Reg. No. :

Question Paper Code : 40778

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

Third/Fourth Semester

Mechanical Engineering

CE 6306 – STRENGTH OF MATERIALS

(Common to Mechanical Engineering (Sandwich)/Agriculture Engineering/ Automobile Engineering/Industrial Engineering/Industrial Engineering and Management/Manufacturing Engineering/Materials Science and Engineering/ Mechanical and Automation Engineering/Mechatronics Engineering/Production Engineering)

(Regulations 2013)

Time : Three Hours

Maximum : 100 Marks

Answer ALL questions.

PART – A (10×2=20 Marks)

1. Give the relation between modulus of elasticity and bulk modulus.
2. What is principal stress ?
3. What do you mean by the point of contraflexure ?
4. What is meant by shear stresses in beam ?
5. What is polar moment of inertia for solid shaft ?
6. Differentiate open coiled helical spring from the close coiled helical spring and state the type of stress induced in each spring due to an axial load.
7. Write the equation giving maximum deflection in case of a simply supported beam subjected to a point load at mid span.
8. State the two theorems of conjugate beam method.
9. Write the expression for circumferential stress and longitudinal stress when a thin cylinder is subjected to an internal fluid pressure of 'P'.
10. Write down the Lame's equations.

PART – B (5×13=65 Marks)

11. a) A solid steel bar, 40 mm diameter, 2 m long passes centrally through a copper tube of internal diameter 40 mm, thickness of metal 5 mm and length 2 m. The ends of the bar and tube are brazed together and a tensile load of 150 kN is applied axially to the compound bar. Assume $E_c = 100\ GN/m^2$ and $E_s = 200\ GN/m^2$. Find the stresses and load sheared by the steel and copper section.

(OR)

b) At a point within a body subjected to two mutually perpendicular directions, the tensile stresses are $80 N/mm^2$ and $40\ N/mm^2$ respectively. Each stress is accompanied by a shear stress of $60\ N/mm^2$. Determine the normal stress, shear stress and resultant stress on an oblique plane inclined at an angle of 45° with the axis of minor tensile stress.

12. a) A simply supported beam of 16m effective span carries the concentrated loads of 4 kN, 5kN and 3 kN at distances 3 m, 7m and 11 m respectively from the left support. Calculate maximum shearing force and bending moment. Draw S.F. and B.M. diagrams.

(OR)

b) A timber beam of rectangular section is support a load of 50 kN uniformly distributed over a span of 4.8 m when beam is simply supported. If the depth of section is to be twice the breadth, and the stress in the timber is not to exceed $7\ N/mm^2$, find the dimensions of the cross section.

13. a) A solid cylindrical shaft is to transmit 300 kW power at 100 r.p.m. a) if the shear stress is not exceed $80\ N/mm^2$, find its diameter. b) what percentage saving in weight would be obtained if this shaft is replaced by a hollow one whose internal diameter equals to 0.6 times the external diameter, the length, material and maximum shear stress being the same.

(OR)

b) A closed coil helical spring is to have a stiffness of 1.5N/mm of compression under a maximum load of 60 N. The maximum shearing stress produced in the wire of the spring is $125\ N/mm^2$. The solid length of the spring is 50 mm. Find the diameter of coil, diameter of wire and number of coils $C = 4.5 \times 10^4\ N/mm^2$.

14. a) A cantilever 2 m long is of rectangular section 120 mm wide and 240 mm deep. It carries a uniformly distributed load of 2.5 kN per metre length for a length of 1.25 metres from the fixed end and a point load of 1 kN at free end. Find the deflection at the free end. Take E = 10 GN/m^2.

(OR)

b) A beam AB of 8 m span is simply supported at the ends. It carries a point load of 10 kN at a distance of 1 m from the end A and a uniformly distributed load of 5 kN/m for a length of 2 m from the end B. If $I = 10 \times 10^{-6}$ m^4, determine : i) Deflection at the mid-span; ii) Maximum deflection; iii) slope at the end A.

15. a) A cylinder shell 3 m long which is closed at the ends has a internal diameter of 1.5 m and a wall thickness of 20 mm. Calculate the circumferential and longitudinal stresses induced and also change in the dimensions of the steel. If it is subjected to an internal pressure of 1.5 N/mm^2. Take Young's modulus = 200 kN/mm^2 and Poisson's ratio = 0.3.

(OR)

b) A compound cylinder, formed by shrinking one tube to another is subjected to an internal pressure of 90 MN/m^2. Before the fluid is admitted, the internal and external diameters of the compound cylinder are 180 mm and 300 mm respectively and the diameter at the junction is 240 mm. If after shrinking on the radial pressure at the common surface is 12 MN/m^2, determine the final stresses developed in the compound cylinder.

PART – C

(1×15=15 Marks)

16.a) A beam ABCD, 10 m long, is simply supported at B and C which are 4 m apart, and overhangs the support B by 3 m. The overhanging part AB carries UDL of 1 kN/m and the part CD carries UDL of 0.5 kN/m. Calculate the position and magnitude of the least value of the bending moment between the supports. Draw the S.F. and B.M. diagrams.

(OR)

b) A bar 250 mm long, cross-sectional area 100 mm × 50 mm, carries a tensile load of 500 kN along lengthwise, a compressive load of 5000 kN on its 100 mm × 250 mm faces and a tensile load of 2500 kN on its 50 mm × 250 mm faces. Calculate i) the change in volume, ii) what change must be made in the 5000 kN load so that no change in the volume of bar occurs. Take $E = 1.8 \times 10^5$ N/mm^2; Poisson's ratio = 0.25.