Reg. No.



MANIPAL INSTITUTE OF TECHNOLOGY

MANIPAL (A constituent unit of MAHE, Manipal)

## I SEMESTER M.TECH. (STRUCTURAL ENGINEERING) END SEMESTER EXAMINATIONS, NOVEMBER 2018

SUBJECT: ADVANCED MECHANICS OF SOLIDS [CIE 5151] REVISED CREDIT SYSTEM (20/11/2018)

Time: 3 Hours

MAX. MARKS: 50

Instructions t	o Candidates:
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✤ Answer ALL the questions.

• Missing data may be suitable assumed.

	The general displacement fields in a body in Cartesian coordinate system is given by	3	<b>CO1</b>
1A.	$u = 3x^2y + y^2$ ; $v = 3yz + xy$ ; $w = 4xz^2 + 5xy^2$ . Find strain tensor and the linear strain		
	at the point (2, -2, 3) in the direction (0, 0.707, 0.707).		
1 <b>B</b> .	Derive the Cauchy's stress formula for an oblique plane.		CO1
1C.	Derive the stress compatibility condition for plane stress condition (2D).		CO2
2A.	ST for a simply supported beam of length '2L', depth '2h' and unit width, loaded by a concentrated load 'W' at midspan, the stress function satisfying the loading	6	CO2
	condition is $\phi = [(bxy^3/6) + (cxy)]$ . The origin of co-ordinates is at midspan. Treat the		
	concentrated load 'W' as shear stress suitably distributed to suit the function, so that		
	$\int_{-h}^{h} \tau_{xy}  dy = -W/2$ on each half length of beam. Find stresses in beam.		
2B.	State of stress at a point in a strained body is given: $\sigma = \begin{bmatrix} 20 & 30 & 40 \\ 30 & 50 & -60 \\ 40 & -60 & -60 \end{bmatrix} MPa$	4	CO1
	Determine the three principal stresses.		
3A.	Derive the equilibrium equation in a 3D cylindrical co-ordinate system corresponding to $\sum F_{\Theta} = 0$ .		CO3
3B.	Starting with the expressions for displacement in a circular plate, derive the expressions of strain and stress in terms of curvature.		CO4
4A.	Obtain the equilibrium equations of a rectangular plate subjected to uniformly distributed load.	8	CO4
<b>4B.</b>	List the surface functions which completely define the shell.	2	CO5
5A.	With examples, give the classification of shells based on Gaussian curvature.	3	CO5
5B.	Obtain the expressions of stress resultants in terms of stresses acting in a shell element.	7	CO5