



Sanjay Ghodawat University, Kolhapur  
Established as State Private University under Govt. of Maharashtra. Act No XL, 2017

2018-19  
EXM/P/09/01

Year and Program: 2018-19

School of Technology

Department of Civil Engineering  
(M. Tech. Structural  
Engineering)  
Semester – I

Course Code: CSE 503

Course Title: Advanced Solid  
Mechanics

End Semester Examination (ESE)

Time: Max Marks: 100

Day and Date

Wednesday  
19-12-2018

10 to 1 pm - 3 hrs

**Instructions:**

- 1) Solve any two question from Q. 1, Q. 2 & Q. 3
- 2) Solve any two question from Q. 4, Q. 5 & Q. 6
- 3) Assume suitable data wherever necessary.

Q.1	a) Explain why the Stress quantity is tensor quantity.	05	L <sub>6</sub>	CO1
	b) State 3D stress quantities in a matrix form	05	L <sub>4</sub>	CO1
	c) Write the stress strain material constitutive relationship for isotropic materials.	08	L <sub>4</sub>	CO2
	d) Write equilibrium equations in Polar coordinate system	07	L <sub>5</sub>	CO2
Q.2	Derive differential equilibrium equations of state of stresses in 3D with neat diagram by considering all equilibrium conditions.	25	L <sub>6</sub>	CO3
Q.3	a) The stresses at a point are expressed as $\sigma_x = 45 \text{ MPa}$ , $\sigma_y = -35 \text{ MPa}$ , $\sigma_z = 90 \text{ MPa}$ , $\tau_{xy} = 40 \text{ MPa}$ , $\tau_{yz} = 50 \text{ MPa}$ , $\tau_{xz} = -30 \text{ MPa}$ . Determine magnitudes and directions of principle stresses	17	L <sub>6</sub>	CO4
	b) Explain hydrostatic and deviatoric state of stresses	04	L <sub>6</sub>	CO4
	c) Explain stress invariants	04	L <sub>6</sub>	CO4
Q.4	Find the stresses in elliptical shaft subjected to torsion and also draw and explain contours of transverse displacement for the same.	25	L <sub>6</sub>	CO5
Q.5	a) Explain Stress- Strain relations of various materials and empirical relationships in terms of plasticity.	17	L <sub>5</sub>	CO5
	b) Explain various factors affecting strain hardening	08	L <sub>6</sub>	CO5
Q.6	a) Enumerate the various yield criteria and explain von Mises criteria in details.	12	L <sub>6</sub>	CO5

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|----|--|----|----------------|-----|
| a) | Find the shape factor for an unsymmetrical 'I' section having top flange (H <sub>z</sub> x V <sub>t</sub> ) 200 x 10 mm, bottom flange 150 mm x 10mm and web 10 mm x 230 mm. | 08 | L <sub>6</sub> | CO6 |
| b) | Explain in details with neat diagrams plastic bending of beams   | 05 | L <sub>6</sub> | CO6 |
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