D 42020 (Pages : 3) Name.....

Reg. No.....

THIRD SEMESTER B.TECH. (ENGINEERING) DEGREE EXAMINATION, DECEMBER 2007

EE 04 303 – STRENGTH OF MATERIALS

(2004 admissions)

Time : Three Hours Maximum : 100 Marks

Answer **all** *questions.*

I. (a) Draw the stress-strain diagram of mild-steel. Mark various points and explain the following terms :

(i) Proportional Limit.

(ii) Elastic Limit.

(iii) Yield Point and Yield Stress.

(iv) Ultimate Strength.

(v) Breaking Strength.

(b) Explain the following :

(i) Principal Planes.

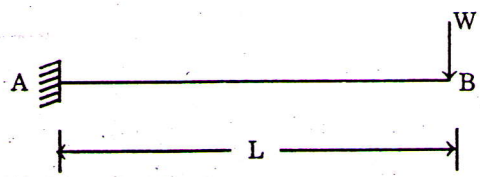
(ii) Principal Stresses.

(iii) Mohr's Circle of Stresses.

(c) Explain Shear Force and Bending moment diagrams. Draw the Shear Force diagram of simply supported beam with uniformly distributed load of intensity w/m length over the whole span of length L.

(d) Explain the assumptions and limitations of theory of simple bending.

(e) Derive the equation for slope at any section of the beam shown below :



(f) Derive the expression for power transmitted in the case of a solid circular shaft.

(g) Write Euler's formula for very long columns with various and conditions and explain each term.

(h) Derive the Lame's equation for the radial pressure and hoop stress at any specified point in the section of a thickly formed cylindrical shell.

(8 × 5 = 40 marks)

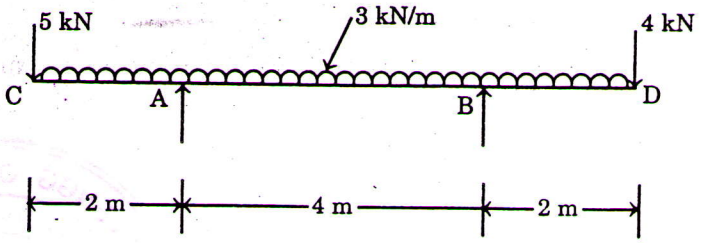
Turn over

II. (a) The diameter of a circular steel rod is 20 mm, and it is 300 mm long. If the rod is subjected to a tensile force of 60 kN, calculate the extension to its length. Given E of steel as 200 kN/mm². Derive any formula used.

Or

(b) The plane stresses at a point across two perpendicular planes are 8000 N/mm² and 4000 N/mm² (both tensile). Determine the normal, tangential and the resultant stresses and its inclination on a plane 20° with major stress plane. Find also the intensity of stress, which alone can produce the same maximum strain. Take Poisson's ratio as 0.25.

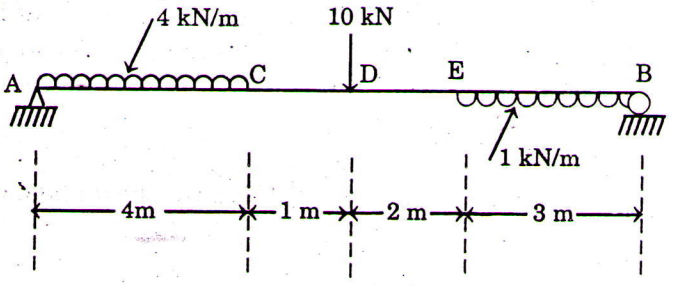
III. (a) Draw the shear force and bending moment diagrams of the beam shown below :



Or

(b) A 6 m long beam with rectangular section 110 mm width and 250 mm depth is simply supported at the ends. If it is loaded with a uniformly distributed load of 4 kN/m. For the left half of the length of the beam, and a central concentrated load of 15 kN; determine the maximum bending stress and shear stress in the beam.

IV. (a) Determine the slope at end A, and the deflection at the centre of the beam shown below :



Or

(b) A hollow circular shaft 250 mm external and 150 mm internal diameter rotates at 20 Hz. What power can be transmitted at a permissible shear stress of 80 N/mm² ? Also calculate the angle of twist in 10 m length of the shaft. Take rigidity modulus as 83 GPa.

V. (a) A cast iron column of hollow cylindrical section 5 m long, with ends firmly built-in, has to carry an axial load of 300 kN. Determine the section, using a factor of safety of 8. Internal diameter to be 8/10 of the external diameter. Rankine's constants for C.I. are :

$$F_C = 550 \text{ N/mm}^2 \; ; \quad \alpha = \frac{1}{1600}.$$

Or

(b) A thick cylinder whose external diameter is k times its internal diameter is subjected to an internal pressure. If the ratio of the maximum to minimum hoop stress is 'n', find the relation between n and k. If the maximum hoop stress is 45 N/mm² and the value of n is 2.5, find the internal radial pressure exerted and the necessary thickness of metal if the diameter of the bore is 150 mm.

[4 × 15 = 60 marks]