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

Question Paper Code : 91292

B.E./B.Tech. DEGREE EXAMINATIONS, NOVEMBER/DECEMBER 2019

Third/Fourth Semester

Mechanical Engineering

CE 6306 – STRENGTH OF MATERIALS

(Common to Mechanical Engineering (Sandwich)/Agricultural Engineering/ Automobile Engineering/Industrial Engineering/Industrial Engineering and Management/Manufacturing Engineering/Materials Sciences and Engineering/ Civil 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. Differentiate Elasticity and Elastic Limit.
2. What is principle of super position ?
3. Define :
   a) Shearing force and
   b) Bending moment
4. What is neutral axis of a beam section ? How do you locate it when a beam is under simple bending ?
5. Define torsional rigidity.
6. What is a spring ? Name the two important types of springs.
7. A cantilever beam is subjected to a point load W at the free end. What is the slope and deflection at the free end ?
8. State the Maxwell's reciprocal theorem.
9. How does a thin cylinder fail due to internal fluid pressure ?
10. State Lame's equations.

PART – B (5×13=65 Marks)

11. a) A steel rod of diameter 32 mm and length 500 mm is placed inside an aluminium tube of internal diameter 35 mm and external diameter 45 mm which is 1mm longer than the steel rod. A load of 300 kN is placed on the assembly through the rigid collar. Find the stress induced in steel rod and aluminium tube. Take the modulus of elasticity of steel as 200 GPa and that of aluminium as 80 GPa.

(OR)

b) At a point in strained material the resultant intensity of stress across a vertical plane is 100 MPa tensile inclined at 35° clockwise to its normal. The normal component of intensity of stress across the horizontal plane is 50 MPa compressive. Determine graphically using Mohr's circle method.

i) The position of principal planes and stresses across them and

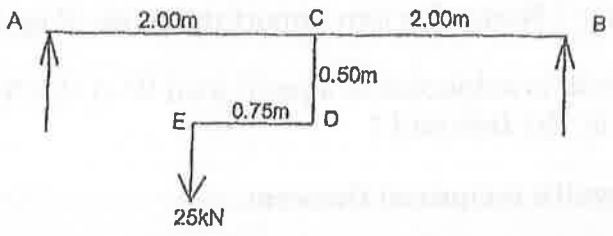
ii) The normal and tangential stress across a plane which is 60° clockwise to the vertical plane.

12. a) i) A simply supported beam AB of length 5 m carries point loads of 8 kN, 10 kN and 15 kN at 1.50 m, 2.50 and 4.0 m respectively from left hand support. Draw shear force and bending moment diagram. **(8)**

ii) A cantilever beam AB of length 2 m carries a uniformly distributed load of 12 kN/m over entire length. Find the maximum shear stress and bending stress, if the size of the beam is 230 mm × 300 mm. **(5)**

(OR)

b) i) Draw shear force diagram and bending moment diagram for the beam shown in figure 12 (b)(i).



F.g.12(b)(i)

ii) A cantilever beam is made up of a flitched section as shown in figure Q. 12 b (ii). If the allowable bending stresses in steel and timber are respectively 165 N/mm^2 and 8.5 N/mm^2 find the value of W.

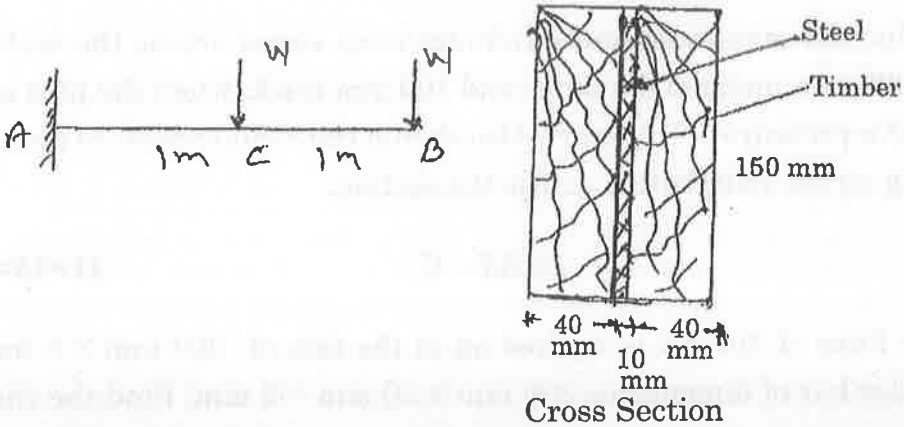


Fig. Q.12(b)(ii)

13. a) A hollow shaft of external diameter 120 mm transmits 300 kW power at 200 r.p.m. Determine the maximum internal diameter if the maximum stress in the shaft is not to exceed 60 N/mm^2.

(OR)

b) A closely coiled helical spring of mean diameter 20 cm is made of 3 cm diameter rod and has 16 turns. A weight of 3 kN is dropped on this spring. Find the height by which the weight should be dropped before striking the spring so that the spring may be compressed by 18 cm. Take C = 8×10^4 N/mm^2.

14. a) A beam of length 5 m and of uniform rectangular section is supported at its ends and carries uniformly distributed load over the entire length. Calculate the depth of the section if the maximum permissible bending stress is 8 N/mm^2 and the central deflection is not to exceed 10 mm. E = 200 GPa.

(OR)

b) Derive the equation for slope and deflection of a simply supported beam of length 'L' carrying point load 'W' at the centre by Mohr's theorem.

15. a) Derive an expression for change in volume of a thin cylinder subjected to internal fluid pressure.

(OR)

b) Determine the maximum and minimum hoop stress across the section of a pipe of 400 mm internal diameter and 100 mm thick, when the pipe contains a fluid at a pressure of 8 N/mm^2. Also sketch the radial pressure distribution and hoop stress distribution across the section.

PART – C **(1×15=15 Marks)**

16. a) A tensile force of 200 kN is applied on to the face of 300 mm × 5 mm for a rectangular bar of dimensions 300 mm × 20 mm × 5 mm. Find the change in volume.

(OR)

b) Using conjugate beam method, find the maximum slope and deflection for a cantilever of length 3 m loaded with a 5 kN force at free end and 3 kN force at 1 m from the free end. Take E = 200 GPa I = 300×10^{-6} m^4.