

**B.Tech. MECHANICAL ENGINEERING
(COMPUTER INTEGRATED MANUFACTURING)
BTCLEVI / BTMEVI / BTELVI / BTCSVI / BTECVI**

Term-End Examination

00140

June, 2016

BME-017 : STRENGTH OF MATERIALS

Time : 3 hours

Maximum Marks : 70

***Note :** Answer any **seven** questions. All questions carry equal marks. Use of scientific calculator is permitted.*

1. A hollow and a solid shaft of the same material have the same weight while the inner diameter of the hollow shaft is $\frac{2}{3}^{\text{rd}}$ of its outer diameter. What will be the torque carried by the hollow shaft, if the solid shaft can carry a torque 'T' of same maximum shearing stress in both the shafts ?

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2. A tube of aluminium, 40 mm external diameter and 20 mm internal diameter, is snugly fitted onto a solid steel rod of 20 mm diameter. The composite bar is loaded in compression by axial load P . Find the stress in aluminium when the load is such that the stress in steel is 70 N/mm^2 . What is the value of P ? $E_s = 2 \times 10^5 \text{ N/mm}^2$ and $E_a = 7 \times 10^4 \text{ N/mm}^2$. 10

3. Draw the S.F. and B.M. diagrams for the simply supported beam shown in Figure 1. 10

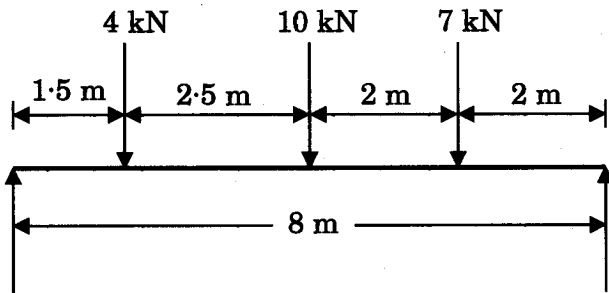


Figure 1

4. A timber beam, 100 mm wide and 150 mm deep, supports a uniformly distributed load over a span of 2 metres. If the safe stresses are 28 N/mm^2 longitudinally and 2.0 N/mm^2 transverse shear, calculate the maximum load which can be supported by the beam. 10

5. A cantilever of length 2 metres carries a uniformly distributed load of 2500 N per metre for a length of 1.25 m from the fixed end and a point load of 1000 N at the free end. If the section is rectangular, 120 mm side and 240 mm deep, find the deflection at the free end.

Take $E = 10,000 \text{ N/mm}^2$.

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6. Two shafts of the same material are subjected to the same torque. If the first shaft is of solid circular section and the second shaft is of hollow section whose internal diameter is $\frac{2}{3}$ of the outside diameter, compare the weights of the two shafts.

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7. A helical spring is made of 12 mm diameter steel wire by winding it on a 120 mm diameter rod. If there are 10 active turns, what is the spring constant? Take $C = 8.2 \times 10^4 \text{ N/mm}^2$. What force must be applied to the spring to elongate it by 40 mm?

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8. At a certain point in a strained material the principal stresses are 100 N/mm^2 and 40 N/mm^2 (both tensile). Find the normal, tangential and resultant stresses across a plane through the point at 48° to the major principal plane, using Mohr's circle of stresses.

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9. A thin spherical shell, 1400 mm diameter, is subjected to an internal pressure of 1.8 N/mm^2 . If the permissible stress in the plate material is 140 N/mm^2 , and the joint efficiency is 75%, find the minimum thickness. 10
10. A cast-iron test beam is $20 \text{ mm} \times 20 \text{ mm}$ in section and one metre long. It is supported at the ends. It fails when a central load of 640 N is applied. What uniformly distributed load will break a cantilever of the same material, 50 mm wide, 100 mm deep and 2 metre long? 10
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