Seat No.: _____ Enrolment No._____

GUJARAT TECHNOLOGICAL UNIVERSITY

BE SEM-VII Examination-Nov/Dec.-2011

Subject code: 170603 **Date: 24/11/2011**

Subject Name: Structural Design I

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.**
4. **Draw neat and clean sketches with pencil only.**
5. **IS 456-2000, IS 800-2007, SP-16, IS 875 Part I, II and III and steel table are permitted.**
6. **Adopt M20 grade of concrete & Fe 415 grade of reinforcement for RC design and f_y = 250 grade for steel design unless otherwise stated.**

Q.1 Write answer in short (Two marks for each). **14**

(1) Why the minimum reinforcement less than 0.85/f_y is permitted in RC slabs as compared to the RC beams?

(2) What are IS 456 guidelines to satisfy limit state of cracking in slabs?

(3) Why is the larger concrete cover required for footing reinforcement?

(4) What are the criteria for minimum eccentricity in column design as per IS 456?

(5) Write the design bending strength of a laterally unsupported beam as governed by lateral torsion bucking as per IS 800?

(6) What are IS 800 recommendations for compression member in trusses?

(7) Write the expression given in IS 800 to calculate design strength of a groove weld in tension & a groove weld in shear?

Q.2 **(a)** Elaborate with reasons for "Limit state method is more desirable than working stress method". **07**

(b) Determine the plan dimensions of a combined footing for two axially loaded columns with following data if (1) width is not restricted, considering 1 m projection from C_1 (2) width is restricted to 2.3 m. Assume self weight of footing is 15% of axial loads. **07**

Columns	C_1	C_2
Type	Interior	Interior
Size	400 mm x 400 mm	400 mm x 400 mm
P	1000 kN	1200 kN
Spacing	3 m c/c from C_1 to C_2	
ABP	150 kN/m^2 at 1.6 m depth	

OR

(b) Write the steps for design of base plate. **07**

Q.3	**(a)**	A short column of 300 mm x 500 mm size is subjected to an axial factored load of 2000 kN and factored moments Mux = 80 kNm and Muy = 60 kNm. Determine the main reinforcement only in the column if the moment due to minimum eccentricity is less than the applied loads. Use M20 – Fe 415 and 28 mm diameter bar.	**07**
	(b)	A rectangular beam section of size 230 mm x 600 mm overall depth is subjected to a factored sagging BM = 48 kN.m; factored SF = 48 kN and factored TM = 18 kN.m. Design the main reinforcement only at the section. Use M20 – Fe 415.	**07**

OR

Q.3		An RCC column of size 350 mm x 350 mm reinforced with 8 mm 16 mm diameter bars carries characteristic load of 800 kN. The allowable bearing pressure on soil is 200 kN/m^2. Design isolated pad footing. Use M20 and Fe 415 for both column and footing. Carry out all checks. Draw detail reinforcement layout also. Assume 10% dead load of footing.	**14**

Q.4		Design a simply supported steel beam of 7 m spam carrying a RC floor capable of providing lateral restraint to the top compression flange. The total factored udl subjected was 53.6 kN/m thr' out and factored point load act at center as 150 kN. Use ISMB section. Perform the check for web buckling only.	**14**

OR

Q.4	**(a)**	Determine the tensile strength of a roof truss diagonal 100 x 75 x 6 mm having f_y = 250 MPa connected to gusset plate by 4 mm welds of 140 mm long at top and 310 mm long at bottom. The longer edge of 100 mm was connected to plate of 8mm thickness.	**10**
	(b)	Why are the connections using HSFG bolts called slip critical connection? What is a main purpose of a washer in HSFG bolts?	**04**

Q.5	**(a)**	A cantilever RC beam requires 910 mm^2 area of reinforcement for flexure. 2 no. 25 mm diameter bars are provided and anchored as shown in fig. 1. Check whether sufficient anchorage is provided. If not, calculate the maximum size of bar that can be used as reinforcement. Use M20 and Fe 415.	**07**
	(b)	Calculate the compressive resistance of a compound column consisting of ISHB 300 with one cover plate 350 x 20 mm on each flange and having a length of 5 m. assume that bottom of the column is fixed and top is pinned, f_y = 250 MPa	**07**

OR

Q.5	**(a)**	Explain the situations under which flat slab has to be provided. Write the limitation of direct design method used for the design of flat slab.	**07**
	(b)	Elaborate the effect of shear leg in tension member with necessary sketch.	**07**

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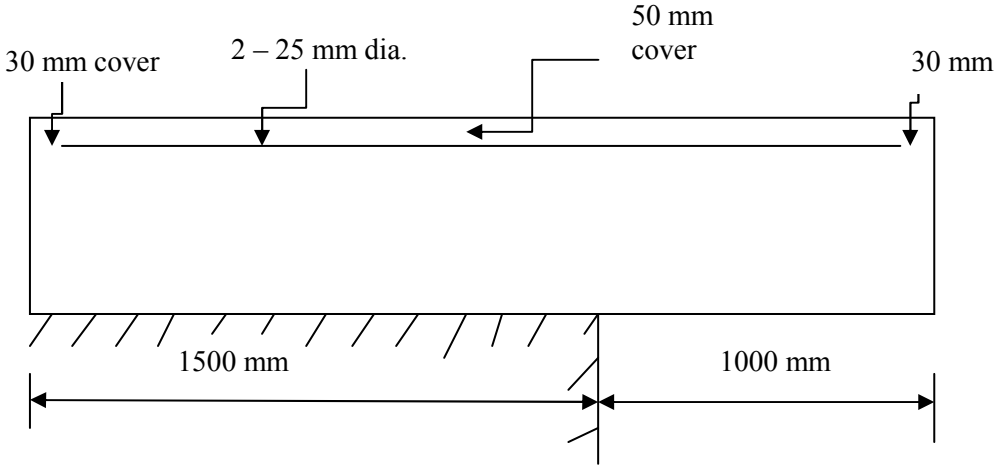

Figure 1(Q. 5 (a))