No. of Printed Pages : 4

BME-017

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

00133

Term-End Examination

June, 2018

BME-017 : STRENGTH OF MATERIALS

Time : 3 hours *Maximum Marks : 70*

Note : *Answer any **seven** questions. All questions carry equal marks. Assume suitable data, if missing. All notations have their usual meaning. Use of scientific calculator is allowed.*

---

1. A steel rod, 60 mm in diameter and 1 m long, is encased by a cast iron (CI) sleeve 8 mm thick and of internal diameter 60 mm. The assembly is subjected to a load of 40 kN. Find the stresses in the two materials and the elongation of the assembly. Take $E_s = 200$ GPa, $E_{CI} = 100$ GPa. *10*

2. Two parallel walls 6 m apart are stayed together by a steel rod 2·5 cm diameter at a temperature of 80°C passing through washers and nuts at each end. Calculate the pull exerted by the rod when it has cooled to 22°C

(a) if the walls do not yield, and

(b) if the total yield at the two ends is 1·5 mm.

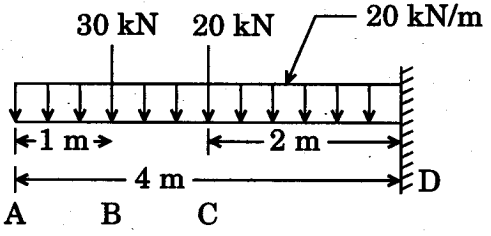
(Take E = 200 GN/mm^2, $\alpha = 11 \times 10^{-6}$/°C) *10*

3. In a two-dimensional problem of a stressed material σ_x = 100 MPa, σ_y = 60 MPa. If the principal stress is limited to 150 MPa, find out the value of shear stress (τ_{xy}). Also find the inclination of the principal plane and magnitude of the maximum shear stress. *10*

4. A shaft is required for an engine which indicates 750 kW at 80 rpm. The maximum twisting moment on the shaft is 1·8 times the mean twisting moment. The main bearings are 5 m apart and the shaft carries a flywheel midway between bearings weighing 400 kN. The bending moment due to this weight is additional to that due to steam pressure, which is 0·8 times the mean twisting moment. Find the diameter of shaft to satisfy the condition that the maximum tensile stress in the material is 56 MPa. *10*

5. A rectangular beam of cross-section 6 cm × 4 cm is 2 m long and simply supported at the ends. It carries a load of 1 kN at midspan. Determine the maximum bending stress induced in the beam. *10*

6. A cantilever beam is loaded as shown in the figure. Draw the shear force and bending moment diagrams. *10*



Figure

7. A flat ribbon of spring steel 3·2 mm wide and 0·5 mm thick is wound around a cylinder 50 cm in diameter. Find the maximum stress in the steel ribbon and the energy stored in bending per metre length of the ribbon.
(Take E = 220 GPa) *10*

8. Prove the maximum deflection of a simply supported beam with uniformly distributed load (w/m) throughout the whole length (L) is $\frac{5\,wL^4}{384\,EI}$, where w = rate of UDL, L = span of beam, EI = flexural rigidity of a beam. *10*

9. Find the maximum stress in a propeller shaft 40 cm external and 20 cm internal diameter, when subject to twisting moment of 4650 N.m. If the modulus of rigidity (G) is 82 GPa, find the twist in a length 20 times the external diameter. *10*

10. A close-coiled helical spring is to have a stiffness of 1 kN/m of compression under a maximum load of 4·5 N and a maximum shearing stress of 126 MPa. The solid length of the spring (the coils are touching) is 4·5 cm. Find the diameter of the wire and the mean diameter of the required coils. (Modulus of Rigidity, G = 42 GPa) *10*