QP Code:R251B040 | Reg. No | | | | | | | | | | | AY 24

GANDHI INSTITUTE OF ENGINEERING AND TECHNOLOGY UNIVERSITY, ODISHA, GUNUPUR

(GIET UNIVERSITY)

M.Tech. (First Semester) Regular Examinations, February – 2025

24MMDPE11021 – Advanced Mechanics of Solids

(Machine Design)

Time: 3 hrs | Maximum: 60 Marks

Answer ALL questions

(The figures in the right hand margin indicate marks)

PART – A **(2 x 5 = 10 Marks)**

Q.1. Answer *ALL* questions	CO #	Blooms Level
a. Define principal stresses and explain their significance in stress analysis.	CO1	K1
b. What are compatibility conditions in strain analysis?	CO2	K1
c. Explain shear center and its importance in beam bending.	CO3	K2
d. What is the significance of the Goodman, Gerber, and Soderberg criteria in fatigue design?	CO5	K1
e. Define fracture toughness and its role in material failure.	CO6	K1

PART – B **(10 x 5 = 50 Marks)**

Answer *ALL* the questions	Marks	CO #	Blooms Level
2. a. Derive the differential equations of equilibrium for a three-dimensional stress system.	10	CO1	K3
(OR)			
b. Stress tensor is given by $\tau_{ij}=\begin{vmatrix}1 & 3 & 2\\ 3 & 2 & 1\\ 2 & 1 & -1\end{vmatrix}$ units. Determine the Traction vector and its components on an arbitrary plane having direction cosine $n_x=n_y=n_z=\frac{1}{(3)^{1/2}}$	10	CO1	K2
3.a. 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	CO2	K3
(OR)			
b. Write notes on a) Strain gauge b) Airy's stress function	10	CO4	K3
4.a. A thick cylinder with internal radius of 10cm and external radius of 20cm is subjected to an internal fluid pressure of 100 MPa. Draw the variation of radial and hoop stresses in the cylinder wall. Also determine the maximum shear stress in the cylinder wall.	10	C03	K3
(OR)			
b. A thin-walled symmetric I-section beam has the following dimensions: Flange width = 100 mm Flange thickness = 10 mm Web height = 200 mm Web thickness = 5 mm Determine the location of the shear center with respect to the centroid.	10	C03	K3

5.a.	State and prove Castigliano's first theorem and apply it to find deflection in a beam.	10	CO5	K3
	(OR)			
b.	A thin-walled L-section beam is subjected to a bending moment of 2 kNm in an arbitrary direction. The cross-sectional properties are: Flange width = 80 mm, Flange thickness = 5 mm, Web height = 120 mm, Web thickness = 5 mm. (i) Calculate the bending stress at a point (x = 50 mm, y = 80 mm) on the section. (ii) Identify the location where maximum tensile and compressive stress occurs in the section.	10	CO4	K3
6.a.	What is notch sensitivity? How does it affect fatigue life?	10	CO6	K4
	(OR)			
b.	Explain the three basic modes of fracture and discuss methods to evaluate fracture toughness.	10	CO6	K4

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