

GUJARAT TECHNOLOGICAL UNIVERSITY**BE - SEMESTER-III (NEW) EXAMINATION – SUMMER 2024****Subject Code:3132005****Date:04-07-2024****Subject Name:Engineering Mechanics****Time:10:30 AM TO 01:00 PM****Total Marks:70****Instructions:**

1. Attempt all questions.
2. Make suitable assumptions wherever necessary.
3. Figures to the right indicate full marks.
4. Simple and non-programmable scientific calculators are allowed.

Marks

- | | | | |
|------------|-----|--|-----------|
| Q.1 | (a) | Explain law of parallelogram to find the resultant force and its direction. | 03 |
| | (b) | Calculate the force 'P' required to move the object as shown in fig-1. Take $\mu = 0.2$ wherever required. | 04 |
| | (c) | Find a force and couple at 'O' point for the system given in fig-2. | 07 |
| Q.2 | (a) | Explain free body diagram with a suitable example. | 03 |
| | (b) | Explain Varignon's law. | 04 |
| | (c) | Analyze the beam shown in fig.-3 and draw SFD and BMD. | 07 |
| OR | | | |
| | (c) | Explain laws of friction. Also explain angle of repose. | 07 |
| Q.3 | (a) | Find CG of a wire object shown in fig-4. | 03 |
| | (b) | Enlist the assumptions made in the theory of plane truss. | 04 |
| | (c) | Analyze the beam shown in fig-5 and draw SFD and BMD. | 07 |
| OR | | | |
| Q.3 | (a) | List out types of support with their figures showing reactions they offer. | 03 |
| | (b) | Differentiate between centroid and center of gravity. | 04 |
| | (c) | List the uses of truss. What are the basic differences between truss and frame? | 07 |
| Q.4 | (a) | Find reaction of the beam shown in fig-6. | 03 |
| | (b) | For the same beam (fig-6), find maximum bending moment. | 04 |
| | (c) | Find moment of inertia with respect to X axis of CG for the section shown in fig-7. | 07 |
| OR | | | |
| Q.4 | (a) | Explain nominal stress and true stress when strain-stress curve of mild steel is studied. | 03 |
| | (b) | What is section modulus "Z"? | 04 |
| | (c) | For a stepped circular bar shown in fig-8 find the elongation of each part. Take $E_s = 200$ GPa, $E_c = 100$ GPa. | 07 |
| Q.5 | (a) | Find the stress generated in a restrained bar of length 1 m and dia. 20 mm when temperature changes from 80° to 35° . What will be the type of stress? Take $\alpha_s = 11 \times 10^{-6}/^\circ\text{C}$ and $E_s = 205$ GPa. | 03 |
| | (b) | Prove that maximum shear stress is equal to 1.5 times value of average shear stress for a rectangular section. | 04 |
| | (c) | Write down the process to generate a Mohr circle when 2 normal stresses and one shear stress are applied on the object. | 07 |
| OR | | | |
| Q.5 | (a) | For a cross section 250 X 350 of a beam, draw a shear stress distribution when section is subjected to bending moment (M) = 66 kN.m and maximum shear force (F) = 41 kN | 03 |
| | (b) | Derive the relation between Young's modulus (E), bulk modulus (K), and modulus of rigidity (G), if $K = \mu E / (3(\mu - 2))$ and $E = 3K(\mu - 2) / \mu$. | 04 |

- (c) A cantilever beam of span 2.5 m and 300 mm X 600 mm rectangular section carries UDL of 30 kN/m on entire span as well as point load of 10 kN at the free end. Find the maximum bending stress and draw stress distribution curve.

07

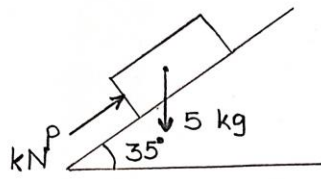


Fig-1

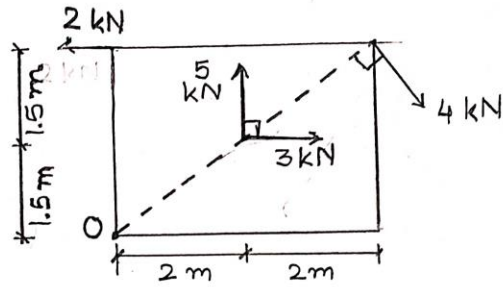


Fig-2

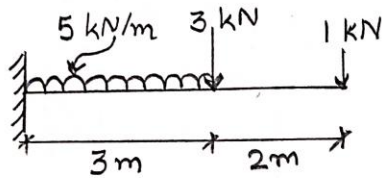


Fig-3

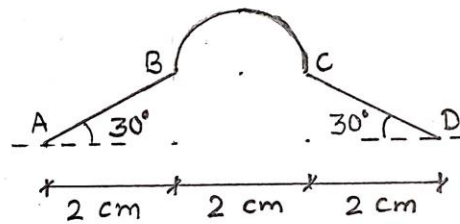


Fig-4

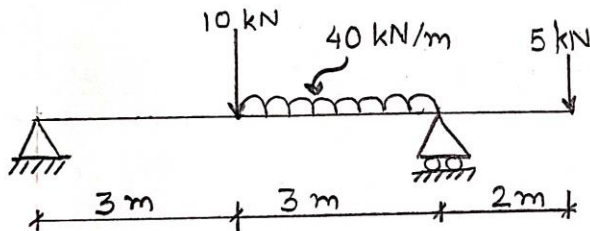


Fig-5

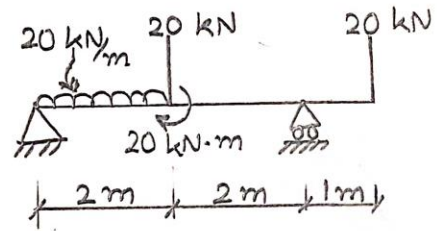


Fig-6

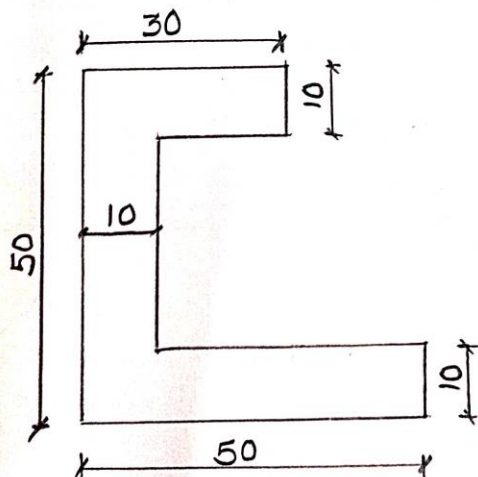


Fig-7

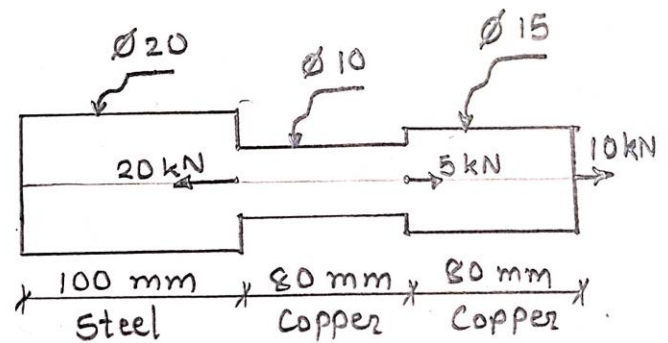


Fig-8