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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.

A trooppe board High and more 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

 $(5\times16=80 \text{ Marks})$

11. a) A brass bar of 10 mm \times 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/m², and $E_c = 110$ GN/m².
- 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 $100~\text{mm} \times 30~\text{mm}$, web $30~\text{mm} \times 120~\text{mm}$, bottom flange $120~\text{mm} \times 30~\text{mm}$ 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 $30~\text{N/m}^2$ and in compression $45~\text{N/m}^2$. 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 $80 \, \text{GN/m}^2$.

(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/m²? Modulus of rigidity of the spring wire material is 80 GN/m². 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) \times 160 mm (deep) and E = 10 GN/m². 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 $\sigma_c = 330MN/m^2$ 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/m², find the maximum safe air pressure.

(OR)

- b) A short metallic column of 500 mm² 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.

- A 3m long contilever to invited with a point lead of 600 M at the free end. If the
 next top in metangular 30, mm (mids) × 360 mm (depart and R = 10 GM/6s².
 Calculate the slope and deflection at
 - ii. The free end of the amendance
 - Advenoral with much in U.O to supervish A. (ii)

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Maximum effective events presents to the cylinder = 500 kMrs.
Distance from picton to mose-band centre = 1.5 m
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Assume of a 320MW/m2 and a = 1/20000 for both eight freed

15. a) A cylindrical are dram is 2.35 m in diameter with places 1.2 cm thick. The officiencies of the longitudical and createthronial panta are corporatively 12% and 40%. If the tenule stress in the platein; is to be limited to 120 MWW. find the maximum safe air pressure.

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- b) A short metallin column of 600 mm, erons sectional area mercus in saint of annual metalling of 100 keV. I'm a plane inclined at 50 with the distinuit of load, miculate.
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