Total No. of printed pages = 7

END SEMESTER EXAMINATION–2022

Semester : 4th

Subject Code : Cv-402

STRUCTURAL MECHANICS

Full Marks – 70

Time – Three hours

The figures in the margin indicate full marks for the questions.

Instructions :

(i) *All* questions of PART–A are compulsory.

(ii) Answer any *five* questions from PART–B.

PART–A

Marks–25

1 Choose the correct answer : 1×5=5

(i) According to Hook's Law, the ratio of stress and strain is known as

(a) Modulus of elasticity

(b) Young's Modulus

(c) Both (a) & (b)

d) None of these

[Turn over

(ii) Rankin's formula is an empirical formula which is used for

(a) Long Column

(b) Short Column

(c) Both Long and Short columns

(d) None of these

(iii) The property of a material by virtue of which a body returns to its original shape after removal of the load is known as

(a) Ductility (b) Plasticity

(c) Resilience (d) Elasticity

(iv) Which of the following is true (μ = Poisson's ratio)

(a) $0 < \mu < -1/2$ (b) $1 < \mu < 0$

(c) $1 < \mu < -1$ (d) None of these

(v) For the bars of composite section

(a) the load carried by different materials is the same as the total external load.

(b) the total external load is equal to the total sum of the loads carried by different materials.

(c) strain in all materials is equal

(d) Both (b) & (c).

2. Fill in the blanks : 1×5=5

(i) A cantilever beam of length (l) carries a uniformly distributed load 'w' per unit length over the whole length. The downward deflection at the free end will be ____.

(ii) A ____ dam as compared to rectangular dam is economical and easier to construct.

(iii) If the axial force in truss member tends to pull or stretch its joints is called ____.

(iv) The ratio of the effective length of a column and minimum radius of gyration of its cross-sectional area is known as ____.

(v) The sectional modulus for a circular section of diameter 'd' is ____.

3. Write True or False : 1×5=5

(i) To avoid tension at the base of the dam, maximum value of eccentricity is $e \leq b/6$.

(ii) Generally in a truss system compressive parts are thicker than tensile parts.

(iii) The point of contraflexure occurs only in cantilever beam.

(iv) Flitch beam means a beam of composite section consisting of wooden beam strengthened by mild steel plates.

(v) The flexural rigidity for the deflection of beams is expressed as 1/EI.

4. Match the following columns : 1×5=5

Column-A	Column-B
(a) End conditions	(i) L_e
(b) Both ends fixed	(ii) $L_e = L/\sqrt{2}$
(c) Both ends hinged	(iii) $L_e = 2L$
(d) One end fixed and other end is free	(iv) $L_e = L/2$
(e) One end fixed and other end is hinged	(v) $L_e = L$

5. What do you mean by the following terms : 1×5=5

(i) Shear Force

(ii) Overhanging Beam

(iii) Buckling or Crippling load

(iv) Slenderness Ratio

(v) Poisson's Ratio.

PART – B

Marks – 45

6. (a) Define Stress, Strain and Modulus of Rigidity. State Hook's Law. 1+1+1+1=4

(b) A rod 200 cm long and of diameter 3 cm is subjected to an axial pull of 30 kN. If the Young's modulus of the material of the rod is 2×10^5 N/m^2. Determine 5

(i) Stress

(ii) Strain.

7. A simply supported beam of length 6m carries point load of 3 kN and 6 kN at a distance of 2m and 4m from the left end. Draw the shear force and bending moment diagram for the beam. 9

8. (a) What do you mean by section modulus ? Find an expression for section modulus for a rectangular section. 1+3=4

(b) A steel plate of width 120 mm and of thickness 20 mm is bent into a circular arc of radius 10m. Determine 5

(i) The maximum stress induced

(ii) The bending moment (which will produce the maximum stress).

9. (a) What is slope and deflection of a beam ? 2

(b) A beam 6m long simply supported at its ends, is carrying a point load of 50 kN at its centre. The moment of inertia of the beam is 78×10^6 mm^4 and $E = 2.1 \times 10^5$ N/mm^2. Calculate

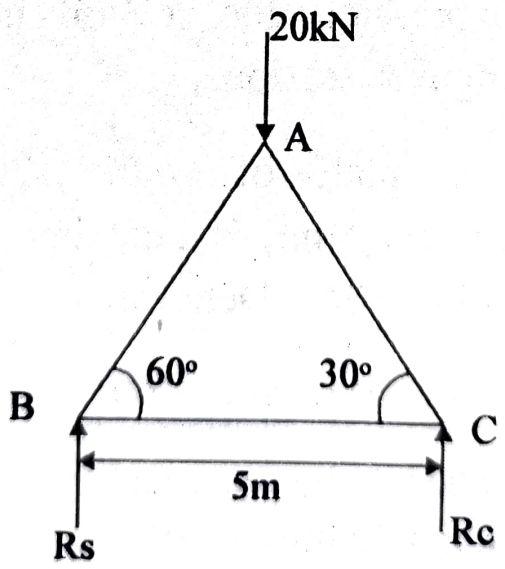
(i) Deflection at the centre of the beam

(ii) Slope at the support. $3\frac{1}{2}+3\frac{1}{2}=7$

10. (a) Explain the assumption made in Euler's Column theory. 5

(b) A solid round bar 3m long and 5 cm in diameter is used as a strut with both ends hinged. Determine the crippling load. Take $E = 2.0 \times 10^5$ N/mm^2. 4

11. Find the forces in the member AC and BC of the truss shown in the following figure : 9



12. (a) Write the forces acting on dam and retaining wall. 2+2=4

(b) A masonry dam of rectangular section 20m high and 10m wide has water up to a height of 16m on its one side. Find pressure force due to water on one meter length of the dam. 5