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

Question Paper Code : 42846

B.E./B.Tech. DEGREE EXAMINATION, APRIL/MAY 2018

Fourth Semester

Mechanical Engineering

ME 2254 – STRENGTH OF MATERIALS

(Common to Production Engineering and Automobile Engineering)

(Regulations 2008)

(Also common to PTME 2254 – Strength of materials for BE (Part-Time) Third Semester – Mechanical Engineering – Regulations 2009)

Time : Three Hours | Maximum : 100 Marks

Answer ALL questions.

PART – A (10×2=20 Marks)

1. Define shear strain.
2. Write the relationship between the elastic constants.
3. What do you mean by point of inflexion ?
4. Write the equation of theory of simple bending.
5. What is meant by compound shaft ?
6. Define laminated springs.
7. What is meant by slope ?
8. Define Slenderness ratio.
9. Define the term hoop stress.
10. What is meant by shear plane ?

PART – B (5×16=80 Marks)

11. a) A brass bar of 10 mm × 10 mm size and 400 mm length is subjected to an axial compression of 12 kN (the bar is prevented from bending). The decrease in length and increase in lateral dimensions are found to be 0.5 mm and 0.003 mm respectively. Determine the elastic constants E, γ, G & K.

(OR)

b) A steel bar is placed between two copper bars, each having the same area and length as steel bar at $20^{\circ}C$. At this stage, they are rigidly connected together at both the ends. When the temperature is raised to $320^{\circ}C$, the length of the bars increases by 1.5 mm. Determine the original length and final stresses in the bars. Take $E_s = 220$ GN/m^2, and $E_c = 110$ GN/m^2.

12. a) A simply supported beam AB of span 6 m carries a uniformly distributed load of 20 kN/m for 3 m from the left hand support A, a concentrated load of 40 kN at mid span, and a moment of 120 kN/m at 1.5 m from the right hand support B. Draw the shear force and bending moment diagram, and also the position of maximum bending moment.

(OR)

b) A beam simply supported at its end is of I cross section having top flange 100 mm × 30 mm, web 30 mm × 120 mm, bottom flange 120 mm × 30 mm is loaded with a U.D.L. over its entire span. If the beam is 8 m long, find the U.D.L., if maximum permissible bending stress in tension limited to 30 N/m^2 and in compression 45 N/m^2. What is the actual maximum bending stress set up in the section ?

13. a) A hollow circular shaft 20 mm thick transmits 294 kW at 200 rpm. Determine the diameters of the shaft if shear strain due to torsion is not to exceed 8.6×10^{-4}. Take modulus of rigidity as 80 GN/m^2.

(OR)

b) A closed coil spring has mean diameter of 75 mm and spring constant of 90 kN/m. It has 8 coils. What is the suitable diameter of the spring wire if maximum shear stress is not to exceed 250 MN/m^2 ? Modulus of rigidity of the spring wire material is 80 GN/m^2. What is the maximum axial load the spring can carry ?

14. a) A 2m long cantilever is loaded with a point load of 500 N at the free end. If the section is rectangular 80 mm (wide) × 160 mm (deep) and E = 10 GN/m^2. Calculate the slope and deflection at

i) The free end of the cantilever

ii) A distance of 0.6 m from the free end.

(OR)

b) From the following data, determine the diameter of the piston rod :
Diameter of the engine cylinder = 0.3 m
Maximum effective steam pressure in the cylinder = 800 kN/m^2
Distance from piston to cross-head centre = 1.5 m
Factor of safety = 4
Assume $\sigma_c = 330 MN/m^2$ and $\alpha = 1/30000$ for both ends fixed.

15. a) A cylindrical air drum is 2.25 m in diameter with plates 1.2 cm thick. The efficiencies of the longitudinal and circumferential joints are respectively 75% and 40%. If the tensile stress in the plating is to be limited to 120 MN/m^2, find the maximum safe air pressure.

(OR)

b) A short metallic column of 500 mm^2 cross-sectional area carries an axial compressive load of 100 kN. For a plane inclined at 60° with the direction of load, calculate :

i) Normal stress; ii) Tangential stress; iii) Resultant stress; iv) Maximum shear stress and v) Obliquity of the resultant stress.