

Enrollment No:

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**LDRP INSTITUTE OF TECHNOLOGY AND RESEARCH, GANDHINAGAR**  
**DEPARTMENT OF MECHANICAL ENGINEERING**  
**B.E. 3<sup>rd</sup> SEMESTER**  
**MID SEMESTER EXAMINATION AUGUST-2014**

Date: 28<sup>th</sup> August 2014  
Subject: ASM  
Time: 12.00 PM to 1.30PM

Branch: MECHANICAL  
Subject Code: ME 305  
Total Marks: 30

**Instructions:**

- (1) All Questions are compulsory.
- (2) Figures to the right indicate full marks.
- (3) Use of scientific calculator is permitted.
- (4) Make suitable assumption, wherever necessary.

Que. 1 (A)	Define each term and give their units : 1) Strain energy 2) Resilience 3) Proof resilience 4) Modulus of resilience	4
(B)	<p>A steel bar 1m long and rectangular section 40mmx40mm is subjected to an axial load of 1kN. Find the maximum stress induced in the bar if,</p> <ol style="list-style-type: none"><li>1) The load is applied gradually</li><li>2) The load is applied suddenly</li></ol> <p>Also, find strain energies in both cases. Take <math>E = 200\text{GPa}</math>.</p> <p style="text-align: center;"><b>OR</b></p> <p>The principal stresses at a point in a body are <math>30\text{MN/m}^2</math> (tensile), <math>40\text{MN/m}^2</math> (compressive) and <math>10\text{MN/m}^2</math> (compressive). Find,</p> <ol style="list-style-type: none"><li>a) Energy of distortion per unit volume</li><li>b) Energy of dilation per unit volume</li><li>c) Total strain energy per unit volume. Take <math>E = 2 \times 10^5 \text{ N/mm}^2</math>, <math>\mu = 0.25</math></li></ol>	6
Que. 2 (A)	Derive the formula for deflection of an open coil helical spring subjected to axial load.	4
(B)	<p>A closed coil spring is to be cast such that its mean diameter is 16 times that of wire diameter. The spring has to carry static load of 1200N. Find the diameter of wire and mean diameter of spring if maximum shear stress allowed in spring material is <math>84 \text{ N/mm}^2</math>. Find the number of coils if spring stiffness is <math>64 \text{ N/mm}</math> and shear modulus of spring material is <math>90 \text{ GPa}</math>.</p> <p style="text-align: center;"><b>OR</b></p> <p>(A) Derive the formula for maximum bending stress and deflection of a semi elliptical leaf-spring.</p>	6
(B)	<p>A quarterly laminated steel cantilever spring of span 400 mm is loaded at the free end by 4 kN point load. The deflection under the load shall not exceed 20 mm and the maximum stress is 300 MPa. Find the required dimensions of the spring if thickness to breadth ratio for leaf is 1/5. The spring becomes</p>	6



	straight due to the load.	
Que.3 (A)	Explain given failure theories (i) Maximum Principal strain theory (ii) Maximum strain energy theory.	4
(B)	A member having square cross section is subjected to axial pull of 10kN and shear force of 5 kN. Design the cross section of member based on (i) The maximum principal stress theory (ii) The maximum shear stress theory. For a member elastic limit in axial tension is 250 MPa, Poisson's Ratio = 0.3 and Factor of safety = 2.5.	6
	OR	
(A)	Explain maximum shear stress theory, total strain energy theory and shear strain energy theory.	4
(B)	Find the diameter of a shaft according to (i) maximum shear stress theory (ii) shear strain energy theory, if the shaft is subjected to a maximum torque of 15 kNm and a maximum bending moment of 10 kNm at a particular section. Take allowable equivalent stress in simple tension as 180 MN/m <sup>2</sup> .	6