Seat No.: _____ Enrolment No._____

GUJARAT TECHNOLOGICAL UNIVERSITY

BE - SEMESTER– IV (NEW) EXAMINATION – SUMMER 2015

Subject Code: 2140603 Date: 03/06/2015

Subject Name: STRUCTURAL ANALYSIS - I

Time: 10:30am-1.00pm Total Marks: 70

Instructions:

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

Q.1 **(a)** (i) Find SI and KI of the structures as shown in fig. 1(a) and (b). **05**

(ii) State the Maxwell's Reciprocal theorem. **02**

(b) A solid cast iron circular column of 5.0 m height is to be erected such that its both ends are hinged. Find the size of the section, if column has to carry a safe axial load of 500 kN. Take Factor of safety of 5. Take f_c =500 N/mm^2, Rankine's constant α = 1/1500. **07**

Q.2 **(a)** Find slope and deflection of point B and C for the beam as shown in fig.2. Take EI=5000 kN.m^2. **07**

(b) For a beam as shown in fig. 3 calculate the slope at support C and deflection under point load. Take E= 2 x 10^5 N/mm^2, I= 5 x 10^8 mm^4. **07**

OR

(b) For a beam as shown in fig. 4 calculate slope and deflection under point load. Take E= 2 x 10^5 N/mm^2, I= 5 x 10^8 mm^4. **07**

Q.3 **(a)** A masonry pier of 3 x 4 m supports a vertical load of 100 kN as shown in fig.5. Find the stress developed at each corner of the pier. What additional load should be placed at the centre of the pier so that there is no tension? **07**

(b) (i) A cylinder vessel closed with plane ends is made of a 5 mm thick steel plate. Its diameter is 250 mm and length is 1000 mm. it is subjected to an internal fluid pressure of 3.0 N/mm^2. Calculate the longitudinal and hoop stresses in the shell plate. Also calculate change in volume of the cylinder. Take E= 210 GN/m^2 , μ =0.3. **04**

(ii) Draw 'Core' for the (a) Rectangular section (b) Hollow circular section. **03**

OR

Q.3 **(a)** A masonry Retaining wall with vertical face is 6.0 m high. Its width at top is 1 m and at base the width is 3.0 m. Weight of masonry is 24 kN/m^3. Up to what height a soil weighing 15 kN/m^3 can be retained by this wall, so that maximum pressure at the base is 1.2 times the minimum pressure at the base? Angle of repose of the soil is 30^0. **07**

(b) (i) Derive the expression of increase in volume for thin spherical cell subjected to internal fluid pressure. **04**

(ii) Explain the condition to avoid tensile stresses at the base of a masonry dam when subjected to hydrostatic pressure. **03**

Q.4 **(a)** A symmetrical three hinged circular arch has a span 20 m and central rise 5 m. It carries a point load of 20 kN at 5 m from left support. Calculate value of thrust at springing. Also calculate maximum positive Bending Moment and Bending Moment at 6.0 m from left support. **07**

(b) Analyze Propped cantilever as shown in fig.6. Draw Shear Force diagram. **07**

OR

Q.4 **(a)** A cable of horizontal span of 28 m is to be used to support six equal loads of **07**

50 kN each at 4 m spacing. The central dip of the cable is limited to 2.0 m. Find the length of the cable required and its sectional area if the safe tensile stress is 750 N/mm^2.

(b) Analyse a fixed beam as shown in fig.7. Draw bending moment diagram **07**

Q.5 **(a)** A steel bar of 100 cm long and rectangular in section 50 mm x 100 mm is subjected to an axial load of 1.5 kN. Find the maximum stress if , **07**
(a) the load is applied gradually.
(b) the load is applied suddenly
(c)the load is applied after falling through a height of 10 cm.
What are the strain energies in each of the above case? Take E= 2 x 10^5 N/mm^2.

(b) Derive the equation for strain energy stored in an element due to Torsion. **07**

OR

Q.5 **(a)** A vertical steel rod of 1.25 m long is rigidly secured at its upper end and a weight of 1000 N is allowed to slide freely on the rod through a distance of 50 mm on the stop at the lower end. The upper 750 mm length of the rod has a diameter of 28 mm while the lower 500 mm length is 15 mm diameter. Calculate the maximum instantaneous stress and elongation of the rod and strain energy at maximum elongation. E= 200 GN/mm^2. **07**

(b) Define Resilience, Proof Resilience, and Modulus of Resilience. Derive the equation for strain energy stored in an element due to Bending. **07**

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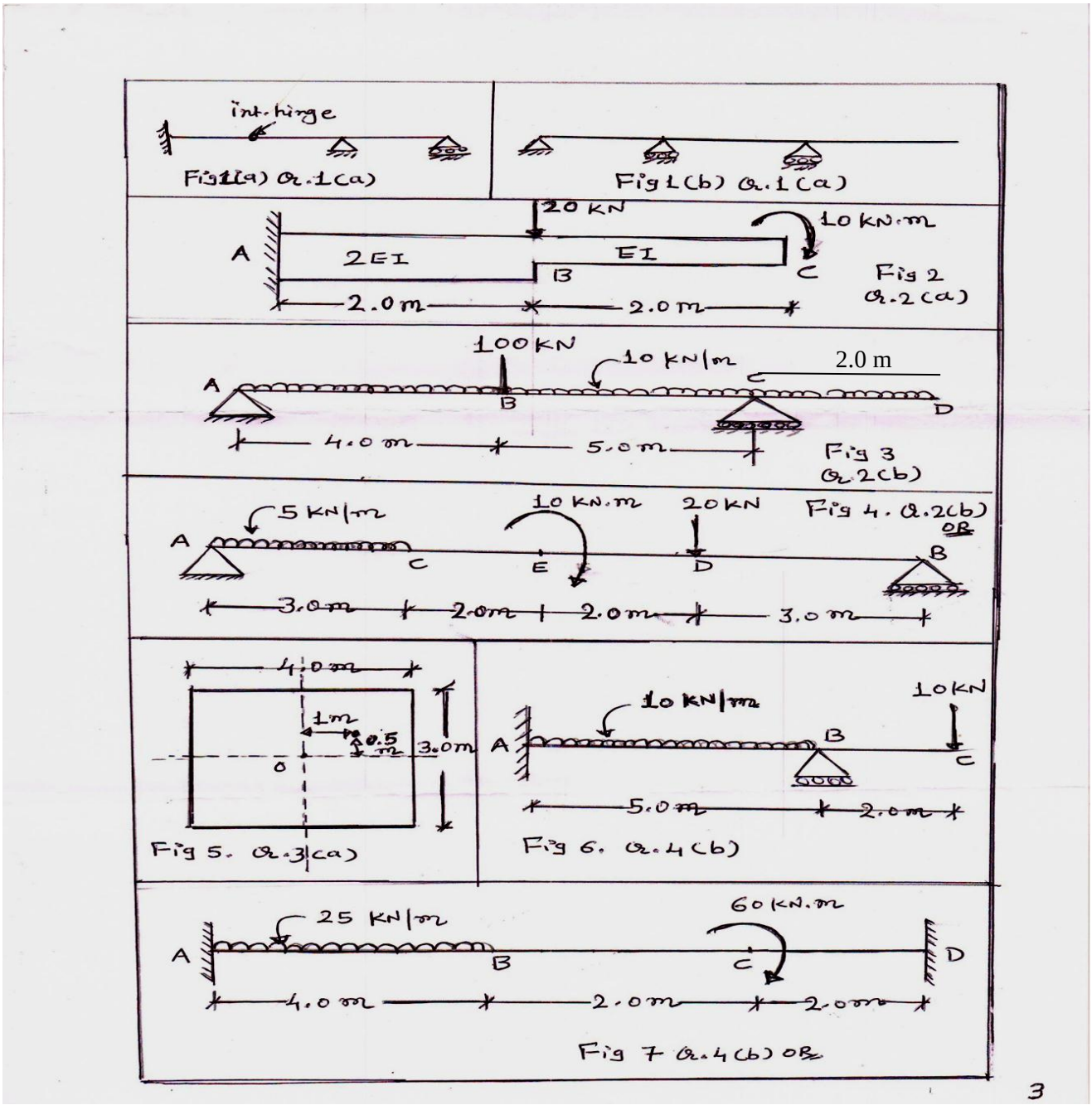
int. hinge
Fig 1(a) Q.1(a)
Fig 1(b) Q.1(a)
20 KN
10 KN.m
A
2EI
EI
B
C
2.0 m
2.0 m
Fig 2 Q.2(a)
100 KN
10 KN/m
2.0 m
A
B
C
D
4.0 m
5.0 m
Fig 3 Q.2(b)
5 KN/m
10 KN.m
20 KN
Fig 4. Q.2(b) OR
A
C
E
D
B
3.0 m
2.0 m
2.0 m
3.0 m
4.0 m
1m
0.5 m
3.0m
O
Fig 5. Q.3(a)
10 KN/m
10 KN
A
B
C
5.0 m
2.0 m
Fig 6. Q.4(b)
25 KN/m
60 KN.m
A
B
C
D
4.0 m
2.0 m
2.0 m
Fig 7 Q.4(b) OR

3