QP Code: RM23MTECH115 Reg. No | | | | | | | | | | AY 23

GIET UNIVERSITY, GUNUPUR – 765022

M. Tech (Second Semester) Examinations, May – 2024

MPCMD2020 - Applied Elasticity and Plasticity

(Machine Design)

Time: 3 Hrs Maximum: 70 Marks

(The figures in the right hand margin indicate marks.)

PART – A **(2 x 10 = 20 Marks)**

Q.1. Answer all questions		CO#	Blooms Level
a.	Define elasticity and distinguish between stress and strain.	CO1	K1
b.	Explain the difference between isotropic, orthotropic, and anisotropic materials with suitable examples.	CO2	K2
c.	How do you conduct the transformation of plane stress or plane strain components using Mohr's circle?	CO3	K2
d.	What are the methods used for the transformation of plane stress or plane strain components, and how do they differ?	CO3	K1
e.	Define principal stress and principal strains and explain their significance in elasticity and plasticity.	CO4	K1
f.	Describe Hooke's law and its application in stress-strain relations for linearly elastic solids.	CO1	K2
g.	Write the equilibrium equations and compatibility conditions for stress and strain in linearly elastic solids?	CO1	K1
h.	Explain the concept of Airy's stress function and its role in solving problems in elasticity.	CO1	K2
i.	How do you solve axisymmetric problems in elasticity? Provide an overview of the solution approach.	CO2	K2
j.	Discuss the differences between Tresca and Von Mises yield criteria in plasticity theory.	CO3	K2

PART – B **(10 x 5=50 Marks)**

Answer ***ANY FIVE*** questions		Marks	CO#	Blooms Level
2.	Following unit elongation were measured with a rectangular strain rosette: $e_0=3x10^{-4}$, $e_{45}= -4x10^{-4}$, $e_{90}=5x10^{-4}$. Determine the principal strain and their directions.	10	CO1	K3
3.	1. Show that the following Airy's stress functions and examine the stress distribution represented by them: a) $\phi=Ax^2+By^2$, b) $\phi=Ax^3$ c) $\phi=A(x^4 - 3x^2y^2)$	10	CO1	K2

4.	The state of stress at a point is given as $$[\sigma] = \begin{bmatrix} -90 & 70 & -55 \\ 70 & -60 & -40 \\ -55 & -40 & 40 \end{bmatrix}$$ Determine a) Principal stresses b) Direction cosines for the maximum principal stress Maximum shearing strain.	10	CO2	K3
5.	A square cantilever of 12mm x 12mm cross-section and 100 mm length is made of steel having uniaxial yield stress of 500 N/cm2. Calculate the maximum force and maximum moment the cantilever can carry at the free end according to Tresca's and Von-Mises yield criterions.	10	CO3	K3
6.	A rectangular beam having linear stress-strain behaviour is 6cm wide and 8cm deep. It is 3m long, simply supported at the ends and carries a uniformly distributed load over the whole span. The load is increased so that the outer 2cm depth of the beam yields plastically. If the yield stress for the beam material is 240MPa, illustrate the residual stress distribution in the beam.	10	CO3	K3
7.	A circular shaft of inner radius 4cm and outer radius 10cm is subjected to a twisting couple so that the outer 2cm deep shell yields plastically. Find the twisting couple applied to the shaft yield stress in shear for the shaft material is 425N/mm^2. Also find the couple for full yielding.	10	CO4	K2
8.	A region on the surface of a A 6011 aluminum alloy indicate the following stresses: σ_{xx} =70 Mpa σ_{yy} =120 Mpa σ_{xy} =60 Mpa. Determine the yielding for both Tresca's and von Mises' criteria, given that Y=158 MPa (the yield stress).	10	CO4	K3

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