Seat No.: _____ Enrolment No._____

GUJARAT TECHNOLOGICAL UNIVERSITY
BE - SEMESTER– V • EXAMINATION – WINTER 2016

Subject Code: 150605 **Date: 24/11/2016**
Subject Name: Structural Analysis - III
Time: 10:30AM – 01:00PM **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)** Solve the following (4 marks each) **08**

1. Find the shape factor for a beam of solid rectangular cross-section
2. Find vertical reactions at simple supports 'A', 'B' & 'E' of a beam ABCDEF curved in plan in x-y plane, carrying vertical downward loads 'P' at points 'C', 'D' and 'F'. Co-ordinates of points are A(0,L), B(0,0), C(L,0), D(2L,0), E(2L, – L), F(L, – L). 'F' is the free end

(b) Find the bending rotation produced at the free end of a cantilever, carrying a vertical downward load 'P' at the free end. The cantilever is in the form of a quarter circle of radius 'R' in plan. Take E = 2G, J = 2I **06**

Q.2 **(a)** A statically indeterminate pin-jointed truss ABCD has 4 joints. Lengths of members AB=CD=4m, AC=BD=5m and AD=BC=3m. The Support 'A' is hinged and 'B' is a roller offering vertical reaction. Find the redundant force in members 'BC' using flexibility method if the truss carries a horizontal load, parallel to member 'AB' and of magnitude 8kN, at 'D' acting rightward. Take axial rigidity AE = 1 **07**

(b) A prismatic cantilever of radius 'R' is semicircular in plan and has end 'A' fixed. It carries a torque 'T' at the free end 'B'. Draw the BMD showing ordinates at quarter points **07**

OR

(b) A prismatic ring beam of radius 'R' carrying u.d.l. of intensity '*w*' on entire length is resting on 6 equidistant supports as measured along length. Find the BM over any intermediate support **07**

Q.3 **(a)** A portal has bay width BC = L and leg heights AB = 1.5L and CD = L. If the plastic moment carrying capacity of all members is same sketch various possible collapse mechanisms showing rotations at plastic hinges if the frame carries a vertical downward point load 'P' at centre of BC and a horizontal rightward load 'P/2' at 'C'. Find collapse load for any one mechanism **07**

(b) A prismatic fixed ended beam has plastic moment carrying capacity 'M_P'. It is loaded with u.d.l. on middle third portion. Find the intensity of the load using kinematic method, if the beam collapses. **07**

OR

Q.3 **(a)** A 2-span continuous beam has plastic moment carrying capacity as 180 kN-m. Span AB = 3.4m and BC = 4.5m. Both spans carry vertical downward point load of magnitude 80 kN at the centre. Using kinematic method find collapse load factor for beam. Ends A & C are simple supports **07**

(b) Using static method find the collapse load for a fixed ended beam carrying u.d.l. on entire length 'L' in terms of plastic moment carrying capacity 'M_P' **07**

Q.4	**(a)**	A 2-span continuous beam of prismatic section carries u.d.l. of intensity 12 kN/m on span AB and a point load of magnitude 71.679 kN at centre of BC. End 'A' is fixed. Supports 'B' & 'C' are simple supports. Find redundant support moments using flexibility method. Take AB=4m, BC=5m	**07**
	(b)	A prismatic propped cantilever of span 4m carries a vertical downward point load 100 kN at its centre. Using stiffness method find the rotation at the prop. Hence find member end actions. Draw BMD	**07**

OR

Q.4	**(a)**	A prismatic beam has 2 equal spans AB = BC= L. Supports 'A' & 'C' are fixed. The beam carries a downward u.d.l. of intensity '*w*' on entire length. Using stiffness method find settlement of support 'B' such that no reaction develops at roller support 'B'	**07**
	(b)	A 3-span continuous beam ABCD has end 'A' fixed and 'B', 'C', 'D' as roller supports. The beam has to be analysed using flexibility method considering redundants that are available only at the supports. Sketch all possible released structures for the beam, showing the redundant chosen.	**07**
Q.5	**(a)**	A conical dome has a base diameter 16m and central rise 4m. It carries a distributed vertical downward load of intensity 3kN/m^2 of projected (plan) area. Find the maximum force developed along generator	**07**
	(b)	Analyse a hemispherical dome of uniform thickness, resting on level surface, carrying its own weight. Locate a critical section at which hoop stress becomes zero	**07**

OR

Q.5	**(a)**	A hemispherical dome of radius 20m carries circular cylinder of diameter 6m.Consider the axis of cylinder and dome to be same. Take total weight of cylinder as 200kN. This load has to be considered in addition to self-weight. Find the hoop stress developed at 14.142m above level base on which the dome rests. Take thickness of dome as 275mm & density of material as 25 kN/m^3	**07**
	(b)	A weightless hemispherical dome carries a concentrated load of magnitude 300kN at its crown. Find the meridional stress developed in the dome at the base if the thickness and diameter of dome are 125mm and 20m	**07**

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