

GUJARAT TECHNOLOGICAL UNIVERSITY**B.E. Sem-III Remedial Examination May 2011****Subject code: 130604****Date: 25-05-2011****Subject Name: Structural Analysis-1****Time: 10.30 am – 01.00 pm****Total Marks: 70****Instructions:**

1. Attempt all questions.
2. Make suitable assumptions wherever necessary.
3. Figures to the right indicate full marks.

- Q.1 (a)** Do as directed **07**
- (i) State theorem of moment area method.
 - (ii) Sketch a beam with $SI=2$ & $KI=2$ (neglect axial deformations)
 - (iii) Sketch kern of rectangular section 600 x 900 mm.
 - (iv) Write predominant actions in structural elements column, beam, arch and cable.
 - (v) State Maxwell's reciprocal theorem
 - (vi) Define : Resilience, Modulus of resilience
 - (vii) Write down any four assumptions made for derivation of Euler's crippling load formula.
- (b)** Do as directed
- (i) Find SI and KI of structures shown at fig.1(a) & fig.1 (b) **04**
 - (ii) For the portal shown in the fig.2, find out moment at B, shear and axial force in member AB. **03**
- Q.2 (a)** A solid steel shaft has to transmit 120 kW at 600 r.p.m. Find the diameter of the shaft if the shear stress is to be limited to 100 N/mm^2 . Estimate the possible % saving in the material of the shaft if hollow shaft of internal diameter equals 0.75 times external diameter is replaced against solid shaft. **07**
- (b)** A 1500 mm long wire of 25 mm^2 cross sectional area is hanged vertically. It receives a sliding collar of 100 N weight and stopper at the bottom end. The collar is allowed to fall on stopper through 200 mm height. Determine the instantaneous stress induced in the wire and corresponding elongation. Also determine the strain energy stored in the wire. Take modulus of elasticity of wire as 200 GPa. **07**
- OR
- (b)** A solid cast iron circular column of 4.0 m height is to be erected such that its one end remains fixed and other end remains hinged. Find the size of the section, if column has to carry a safe axial load of 300 kN. Take factor safety of 5, $f_c = 500 \text{ N/mm}^2$, Rankine's constant $\alpha = 1/1500$. **07**
- Q.3 (a)** Find the slope and deflection at point B and C for the beam shown in the fig.3 Take $EI=3000 \text{ kN.m}^2$ **07**
- (b)** For a trapezoidal masonry dam as shown in the fig.4, plot the stress distribution at the base. Take density of masonry = 20 kN / m^3 . **07**
- OR
- Q.3 (a)** Find the slope at A and deflection under C for the beam shown in the fig.5 Take $EI=3000 \text{ kN.m}^2$ **07**

- (b) A cylindrical boiler to generate internal steam pressure 2 N/mm^2 , is to be fabricated using 12 mm thick plate having a limiting tensile stress of 120 N/mm^2 . If the efficiencies of the longitudinal and circumferential joints are 75% and 40 % respectively, find the safe diameter of the boiler. **07**
- Q.4 (a)** Draw the I.L.D. for R_A , R_B , F_c and M_C for the beam shown in the fig.6. **07**
- (b) (i) Write the expressions for strain energy stored due to bending, shear and torsion. Write meaning of each term. **03**
- (ii) Derive the expression for the determination of horizontal thrust for a parabolic arch loaded by uniformly distributed load. **04**
- OR
- Q.4 (a)** Two wheel loads 20 kN and 40 kN, 2 m fixed distance apart, crosses a girder of 16m span. Find the maximum BM and shear force at a section 4.0 m from the left support, using ILD. **07**
- (b) Draw I.L.D. for a member U_2L_2 , U_2U_3 & U_2L_3 for the truss shown in the fig.7. **07**
- Q.5 (a)** For the simply supported beam subjected to UDL, derive the expressions for slope at support and deflection at the midspan using moment area method. **07**
- (b) For a semicircular arch shown in the fig.8 :determine, **07**
- (i) Support reactions (ii) BM, radial shear and axial thrust at point load location.
- OR
- Q.5 (a)** A closed coil spring is to be made such that its mean diameter is 10 times that of wire diameter. The spring has to carry static load of 750 N. Find the diameter of wire and mean diameter of spring if maximum shear stress allowed in spring material is 80 N/mm^2 . Find the number of coils if spring stiffness is 25 N/mm and modulus of rigidity of spring material is $90 \times 10^3 \text{ N/mm}^2$. **07**
- (b) A cable of span 200 m and dip 20 m carries a load of 6 kN/m on horizontal span .Determine the maximum tension in the cable and its inclination at the supports if both the supports are at same level. Estimate the load transferred on the supporting tower if cables are passing over the smooth rollers. The back anchor cables are inclined at 45° . **07**

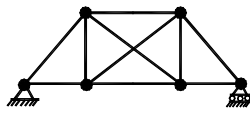


fig.1(a) Q:1(b)(i)

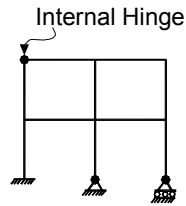


fig.1(b) Q:1(b)(i)

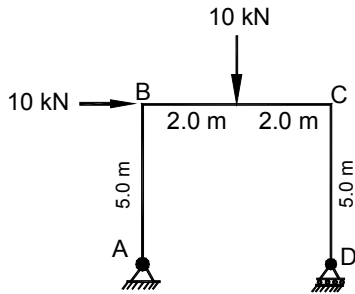


fig.2 Q:1(b)(ii)

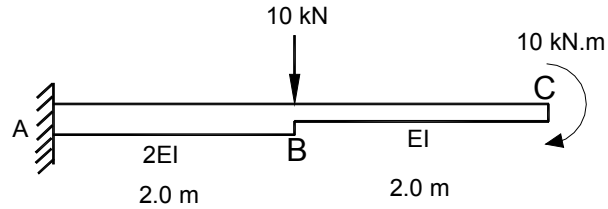


fig.3 Q:3(a)

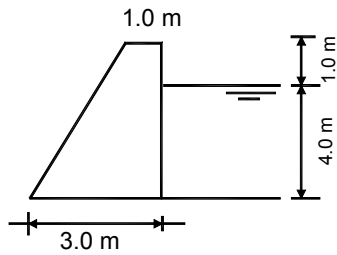


fig.4 Q:3(b)

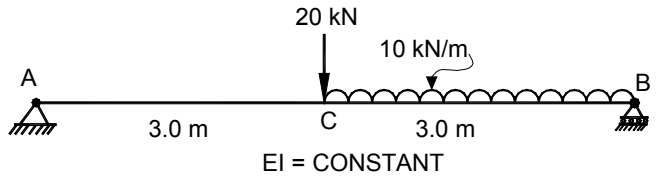


fig.5 Q: 3(a) OR

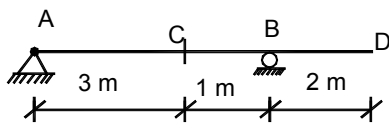


fig.6 Q:4(a)

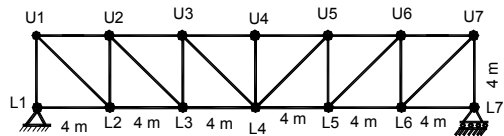


fig.7 Q:4(b) OR

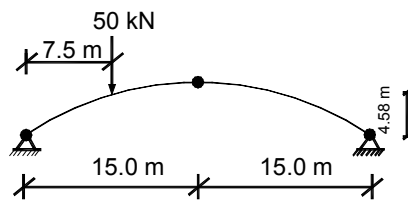


fig.8 Q:5(b)