R17 Regulation *Subject code:* 1P3CE

TKR COLLEGE OF ENGINEERING AND TECHNOLOGY

(Autonomous, Accredited by NAAC with 'A' Grade)

B.Tech II Year I Semester Supplementary Examinations, February 2021

MECHANICS OF SOLIDS

(Mechanical Engineering)

Maximum Marks: 70 Date: 01.03.2021 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.
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 Young's modulus?

2 What is the use of Mohr's circle?

3 Difference between hogging and sagging BM?

4 List out types of beams and loads?

5 What is the ratio of max.shear stress to the avg.shear stress in the case of solid circular section?

6 Define Neutral Axis?

7 Define the torsional stiffness.

8 Define principle stresses and principle plane?

9 Write the assumptions in the theory of pure torsion?

10 What are types of stresses in a thin cylindrical vessel subjected to internal pressure?

Part-B

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

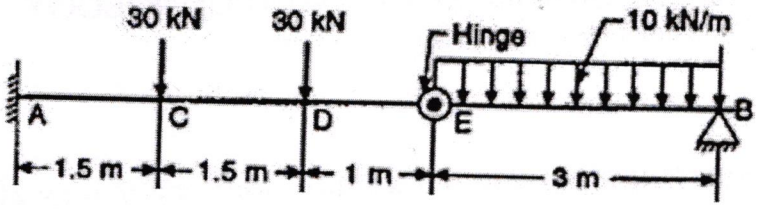
11 a) A steel bar of rectangular cross-section 3 cm x 2 cm, carries an axial load of 30 KN. Estimate the average tensile stress over a normal cross-section of the bar. (5M)

b) A mild steel rod 2.5 m long having a cross sectional area of 50 mm^2 is subjected to a tensile force of 1.5 kN. Determine the stress, strain, and the elongation of the rod. Take $E = 2 \times 10^5$ N/mm^2. (5M)

OR

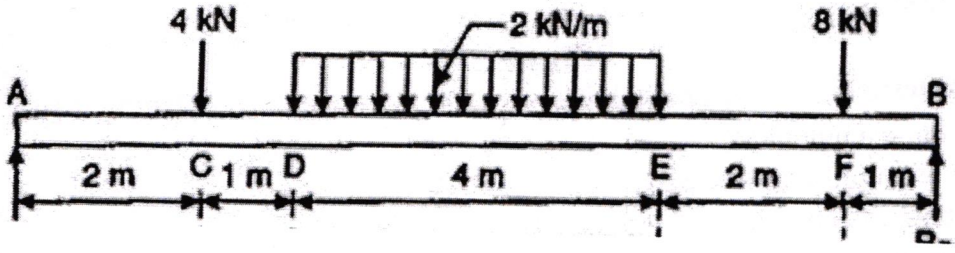
12 A steel rod of 20mm diameter passes centrally through a copper tube of 50mm external diameter and 40mm internal diameter. The tube is closed at each end by rigid plates of negligible thickness. The nuts are tightened lightly home on the projecting parts of the rod. If the temperature of the assembly is raised by 50°C, calculate the stress developed in copper and steel. Take E for steel and copper as 200 GN/m^2 and 100 GN/m^2 and α for steel and copper as 12×10^{-6} per °C and 18×10^{-6} per °C. (10M)

13 Draw S.F.D. and B.M.D. for the beam shown in figure. (10M)



OR

14 A simply supported beam is subjected to a combination of loads as shown in figure. Sketch the S.F. and B.M. diagrams and find the position and magnitude of maximum B.M. (10M)



15 Derive the expression of bending moment equation. (10M)

OR

16 Derive an expression for the distribution of shearing stress over circular section. (10M)

17 At a point, the major principal stress is 120N/mm^2(tensile) and the minor principal stress is compressive. If the yield stress of steel is 250N/mm^2. Find the value of minor principal stress at which yielding take place, according to each of the following theories of failure.
(i) Maximum shear stress theory and
(ii) Maximum principal stress theory. (10M)

OR

18 In a material, the principal stresses are 50N/mm^2, 40N/mm^2 and -30N/mm^2. Calculate the total strain energy, volumetric strain energy, shear strain energy and factor of safety on the total strain energy criterion if the material yields at 100N/mm^2. (10M)

19 A hollow circular shaft of length 6m with inner and outer diameters of 75mm and 100mm is subjected to a torque of 10KNm, if G = 80GPa, find the maximum shear stress and the total angle of twist. (10M)

OR

20 An air vessel, which is made of steel, is 2m long, it has an external diameter of 45 cm and is 1cm thick. Find the increase of external diameter and the increase of length when charged to an internal air pressure of 1MN/m^2. (10M)