Seat No.: _____ Enrolment No._____

GUJARAT TECHNOLOGICAL UNIVERSITY

BE - SEMESTER–IV (New) EXAMINATION – WINTER 2015

Subject Code:2140603 Date:01/01/2016

Subject Name: Structural Analysis-I

Time: 2:30pm to 5:00pm Total Marks: 70

Instructions:

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

Q.1 Attempt the following **(14)**

i. Define Conjugate beam Theorems.
ii. Which points should be take care while using Macaulay's Method.
iii. A simply supported beam is subjected to a central point load. If the slope is 0.8^0 at support due to the effect of loading, calculate deflection at center. Length of the beam is 3m.
iv. Find Structural indeterminacy of the structure shown in **figure 1(a)** & **1(b).**
v. Find Kinematic indeterminacy of the structure shown in **figure 1(a)** & **1(b).**
vi. Give advantages of fixed beam over a simply supported beam.
vii. Differentiate between column and strut

Q.2 **(a)** A column of size 250mm (b) x 350mm (d), 4.2 m in length with its both ends are fixed. Find load carrying capacity of the column by 1) Euler's formula 2) Rankine's formula. Take f_c=320 N/mm^2, E = 2.1 x 10^5 N/mm^2, α= 1/6400. **07**

(b) Analyze the plane frame as shown in **figure 2**. Draw shear force diagram, Bending moment diagram, and axial force diagram. **07**

OR

(b) A cylindrical chimney 25m high of uniform circular section is 6m external dia. & 2.5m internal dia. It is subjected to a horizontal wind pressure of 1500N/mm^2. If the coefficient of wind pressure is 0.7 & unit weight of masonry is 20 kN/ m^3. Find the maximum & minimum stresses at the base of the section. **07**

Q.3 **(a)** Determine deflection at B, C and D for the cantilever beam loaded as shown in **figure 3** using Macaulay's method**.** Take E=2 x 10^5 N/mm^2 & I = 2 x 10^8 mm^4. **07**

(b) Calculate reaction at supports and draw bending moment diagram for the three-hinge arch as shown in **figure 4**. **07**

OR

Q.3 **(a)** Find slope and deflection at point C for the beam shown in **figure 5** using Conjugate beam method. Take EI = 20000 KN-m^2. **07**

(b) i. Differentiate between the real beams and conjugate beam. **07**

ii. A suspension cable having supports at the same level has a span of 40m and a maximum dip of 3m. The cable is loaded with a uniformly distributed load of 10 kN/m through out its length. Find the maximum tension in the cable.

Q.4 **(a)** i. Derive an expression for strain energy stored in a body for any loading condition. **07**

ii. Derive Euler's crippling load formula for the long column fixed at both ends.

(b) A simply supported beam AB of span 6m carries a uniformly distributed load of 15 kN/m over its entire span. Determine the strain energy stored in the beam. Take E = 2 x 10^5 N/mm^2 and I = 10 x 10^7 mm^4. **07**

OR

Q.4 **(a)** A masonry dam 5 m high, 1 m wide at the top and 3 m wide at the base retains water to the full height. The water face of the dam is vertical. Determine the extreme pressure intensities at the base. Water and masonry weigh 10 kN/ m^3 and 22 kN/ m^3 respectively. **07**

(b) A 1.5m long wire of 30 mm^2 cross sectional area is hanged vertically. It receives a sliding collar of 200 N weight and stopper at the bottom end. The collar is allowed to fall on stopper through 250 mm height. Determine the instantaneous stress induced in the wire, corresponding elongation and the strain energy stored in the wire. Take modulus of elasticity of wire 2x10^5 N/mm^2. **07**

Q.5 **(a)** A thin cylinder is filled with fluid, which exerts pressure 2.0 N/mm^2 on the wall. If the diameter of cylinder is 1.2 m, length of 4.0 m and shell thickness of 20 mm. Calculate the change in the volume of the cylinder. Assume E=2x10^5 N/mm^2 and Poisson's ratio as 0.28. **04**

(b) A beam AB of span 5 meter fixed at both ends carries a uniformly distributed load of 20 kN/m over the whole span. The left end 'A' rotates clockwise by 0.8^0 and right end 'B' sinks by 10 mm. Determine the fixed end moments and the reactions at the supports. Draw also shear force and bending moment diagrams. Take E = 200 kN /mm^{2}and I = 10 x10^7 mm^4. **10**

OR

Q.5 **(a)** Derive the equation for fixed end moment developed if one of the supports of a fixed beam settles by amount 'δ'. **04**

(b) Analyze the propped cantilever beam shown in **figure 6** using consistent deformation method and draw shear force and bending moment diagram. **10**

****

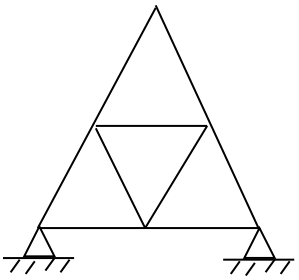

Fig. 1(a)

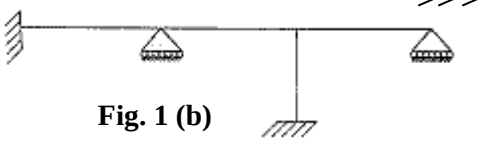

Fig. 1 (b)

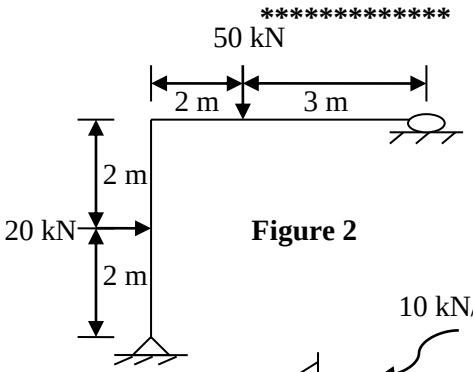

Figure 2

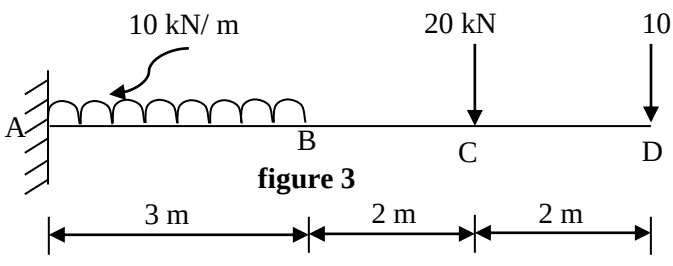

figure 3

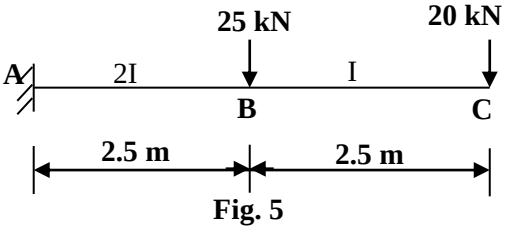

Fig. 5

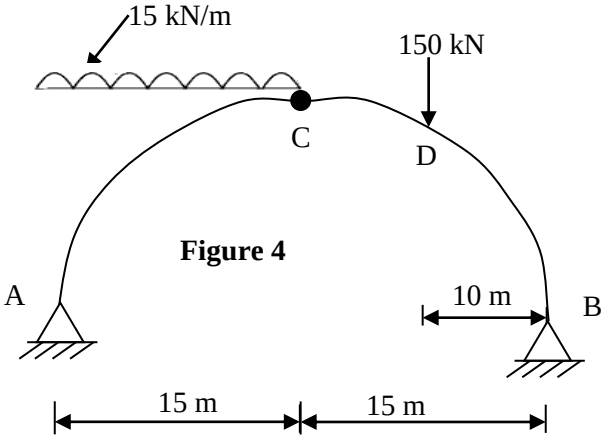

Figure 4

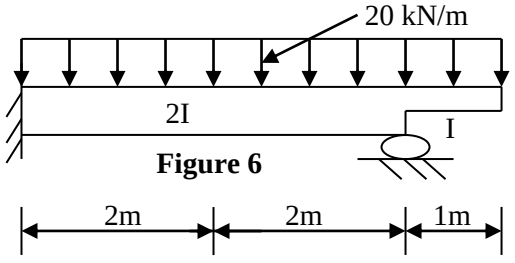

Figure 6