Model Question Paper (CBCS) with effect from 2015-16

USN | | | | | | | | | | |

15ME34

Third Semester B.E. Degree (CBCS) Examination

Mechanics of Materials

Time: 3 hrs. Max. Marks: 80

Note: Answer any FIVE full questions, choosing one full question from each module.

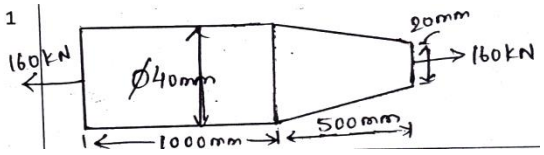
MODULE – I

1 **a** Define the following. (i) Stress (ii) Strain (iii) Poisson's ratio (iv) Elasticity (08 Marks)

b The following data refers to mild steel specimen tested in a laboratory. (08 Marks)
Diameter of specimen = 24mm; Gauge length = 200mm; Extension under load = 0.04mm; Yield point load = 150kN; Maximum load = 225kN; Neck diameter = 18.2mm; Load at failure = 275mm. Determine (i) Young's modulus; (ii) Yield stress (iii) Ultimate stress (iv) percentage elongation.

OR

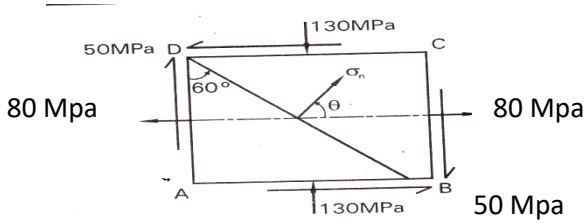
2 **a** Determine the elongation of bar shown in fig when subjected to a tensile load of 150kN. Take E = 200Gpa (08 Marks)



b Derive relation between Young's modulus(E), Modulus of rigidity(G) & Bulk modulus(K) (08 Marks)

MODULE – II

3 **a** A point in a machine member is subjected to stresses as shown in fig. Determine (i) Stresses on a plane which is at an angle of 60^0 w.r.t 80MPa stress. (ii) Magnitude of principal stresses and their locations. (iii) Maximum shear stresses and their locations, by Mohr's circle method (08 Marks)

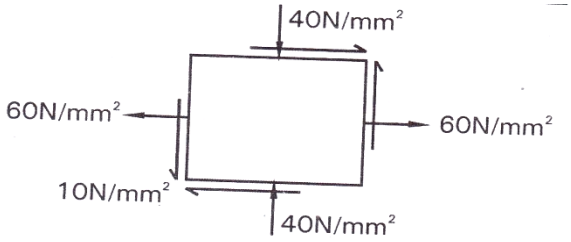


b Define thick & thin cylinder. Also derive an expression for circumferential stress in a thin cylinder (08 Marks)

OR

4 **a** Derive an expression for normal and shear stress on an inclined plane of a member subjected to uni-axial stress (08 Marks)

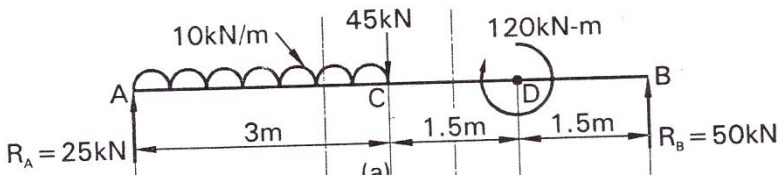
b The state of stress at a point is as shown in fig. Determine (i) Direction of principal planes; (ii) Magnitude of principal stresses (iii) Magnitude of maximum shear stress and its directions. (08 Marks)



MODULE – III

5 **a** Differentiate statically determinate and statically indeterminate beams (08 Marks)

b Draw the SFD and BMD for the structure shown in fig. and find Point of contraflexure. (08 Marks)



OR

6 **a** Derive an expression for Governing differential equation for a beam (08 Marks)

b A cantilever has length of 3m. Its cross-section is of T type with flange 100mmx20mm and web 200mmx12mm, the flange in tension. What is the intensity of UDL that can be applied if the maximum tensile stress is limited to 30N/mm^2. Also compute the maximum compressive stress (08 Marks)

MODULE – IV

7 **a** State the assumptions and Derive General torsional equation (08 Marks)

b A solid shaft has to transmit a power of 1000KW@ 120rpm. Find the diameter of the shaft if shear stress is not to exceed 80N/mm^2. The maximum torque is 1.25times of its mean. What percentage of saving in material would be obtained if the shaft is replaced by hollow shaft whose internal diameter is 0.6times its external diameter. The length, speed, material and maximum shear stress being same (08 Marks)

OR

8 **a** Derive an expression for Euler's crippling load for a column when both of its ends are hinged or pinned (08 Marks)

b A hollow C.I circular section column is 7.5mm long and is pinned at its both ends. The inner diameter of the column is 160mm and the thickness of the wall is 20mm. find the safe load by Rankine's formula, using factor of safety of 5. Also find the slenderness ratio and ratio of Euler's and Rankine's critical loads. Take $\sigma_c = 550N/mm^2$, $\alpha = 1/1600$ & $E = 8x10^4$ (08 Marks)

MODULE – V

9 **a** Define Theories of failures and explain Maximum principal stress theory (08 Marks)

b A rod of circular section is to sustain torsion of 300kN-m & bending moment of 200kN-m. Selecting C40 steel (σ_y= 353Mpa) & assuming FOS=3. Determine the diameter of rod as per (i) Maximum normal stress theory. (ii) Maximum shear stress theory (08 Marks)

OR

10 **a** Derive one expression for strain energy stored in an elastic bar when subjected to axial load, torque and bending moment (08 Marks)

b The maximum stress produced by a pull in a bar of length 1100mm is 100N/mm^2. The area of c/s and length are shown in fig. Calculate the total strain energy stored in bar if E= 200Gpa (08 Marks)