QP Code: RO20MTECH211 Reg. No | | | | | | | | | | | AR 19

GIET UNIVERSITY, GUNUPUR – 765022

M. Tech (Second Semester Examinations) – October' 2021

MPCMD2020 – APPLIED ELASTICITY AND PLASTICITY

(Machine Design)

Time: 2 hrs Maximum: 50 Marks

(The figures in the right hand margin indicate marks)

PART – A

Q.1. Answer ***ALL*** questions (2 x 10 = 20)

a. What is compatibility equation? Express it for 2D without body force.

b. Write three general tri-axial differential equilibrium equations with body forces in polar coordinate.

c. Write the condition of plane strain situation and give an example.

d. For a rotating hollow disc, graphically represent the variation of radial and tangential stress along the thickness.

e. What do you mean by thermal stress and coefficient of thermal expansion?

f. Find the principal stress values for the given tensor.

$$\sigma = \begin{bmatrix} 2 & 3 & 0 \\ 3 & 4 & 4 \\ 0 & 4 & 0 \end{bmatrix}$$

g. What is devioteric stress? Express it in tensor notation.

h. If the stress-strain relationship is given by $\bar{\sigma} = K\bar{\epsilon}^n$ Find the ideal work for plastic deformation.

i. Represent Tresca's and Von-Mises yield criterion in a p-plane.

j. What is stress invariant?

PART – B **(6 x 5 = 30 Marks)**

Answer ***ANY FIVE*** questions Marks

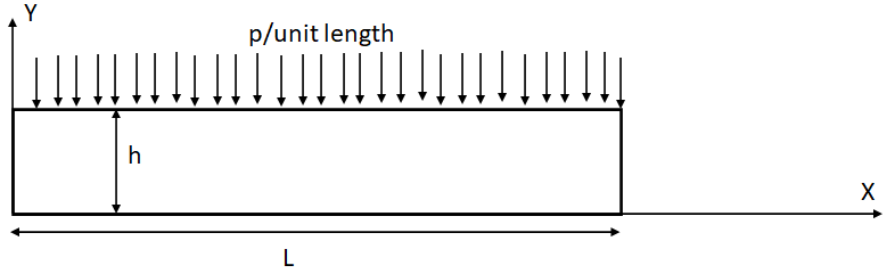
2. Derive the compatibility equations in Cartesian coordinates in stress function terms with body force in plain strain condition. (6)

3. Given the following systems of strains (6)

   $\varepsilon_x = 5+x^2+y^2+x^4+y^4$, $\varepsilon_y = 6+3x^2+3y^2+x^4+y^4$, $\varepsilon_{xy} = 10+4xy(x^2+y^2+2)$, $\varepsilon_z = \varepsilon_{xz} = \varepsilon_{yz} = 0$.

   Determine if the system of strain is possible. If this strain distribution is possible, find the displacement components in term of x & y, assuming that the displacement and rotation at the origin are zero.

4. Find the stress distribution for the problem of simply supported beam applied with distributed load using stress function method by taking suitable boundary conditions. (6)

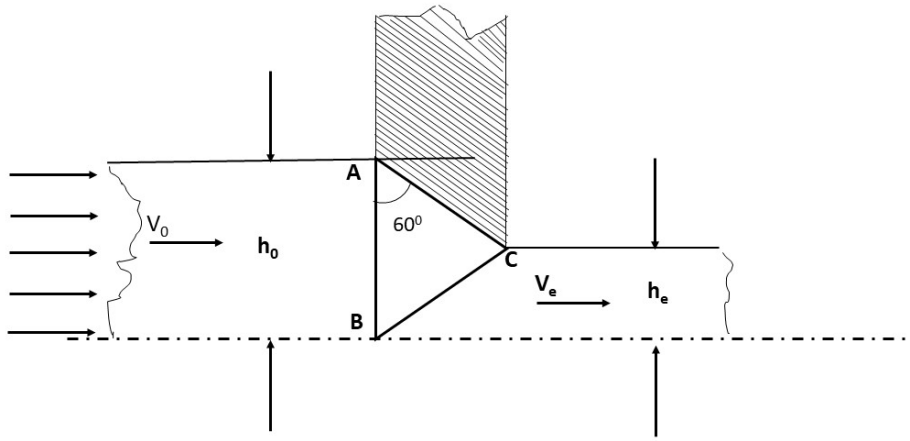


5. Using stress function, derive the stress equations in axi-symmetrical problem of thick cylinder under uniform pressure. (6)

6. A thin-walled tube 0.1mm wall thickness, 50mm diameter and 900mm length is subjected to an internal pressure of 140 kPa and an external torque of 22 N-m. If the end are closed, determine (i) the orientation of principal stress axes in relation to the centre line direction of the tube, (ii) the principal stresses, (iii) the maximum shear stress. (6)

7. Discuss in detail about the various failure theories of plasticity with its limitations (6)

8. Plain-strain friction less extrusion is to be analysed by upper bound method for the conditions shown in figure, only the top half of the physical field is shown. All included angles in triangle ABC are 60^0, while AB is perpendicular to the centreline. Draw the hodograph and calculate $P_e/2k$ for this situation, where k is the shear yield strength. Assume reduction is 50% ($h_o/h_e = 2$) (6)



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