Registration no: | | | | | | | | | | |

Total Number of Pages: 02 **M.TECH**

MDPC 102

1st Semester Regular/ Back Examination – 2016-17

APPLIED ELESTICITY & PLASITCITY

BRANCH(S): MECHANICAL SYSTEM DESIGN

Time: 3 Hours

Max Marks: 70

Q.CODE:Y871

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) Explain stress ellipsoid.
b) State the various failure criterion that govern the failure of materials under static loading.
c) Derive the equations of Equilibrium in 2D case.
d) Discuss the effect of a circular hole in stress distribution of plates
e) Starting from the principal stress tensor, determine the magnitudes of the three maximum shear stresses that occur at a point and their direction cosines.
f) Explain about plane stress and plane strain problems in elasticity with two examples.
g) what is the meaning of pure bending of a cantilever.
h) Define poisson's ratio
i) Define axisymmetric problem with the help of suitable example
j) Compute Lame's constants λ and μ for steel having E = 207 x 10^6 kPa and ν = 0.3.

Q2 a) What is generalized Hooke's law? Establish the stress – strain relationship for isotropic materials and hence the relationship between E, G and K. (5)

b) Explain the compatibility conditions and their physical significance. Derive Beltrami – Mitchell compatibility equations in plane strain. (5)

Q3 a) Define principal stresses and principal directions. Show that the determination of principal stresses and principal directions reduces to the solution of an Eigen value problem. Discuss the existence of three real valued solutions for principal stresses. (5)

b) Derive the transformation equations for 3D stress state (5)

Q4 a) Show that constancy of volume results in $e_1 + e_2 + e_3 = 0$ and $\varepsilon_1 + \varepsilon_2 + \varepsilon_3 = 0$. Why is the relationship for conventional strain valid only for small strains but the relationship for true strains is valid for all strains? (5)

b) On the assumption that there is no change in width during the rolling of a sheet, derive the expression for the significant strain in terms of the change in thickness of the sheet. Also express in terms of percentage reduction. (5)

Q5 a) Explain the use of Airy stress function in the solution of two dimensional problems in elasticity. (5)

b) Explain St. Venant's principle and its applications. (5)

Q6 a) Derive the equilibrium equations in polar coordinates system (5)

b) Sketch the stress-strain distribution for elastic plastic yielding of a beam. Also calculate the bending moment in the elastic-plastic state. The beam has rectangular cross section with width b and height h. (5)

Q7 a) Discuss the general yielding mode of failure. Explain: - elastic-perfectly plastic; nonlinear; lower bound load; and upper bound for the general yielding mode of failure. Distinguish fully plastic load for an axial member and the plastic moment for a beam subjected to pure bending. (10)

Q8 Write short notes on any (5 x 2)

a) Tresca criterion
b) Von Mises criterion
c) Assumptions made in Linear / Classical theory of elasticity
d) Hydrostatic and Deviatoric stresses
e) Ductile failure vs Brittle failure