



R18 Regulation

TKR COLLEGE OF ENGINEERING AND TECHNOLOGY  
(Autonomous, Accredited by NAAC with 'A' Grade)

Subject code: 2P3CE

B.Tech III Semester Regular/Supplementary Examinations, February 2021

## Mechanics of Solids (Mechanical Engineering)

Maximum Marks: 70

Date: 24.02.2021 Duration: 3 hours

- Note:
1. This question paper contains two parts A and B.
  2. Part A is compulsory which carries 20 marks. Answer all questions in Part A.
  3. Part B consists of 5 Units. Answer any one full question from each unit which carries 10M.
  4. Each question carries 10 marks and may have a, b, c, d as sub questions.

### Part-A

All the following questions carry equal marks

(10x2M=20 Marks)

- 1 Define the term shear strain. Represent it graphically
- 2 What is lateral strain and Poisson's ratio?
- 3 Describe the concept of shear force in beams.
- 4 Present the mathematical relationship between the loading, shear force and bending moment.
- 5 What is the contra flexure point?
- 6 What is the relation between maximum shear stress and average shear stress in a circular section.
- 7 What are the axial stresses and compound stresses?
- 8 What are principal stresses and strains?
- 9 Explain the terms: Torsional Rigidity and Torsional Stiffness.
- 10 What is hoop-stress and volumetric strain in shells?

### Part-B

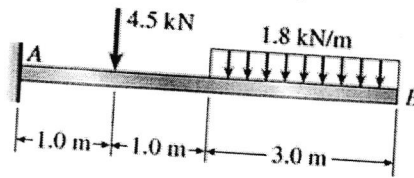
Answer All the following questions.(10M X 5=50Marks)

- 11 A) How the temperature stresses are developed? 5M  
B) A steel bar is placed between two copper bars of same area and length at a temp of  $15^{\circ}\text{C}$ . At this stage, they are rigidly connected together at both ends. When the temperature is raised to  $315^{\circ}\text{C}$ , the length of bars increase by 1.6 mm. Find the original length and stresses in bars. Take  $E_s = 200 \text{ Gpa}$ ,  $E_c = 100 \text{ Gpa}$ ,  $\alpha_s = 0.000012 \text{ per } ^{\circ}\text{C}$ ,  $\alpha_c = 0.000018 \text{ per } ^{\circ}\text{C}$ . 5M

OR

- 12 A) Derive equation for the relation between three elastic moduli. 5M  
B) A bar of 25 mm. diameter is subjected to a pull of 70 kN. The extension measured on a gauge length of 200 mm is 0.1 mm and change in diameter is 0.004 mm. Find poisson's ratio and values of three moduli. 5M

- 13 A cantilever beam is loaded as shown in the figure. Plot the shear force and bending moment diagrams. Also find the reactions at the fixed support. What is the bending moment at a distance of 0.5 m from the fixed support? 10M



OR

- 14 Draw the S.F. and B.M. diagrams for the simply supported beam a point load acting at the center. 10M
- 15 Draw "Mohr's stress circle" for principal stresses of  $60 \text{ N/mm}^2$  tensile and  $30 \text{ N/mm}^2$  compressive and find the resultant stresses on planes making  $30^\circ$  and  $60^\circ$  with the major principal plane. Find also normal and tangential stresses on these planes? 10M
- OR
- 16 The tension flange of a cast iron I section beam is 240 mm wide and 50 mm deep, the compression flange is 100 mm wide and 20 mm deep where as the web is 300 mm deep and 30 mm thick. Find the load per unit run which can be carried over a 4 m span of a simply supported beam if the maximum permissible stresses are 90 MPa in compression and 24 MPa in tension. 10M
- 17 A bolt is subjected to an axial pull of 9 kN and a transverse shear of 4.5 kN. Determine the diameter of the bolt if the elastic limit in tension is 225 MPa using maximum principal stress theory and the maximum shear stress theory. Assume a factor of safety of 3. 10M
- OR
- 18 At a point in a strained material, the intensities of normal stresses on two planes at right angles to each other are  $35 \text{ N/mm}^2$  and  $20 \text{ N/mm}^2$  both tensile. They are accompanied by shear stress of  $15 \text{ N/mm}^2$ . Find the principal planes and principal stresses. Find also maximum shear stress. 10M
- 19 A hollow shaft of 600 mm. external dia. and 400 mm internal dia. is transmitting a power of 6000 kW at 160 rpm. Find the shear stresses at the outer and inner surfaces of the shaft. Draw the shear stress distribution for the wall of the shaft. Find the twist over a length of 4 m. of the shaft. Take  $E = 80 \text{ Gpa}$ . 10M
- OR
- 20 A cylindrical vessel is 1.5 m diameter and 4 m long is closed at ends by rigid plates. It is subjected to an internal pressure of 3 MPa. If the maximum principal stress is not to exceed 150 MPa, find the thickness of the shell. Also find the changes in diameter, length and volume of the shell. Take Young's modulus = 200 GPa and Poisson's ratio = 0.25. 10M