BE Semester- IV (Civil Engineering) Question Bank

(Subject Name): <u>STRUCTURAL ANALYSIS - I</u>

All questions carry equal marks (10 marks)

Q.1	Explain various types of Statically Determinate & Indeterminate planar Structures.
Q.2	Explain Static & Kinematic inderminancy with examples. Also give examples of stable/unstable structures.
Q.3	Explain dead load, live load, wind load, earthquake load, hydro-static load moving-load as per IRC.
Q.4	Explain the given terms with units: • Resilience • Proof resilience • Modulus of resilience
Q.5	Determine Strain energy in tension, compression, and shear.
Q.6	A copper tube of outside diameter 38 mm & inside diameter 35.5 mm, is closely wound with steel wire of 0.75 mm diameter. Estimate the tension at which the wire must have been wound, if an internal gauge pressure of 20 kg/cm^2 produces a tensile circumferential stress of 70 kg/cm^2 in the copper tube. Es=1.6Ec
Q.7	A beam AB of 4 m span is simply supported at the ends & loaded with a point load of 10 kN at 1 m & udl of 5 kN/m of 2 m length at 2 m from left end. Determine, i) deflection at the point where udl starts, ii) Maximum deflection iii) slope at left end. Take E=2 x 10^5 N/mm^2 & I=1000 cm^4 .Use Macaulay's method.
Q.8	A beam ACB, simply supported at the ends, has moment of inertia 4I for the length AC & I for length CB, & is loaded with a point load P at C. Determine i) slope at end A, ii) deflection at mid-span iii) maximum deflection. Take AC=8m, CB=2m, W=10 KN, I=4000 cm^4 & E=2 x 105 N/mm^2
Q.9	Four wheel loads of 6, 4, 8 & 5 kN cross a girder of 20 m span, left to right followed by & udl of 4 KN/m & 4 m long with the 6 kN load leading. the spacing between the loads in the same order are 3m, 2m & 2m. The head of udl is at 2m from the last 5 KN load. Using influence lines, calculate the S.F. & B.M. at a section 8m from the left support when the 4 KN is at centre of the span.
Q.10	A suspension bridge cable hangs between two points A & B separated horizontally by 120m & with A 20 m above B. The lowest point in the cable is 4 m below B. The cable support a stiffening girder which is hinged vertically below A, B & lowest point in the cable. Find the position & magnitude of the largest bending moment which a point load of 10 kN can induce in the girder together with the position of load.
Q.11	A beam ABC is supported at A, B, & C and is hinged at D distance 3 m from A. AB=7 m & BC=10 m. Draw the influence lines for reactions at A, B & C. If udl of intensity 2 kN/m & length 3 m, travels from left to right, calculate quantities for which I.L. are drawn.
Q.12	A symmetrical 3 hinged arch has a span of 16 m & rise to the central hinge of 4 m. It carries a vertical load of 16 kN at 4 m from the left end. Find a) the

	magnitude of thrust at the springing, b) the reactions at the support, c) bending moment at 6 m from the left hand hinge d) max. positive & negative moment.
Q.13	450 kW power has to be transmitted at 100 rpm. Find i) the necessary diameter of Solid circular shaft, ii) the necessary diameter of circular section, the inside diameter being ¾ of the external diameter. Allowable shear stress = 75 N/mm^2 & the density of material = 77 kN/m^3
Q.14	A vertical tie fixed rigidity at the top consists of a steel rod 2 m long & 20 mm diameter encased throughout in a brass tube 20 mm internal diameter & 30 mm external diameter The rod & casing are fixed at both ends. The compound rod is suddenly loaded in tension by weight of 15 kN falling through a height of 3 mm before being arrested by the tie. Determine the max stress in steel & brass. E = 2 x 10^5 N/mm^2 for steel & E = 10^5 N/mm^2 for brass.
Q.15	Two bars A & B are each 20 cm long & are of the same material. Bar A is 2 cm in diameter for a length of 5 cm & 4 cm in diameter for the remaining 15 cm length. Bar B is 2 cm in diameter for the length of 15 cm & 4 cm in diameter for the remaining 5 cm length. An axial blow given to A, produces instantaneous stress of 1200 Kg/cm^2. Calculate the max instantaneous stress produced by the same blow on B. If each bar is stressed up to the elastic limit, calculate the ratio of energy stored by A & B at proof stress. Also, calculate the ratio of strain energy per unit volume of each bar at the same stress.
Q.16	A hollow steel shaft 4 m long is to transmit 150 kW power at 150 rpm. The total angle of twist in this length is not to exceed 2.5^0 & the allowable shear stress is 70 N/mm^2. Determine the inside & outside diameter, if G = 0.082 x 10^6 N/mm^2
Q.17	Compare the crippling loads given by Euler's & Rankine's formula for a tubular steel strut 2.3 m long having outer & inner diameter 38 mm & 33 mm respectively, loaded through pin joints at each end. Take the yield stress as 335 N/mm^2, the Rankine's constant = 1/7500 & E = 0.205 x 10^6 N/mm^2. For what length of strut of this cross section does the Euler formula cease to apply?
Q.18	Determine Strain energy in bending and torsion.
Q.19	A short hollow cylindrical cast iron column having outside diameter 30 cm & inside diameter 20 cm was cast in a factory. On inspection, it was found that the bore is eccentric in such a way that the thickness varies from 3 cm at one end to 7 cm at the other. Calculate extreme intensities of stress induced in the section, if column carries a load of 800 kN along the axis of the bore.
Q.20	Derive the equation of crippling load for the column having one end fixed & other hinged with usual notation by Euler's theory. Also, explain why Rankine's theory is better than Euler's theory for short columns
Q.21	A masonry retaining wall trapezoidal in section with one face vertical is 1 m wide at top & 3 m at the base & 8 m high. The material retained on the vertical face exerts a lateral pressure varying from zero at top to 25 kN/m^2 at the base. If unit weight of masonry is 21 kN/m^2, calculate the max & min stress intensities induced in the base
Q.22	Determine the concept of fixed beam.
Q.23	Explain the consistent deformation method for indeterminate structures.
Q.24	Explain the three-moment theorem for indeterminate structures.

Q.25	Discuss various tests on fixed beam.
Q.26	Derive the equation of crippling load for the column having both end hinged with usual notation by Euler's theory. Also, explain why Rankine's theory is better than Euler's theory for short columns
Q.27	A hollow shaft of diameter ratio 3/5 is required to transmit 800 kW at 110 rpm, max torque being 20% greater than the mean. The shear stress is not exceeding 63 MPa & the twist in a length of 3 m is not to exceed 1.4^0. Calculate the min external diameter satisfying these conditions.
Q.28	A cantilever beam having span L is loaded with w per unit length. Derive equation for max slope & max deflection in term of 'w' & 'L'.
Q.29	Explain Maxwell's reciprocal theorem for cantilever beam.
Q.30	A concrete pier 1.5 m x 1.5 m in section & 6 m long carries a compressive load P, lying at a point on the top which is 50 cm from each of the two adjacent faces. What is the max value of P, if no tensile stress is produced in the bar? Take weight of concrete pier as 2 x 10^4 N/m^3.
Q.31	Derive the equation of crippling load for the column having one end fixed & other free with usual notation by Euler's theory. Also, explain why Rankine's theory is better than Euler's theory for short columns
Q.32	Determine the max possible span for a cable support at its two end (level support), if the central sag is limited to 10 % of the span, & if the permissible tensile stress is 150MPa. Assume the unit weight of the steel as 78.5 kN/m^3. Take parabolic profile of cable having span/rise as 10.
Q.33	A simply supported beam having span L is loaded with w per unit length. Derive equation for max slope & max deflection in term of 'w' & 'L'.
Q.34	Determine Strain energy for suddenly applied load and impact load.
Q.35	A steel specimen 1.5 cm^2 in cross section 0.005 cm over a 5 cm gauge length under an axial load 30 kN. Calculate strain energy stored in the specimen at this point. If the load at the elastic limit for the specimen is 50 KN, calculate the elongation at elastic limit & proof resilience.
Q.36	A propped cantilever beam having span L is loaded with w per unit length & central point load P. Derive equation for max slope & max deflection in term of 'w', 'P' & 'L'.
Q.37	A three-hinged parabolic arch of 18 m span & 3 m central rise carries point load of 6 kN at 3 m horizontally from the left hand hinge. Calculate the max positive & negative bending moment. Also draw bending moment diagram.
Q.38	Explain Maxwell's reciprocal theorem for simply supported beam.
Q.39	A cantilever beam having span L is loaded with w per unit length & point load P at end. Derive equation for max slope & max deflection in term of 'w','P' & 'L'.
Q.40	Derive the equation of crippling load for the column having both end fixed with usual notation by Euler's theory. Also, explain why Rankine's theory is better than Euler's theory for short columns