICITY & PLASTICITY
BRANCH(S): GEOTECHNICAL ENGG
Time: 3 Hours
Max Marks: 70
Q.CODE: B774

Answer Question No.1 which is compulsory and any five from the rest.
The figures in the right hand margin indicate marks.

- Q1** **Answer the following questions:** **(2 x 10)**
- a) Differentiate between *shear stress* and *complimentary shear stress*.
 - b) What is the difference between *body force* and *surface force*. Explain.
 - c) State various stress components in a 3 dimensional system,
 - d) Write the constitutive relationship between stress and strain for a isotropic material in plane stress condition.
 - e) What do you mean by *warping* of elastic members?
 - f) State the independent elastic constants for an isotropic material.
 - g) Draw figures and show difference between Cartesian coordinate and polar coordinate.
 - h) Distinguish between flexural rigidity and torsional rigidity.
 - i) What do you mean by *slip line*?
 - j) Which failure theories are most suited for brittle materials?
- Q2** What do you mean by compatibility condition? Derive the equilibrium and compatibility equations in terms of stress for a three dimensional elastic body. **(10)**
- Q3** Prove that, $\sigma_x = \lambda e + 2G\epsilon_x$, if $\lambda = \mu E / (1 + \mu)(1 - 2\mu)$, where the symbols have their usual meaning. **(10)**
- Q4** What is a stress function? Assuming a suitable stress function in terms of polynomial, investigate the state of stress in a rectangular plate with sides parallel to the coordinate axes. **(2+8)**
- Q5** Using suitable stress function, derive the displacements for a cantilever beam loaded at free end. Derive the stresses for the above beam. **(10)**
- Q6** Discuss the following failure theories: (a) Maximum strain energy theory, (b) Octahedral stress theory. **(5+5)**
- Q7** A hollow circular torsion member is having inside diameter 18mm, outside diameter 22mm and ratio of thickness to inner diameter = 0.10. If the shear stress at the mean diameter is $\tau = 70$ MPa, find the torque and angle of twist. Compare these values with values obtained using elastic theory. Given rigidity modulus $G = 77.5$ GPa. **(10)**
- Q8** **Write short notes on any TWO :** **(5 x 2)**
- a) Plane stress and plane strain condition
 - b) Generalised Hooke's law
 - c) Saint-Venant principle
 - d) Yield criterion