Reg. No. : | | | | | | | | | | | | |

Question Paper Code : X60846

B.E./B.Tech. DEGREE EXAMINATIONS, NOVEMBER/DECEMBER 2020
Fourth Semester
Mechanical Engineering
ME 2254/CE 1259/10122 ME 405 / ME45 / 080120018 – STRENGTH OF MATERIALS
(Common to PTME 2254 – Strength of Materials for B.E. (Part-Time)
Third Semester – Mechanical Engineering – (Regulations – 2009))
(Regulations 2008/2010)

Time : Three Hours | Maximum : 100 Marks

Answer ALL questions

PART – A **(10×2=20 Marks)**

1. Define 'longitudinal strain' and 'lateral strain'.

2. Define strain energy and write its unit.

3. Under what conditions two concentric shaft can act as composite shaft ? State the conditions.

4. Define torsional rigidity.

5. Calculate the polar modulus for a solid circular section of diameter 150 mm.

6. List the engineering uses of springs.

7. List out the limitations of Mc Cauley's method.

8. State Maxwell's reciprocal theorem.

9. Define principal stress and principal plane.

10. Define circumferential and Hoop stress.

PART – B **(5×16=80 Marks)**

11. a) i) A bar 30 mm in diameter is subjected to a tensile load of 54 kN and the measured extension on 300 mm gauge length is 0.112 mm and change in diameter is 0.00366 mm. Calculate Poisson's ratio and the values of three moduli. **(8)**

ii) A tapered circular bar tapers uniformly from a diameter d at its small end to D at its big end . The length of the bar is L. Derive an expression for the elongation of the bar due to an axial tensile force P. **(8)**

(OR)

b) A compound tube consists of a steel 170 mm outer diameter and 10 mm thickness and an outer brass tube 190 mm outer diameter and 10 mm thickness. The two tubes are the same length. The compound tube carries an axial load 1000 kN.

Find the stresses, the load carried by each tube and forces acting on it. Also find the deformation of the tube in terms of its length. Length of each tube is 200 mm. Young's modulus for steel and brass are 200 kN/mm^2 and 100 kN/mm^2 respectively.

12. a) A horizontal beam AB 8 m long is supported at A and C 6 m from A. The beam supports a U.D.L. of 1.5 kN/m over its entire length and also concentrated loads of 3 kN and 1.5 kN at D and B respectively. D being 2 m from A. Draw the S.F. and B.M. diagrams for the beam. Where does the maximum B.M. occur and what is its value ? **(16)**

(OR)

b) Two wooden planks 150 mm × 50 mm each are connected to form a T-section of a beam. If a moment of 3.4 kN/m is applied around the horizontal neutral axis, inducing tension below the neutral axis, find the stresses at the extreme fibers of the cross-section. Also calculate the total tensile force on the cross-section. **(16)**

13. a) A hollow shaft with diameter ratio 3/5 is required to transmit 450 kW at 120 rpm. The shearing stress in the shaft must not exceed 60 N/mm^2 and the twist in a length of 2.5 m is not to exceed 1°. Calculate the minimum external diameter of the shaft. C = 80 kN/mm^2. **(16)**

(OR)

b) Derive a relation for deflection of a closely coiled helical spring subjected to an axial downward load W. **(16)**

14. a) A beam of uniform section, 10 meters long, is simply supported at the ends. It carries point loads of 100 kN and 60 kN at distances of 2 m and 5 m respectively from the left end. Calculate : **(16)**

i) The slope at each support.

ii) The slope and deflection under 100 kN load.
Given : E = 200 kN/mm2 and I = 118×10^{-4} m^4.

(OR)

b) Compare the crippling loads given by Euler's and Rankine formulae for a pin-jointed tubular steel strut 2.5 m long, having outer and inner diameter 40 mm and 30 mm respectively. Pin-jointed at each end. Take the yield stress as 330 N/mm^2, the Rankine's constant = 1/7500 and Modulus of elasticity (E) = 200 kN/mm^2. **(16)**

15. a) The like Principal Stresses at a point are 800 N/mm^2 and 200 N/mm^2. Calculate the following :

i) Maximum shear stress. **(6)**

ii) Normal and shear stress on a plane at 30° with the plane of maximum principal stress. **(6)**

iii) Resultant stress on that plane. **(4)**

(OR)

b) Derive hoop stress and longitudinal stress formula for a thin cylindrical shell and hence deduce their magnitudes if the fluid pressure is 8 MPa, diameter = 100 cm, thickness = 2 cm. **(16)**
