GLOBAL ACADEMY OF TECHNOLOGY **PG**
(Autonomous Institution, Affiliated to VTU)
SEE MODEL QUESTION PAPER
First Semester M.Tech. STRUCTURAL ENGINEERING
20MST13: Mechanics of Deformable Bodies

Time: 3 hr. **Max Marks: 100**

Note: Answer any one full question from each module

Q. No.	Questions	Marks
	Module 1	
1	a) Formulate the equilibrium equations in terms of displacement for 3D case	10
	b) At a point in a body the stress field is given by $\sigma_x = 20x^2 + y^2$, $\sigma_y = 30x^2$, $\sigma_z = 30y^2 + 30z^3$, $\tau_{xy} = z, \tau_{yz} = x^3$, $\tau_{zx} = y^3$ Determine whether these stress components are in equilibrium or not. If not determine suitable body force vector required at this point such that the stress field is in equilibrium.	10
	OR	
2	a) Explain Octahedral stresses. Evaluate the expressions for Octahedral normal and octahedral shear stresses in terms of stress invariants	10
	b) Formulate the equilibrium equations in Polar co-ordinates	10
	Module 2	
3	a. Explain the following: i. Hydrostatic and Deviatoric stress ii. Spherical and Deviatoric strain	10
	b. Explain Plane stress and plane strain	10
	OR	
4	a. The component of strain at a point in a body are as follows: $\epsilon_x = C_1z(x^2+y^2)$; $\epsilon_y = x^2z$; $\gamma_{xy} = 2C_2xyz$ where C_1 and C_2 are constants. Examine whether the strain field is compatible one.	05
	b. Determine the shear strain at point (0,5) if normal strains are as follows in a possible strain field. $\epsilon_x = \log y$ $\epsilon_y = Sin2x$	05
	c. Explain strain at a point. Determine the expressions for components of strain	10
	Module 3	
5	Formulate the equilibrium equations in terms of stress functions	10
	Formulate the equations for Plain strain	10
	OR	
6	The state of stress at a point is given by the following stress tensor: $\tau_{ij} = \begin{bmatrix} 9 & 6 & 3 \\ 6 & 5 & 2 \\ 3 & 2 & 4 \end{bmatrix}$ MPa a) Evaluate the stress invariants. b) Magnitude and directions of principle stresses.	20

	c) Spherical and Deviatoric stress tensor.	
Module 4		
7	a) Formulate the expression for σ_r and for σ_θ for a thick cylinder subjected to external pressure"P", if a and b are internal and external radii respectively. Show the variation of σ_r and for σ_θ for a thick cylinder subjected to internal pressure only, $P_0 = 0$	08
	b) Show that $\emptyset = \frac{3F}{4C}(xy - \frac{xy^3}{3C^2})$ is a stress function and find what problem it can solve when applied to the region included in $y = \pm C$ and x = 0 to l.	12
OR		
8	Discuss the effect of a circular hole on the stress distribution in a rectangular plate subjected to tensile stress in x-direction and hence evaluate the stress concentration	20
Module 5		
9	a) Explain the advantages of theory of plasticity	08
	b) Discuss the failure theories	12
OR		
10	Explain the membrane analogy applied to torsional problems	08
	Outline the stress strain curves for perfectly elastic, rigidly perfectly elastic and linear work hardening material and explain	12