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Question Paper Code : X 60248

B.E./B.Tech. DEGREE EXAMINATIONS, NOV./DEC. 2020

Fourth Semester

Civil Engineering

CE 2252/10111CE 403/CE 43/080100019 – STRENGTH OF MATERIALS

(Regulations 2008/2010)

(Common to PTCE 2252/10111CE403 – Strength of Materials for B.E. (Part-Time)Second Semester – Civil Engineering – Regulations 2009/2010)

Time : Three Hours | Maximum : 100 Marks

Answer ALL questions.

PART – A **(10×2=20 Marks)**

1. Define principle of virtual work.
2. State the Maxwell's reciprocal theorem.
3. Find the reaction at the prop in a propped cantilever of span 3 m carrying a UDL of 5 kN/m over the entire span.
4. State the theorem of three moments.
5. State the middle third rule.
6. What is known as crippling load ?
7. State distortion energy theory for failure.
8. What are the various stress invariants for three dimensional state of stress ?
9. Explain briefly about stress concentration.
10. What is meant by fatigue and fracture due to fatigue ?

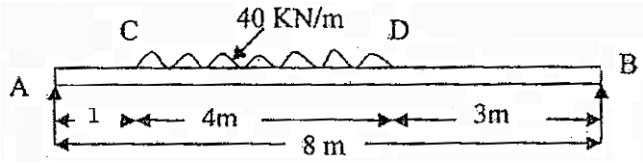
PART – B **(5×16=80 Marks)**

11. a) A bar of uniform cross section A and length L hangs vertically, subjected to its own weight. Prove that the strain energy stored within the bar is given by

$$u = \frac{Axp^2xL^3}{6E} .$$ **(16)**

(OR)

b) A simply supported beam having 8 m span and carries UDL of 40 kN/M as shown in fig. (a). Determine the deflection of the beam at its midpoint and also the position of maximum deflection and maximum deflection. Take $E = 2 \times 10^5$ N/mm^2 and $I = 4.3 \times 10^8$ mm^4.



(16)

Figure (a)

12. a) A cantilever ABC is fixed at A and propped at C is loaded as shown in fig. Q. 12(a). Find the reaction at C. **(16)**

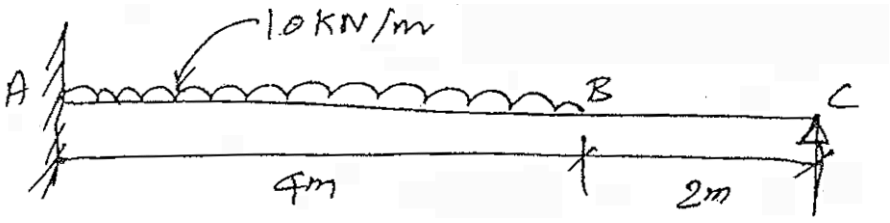


Fig. Q. 12.(a)

(OR)

b) A two span continuous beam ABC fixed at the ends is loaded as shown in fig. Q. 12 (b). Find (i) moment at supports (ii) reactions at the supports. Draw the B.M. and S.F. diagrams. **(16)**

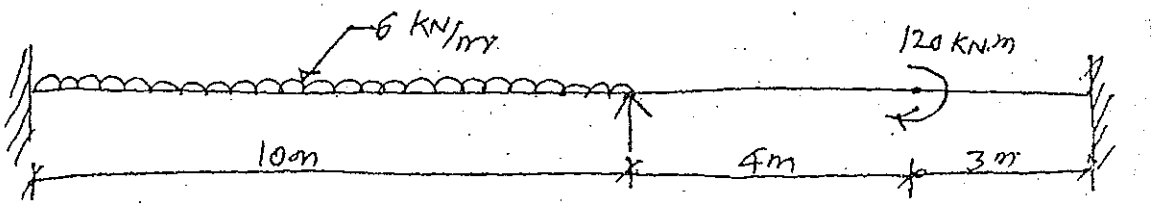


Fig. Q. 12(b)

13. a) Derive an expression for Euler's crippling load when one end of column is fixed and other end is hinged. **(16)**

(OR)

b) A thick walled steel cylindrical shell of internal diameter 150 mm and external diameter 500 mm is subjected to fluid pressure of 100 MPa. Calculate the principal stress and maximum shear stress at a point on the inside surface of the cylinder and calculate the increase in inside diameter due to fluid pressure. Assume E = 200 kN/mm^2 and 1/m = 0.3. **(16)**

14. a) A cylindrical shell made of mild steel plate and 1.2m in diameter is to be subjected to an internal pressure of 1.5 MN/m^2. If the material yields at 200 MN/m^2, calculate the thickness of the plate on the basis of the following three theories, assuming factor of safety 2 in each case.

i) Maximum principal stress theory. **(6)**

ii) Maximum shear stress theory. **(5)**

iii) Maximum shear strain energy theory. **(5)**

(OR)

b) At a section of a mild steel shaft, the maximum torque is 8437.5 Nm and maximum bending moment is 5062.5 Nm. The diameter of shaft is 90 mm and the stress at the elastic limit in simple tension for the material of the shaft is 220 N/mm^2. Determine whether the failure of the material will occur or not according to maximum shear stress theory. If not, then find the factor of safety. **(16)**

15. a) A beam of rectangular section, 80 mm wide and 120 mm deep is subjected to a bending moment of 20 KN-m. The trace of the plane of loading is inclined at 45° to the YY axis of the section. Locate the neutral axis of the section and calculate the bending stress induced at each corner of the beam section. **(16)**

(OR)

b) A curved beam of rectangular cross section is subjected to pure bending with a moment of 400 N-M. The beam has width of 20 mm, depth of 40 mm and is curved is plane parallel to the depth. The mean radius of curvature is 50 mm. Determine the position of neutral axis and the ratio of maximum to the minimum stress. **(16)**

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