433   Register No.: [   ]

April 2024

[N.B.   1.   Answer all questions under Part-A. Each question carries 3 marks.

2.   Answer all the questions either (A) or (B) in Part-B. Each question carries 14 marks.]

PART – A

1.   Define fatigue and creep.

2.   State the Law's of static friction.

3.   Write short notes on temperature stress and strain.

4.   Find the strain energy that can be stored in a steel bar 45mm in diameter and 3m long subjected to a pull of 10 kN. Take $E=200$ kN/mm^2.

5.   Define Axis of Reference and Axis of Symmetry.

6.   Name the stresses developed in thin cylindrical shell subjected to an internal pressure and write the formula to find those stresses.

7.   Define polar modulus for solid shaft.

8.   Calculate the modulus of rigidity of spring 10 turns 65mm mean diameter and wire diameter is 6.5 mm. The spring compresses 10mm under a load of 70 N.

9.   Define bending moment.

10.   Define moment of resistance and strength of beam.

PART – B

11.   (a)   (i)   List the purpose of alloying on steel.(4)
      (ii)   Explain with neat sketch the testing procedure of the creep on a material.(10)

(Or)

(b)   During tension test on M.S Specimen the following observations were made. Diameter of the rod 20 mm, Gauge length 200 mm, Yield load, Ultimate load and Breaking load are 85kN, 120kN and 90kN respectively. The final length of the specimen is 205.6 mm and neck diameter is 14.5 mm. Determine yield stress, Breaking stress, ultimate stress, Percentage of elongation and Percentage of reduction in area.

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12. (a) The modulus of rigidity of a metal rod is 0.4×10^5 N/mm². A 10mm diameter of the metal rod is subjected to an axial load of 4.9 kN. The change in diameter is found to be 1.95×10^{-3} mm. Calculate Poisson's ratio, Young's modulus and bulk modulus.

(Or)

(b) A steel rod 20 mm diameter and 6m long is connected to two grips at each ends at a temperature of 120°C. Find the pull exerted when the temperature falls to 40°C. (i) if the ends do not yield (ii) if the ends yield by 1mm. Take E= 2×10^5 N/mm² and $\propto$ = 12×10^{-6} / °C.

13. (a) An I section has the top flange 120mm X 20mm thick, web 180mm X 20mm thick and the bottom flange 200mm X 40mm thick. Calculate the Ixx, Iyy, Kxx and Kyy of the section.

(Or)

(b) (i) A spherical shell of 1m internal diameter and 5mm thick is filled with a fluid under pressure until its volume increase by 0.2×10^6 mm³. Calculate the pressure exerted by the fluid on the shell. Take E=2×10^5 N/mm² and 1/m=0.25 for the materials.(10)

(ii) Derive an expression for tensile stress in a cylindrical shell subjected to an internal pressure.(4)

14. (a) A hollow shaft having inner diameter 0.6 times the outer diameter is to replace a solid shaft of the same material to transmit 550 kW at 220 rpm, the permissible shear stress is 80 N/mm². Calculate the diameters of the hollow and solid shafts and also calculate the percentage of saving in material.

(Or)

(b) A truck weighing 20 kN and moving at 6 km/hr has to be brought to rest by a buffer. Find how many springs, each of 15 coils will be required to store the energy of motion during compression of 200 mm. The spring is made out of 25 mm diameter steel rod coiled to a mean diameter of 200 mm. Take C=0.945×10^5 N/mm².

15. (a) A simply supported beam of span 6m is subjected to a UDL of 4 kN/m for 1.5 m from left support and another UDL of 2 kN/m for 3 m from the right support. In addition the beam carries a point load at 5kN at a distance of 1.5m from the right support. Construct shear force diagram and Bending moment diagram and also determine the maximum BM of the beam.

(Or)

(b) A beam of symmetrical section whose depth is 400mm and I=193×10^6 mm⁴ is simply supported over a span of 8m. What UDL it may carry if the maximum bending stress is not to exceed 120 N/mm²? What concentrated load may be carried by the beam at the centre with the same permissible stresses?

185/22—2