

GUJARAT TECHNOLOGICAL UNIVERSITY

8th Semester Civil Engineering - PDDC

Subject Code & Name: X80602 - Structural Design-II

Teaching scheme hours				Subject Credits	Evaluation Scheme (Examination Scheme)				
Theory Hours	Tutorial Hours	Practical Hours	Total Hours		University Exam (E)		Internal Exam		Total Marks
					Theory (E)	Practical (E)	Mid Sem Theory (M)	Practical (I)	
4	2	0	6	6	70	30	30	20	150

Sr. No.	Course content (RC Design)
1.	Loading standards as per I.S, distribution & flow of loads, lateral load due to wind as per IS: 875(Part - III), load combinations, guide lines for preparation of structural layout for buildings.
2.	Analysis, design & detailing of G+3 RC framed building for residential /commercial Purpose including ductile detailing in beams and columns.
3.	Design & detailing of underground and elevated circular & rectangular RC water tanks.
4.	Design & detailing of cantilever & counter fort retaining wall for various ground Conditions.

Term Work:

Term work shall consist of not less than 2 designs suitably selected from topics of course. The report shall consist of full analytical treatment, design procedure, references and all necessary drawings in form of neat dimensioned sketches. In addition to one detailed working drawing shall be prepared on full imperial size drawing sheet.

References Books (RC Design):

1. Shah & Karve; Limit State Theory & Design of Reinforced Concrete; Structure Pub., Pune
2. Shah & Karve; Design of Multi-storied Building (G+3); Structure Pub., Pune
3. KrishanaRaju N.; Advanced Design of Concrete Structures; Tata Mc-Graw Hill, Delhi
4. KrishanaRaju N.; Prestressed Concrete; Tata Mc-Graw Hill,
5. Dr. H.J. Shah; Reinforced concrete Vol-II; Charotar Pub. Anand,
6. IS : 456 - Code of practice for plain and reinforced concrete
7. IS : 875 (Part I to V) - Code of practice for structural safety of Buildings Loading standards
8. IS : 1893 - Criteria for earthquake resistant design of structures
9. IS : 13920 - Code of Practice for ductile detailing of RC structure subjected to seismic force
10. IS : 3370 - Code for concrete Storage tanks.
11. SP : 16 - Design aids for reinforced concrete
12. SP : 34 - Reinforcement detailing

GUJARAT TECHNOLOGICAL UNIVERSITY
PDDC - SEMESTER-VIII • EXAMINATION – Winter - 2016

Subject Code: X80602**Date: 26/10/2016****Subject Name: Structural Design - II****Time: 02.30 pm - 05.00 PM****Total Marks: 70****Instructions:**

1. Attempt all questions.
2. Make suitable assumptions wherever necessary.
3. Figures to the right indicate full marks.
4. Use of IS:456, IS:875, IS:1893, IS:13920, IS:3370, SP:16 and SP:34 are permitted.
5. Use M20 grade concrete and Fe415 grade steel if not mentioned.

- Q.1 (a)** Determine wind load on any intermediate frame of a multistory building. Also, determine nodal forces at each floor level. Use following data: **14**
- Length of building = 50 m
Width of building = 40 m
Height of building = 31 m
Storey height = 3 m
Frame spacing = 5 m in both directions
Location of building = Pune
Upwind slope = 10°
Height of hill = 800 m
Location of building on wind ward side from crest = 150 m
- Q.2 (a)** Explain different types of load to be consider while structural design as per Indian Standards. **07**
- (b)** Explain various types of retaining walls. **07**
- OR**
- (b)** Explain importance of weep holes and shear key in retaining walls. **07**
- Q.3 (a)** Prepare a typical structural lay out for G+3 storey building having 5 bays of 5 m in X direction and 5 bays of 4 m in Y-direction. Design a two way slab at a typical floor. Floor height = 3.0 m, floor finish load = 1 kN/m^2 and live load = 3 kN/m^2 . All exterior walls are of 230 mm thick and interior wall of 115 mm thick. Assume beam size of 230 mm X 450 mm. Draw neat sketch of reinforcement detailing. **14**
- OR**
- Q.3 (a)** Prepare a typical structural lay out for G+3 storey building having 5 bays of 5 m in X direction and 5 bays of 4 m in Y-direction. Design a typical continuous beam OR a typical column. Floor height = 3.0 m, floor finish load = 1 kN/m^2 and live load = 3 kN/m^2 . All exterior walls are of 230 mm thick and interior wall of 115 mm thick. Assume beam size of 230 mm X 450 mm. Draw neat sketch of reinforcement detailing. **14**
- Q.4 (a)** Fix the basic dimensions of various elements of the cantilever retaining wall of height 4 m. Angle of repose of soil is 30° . The safe bearing capacity of soil is 180 kN/m^2 and unit weight of soil is 18 kN/m^3 . Coefficient of friction between soil and concrete is 0.55. Provide the checks for stability of the retaining wall. Design the stem and heel of the retaining wall. **14**

OR

Q.4 (a) Calculate preliminary sizes of all the components of a counterfort type retaining wall to retain 7 m earth above ground level. Angle of repose of soil is 30° . The safe bearing capacity of soil is 180 kN/m^2 and unit weight of soil is 18 kN/m^3 . Coefficient of friction between soil and concrete is 0.55. Provide the checks for stability of the retaining wall. Design the intermediate counterfort of the retaining wall. **14**

Q.5 (a) Design a circular under-ground water tank with flexible base for a capacity of 5 lakh litres. Angle of repose of soil is 30° . Unit weight of soil is 18 kN/m^3 . Use M30 and Fe415. **14**

OR

Q.5 (a) Design and detail top spherical dome and cylindrical wall of overhead circular water tank. Assume diameter of tank 10m and thickness of top dome as 100mm with 1 kN/m^2 live load. Use M25 and Fe415. **14**

GUJARAT TECHNOLOGICAL UNIVERSITY**PDDC - SEMESTER-VIII EXAMINATION – SUMMER 2016****Subject Code: X80602****Date: 12/05/2016****Subject Name: Structural Design-II****Time: 10:30 AM TO 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. Use of IS 456:2000, IS 875 (Part I,II,III), IS 3370 (Part I,II,III,IV) and SP-16 is allowed.
5. Use M-20 grade concrete and Fe-415 grade steel if not mentioned.

- Q.1** A 12 storey building having 6 bays at 4 m spacing in one direction and 10 bays at 5 m spacing in the perpendicular direction is situated on a hill near Vadodara with upwind slope of 8° . The storey height is 3.5 m. The height of crest point from mean ground level is 800 m. The building is located at 150 m on the upwind side from the crest point. Showing the variation of wind pressure, calculate the nodal forces due to wind in both directions. **14**
- Q.2(a)** Explain significance of shear key and weep holes in retaining wall. **07**
- Q.2(b)** Explain various types of retaining walls with their significance. **07**
- OR**
- Q.2(b)** Explain significance of cracked and un-cracked sections in design of water tanks. **07**
- Q.3** Calculate preliminary sizes of all the components of a counter-fort type retaining wall to retain 7 m earth above ground level. The unit weight of soil is 17 kN/m^3 , Angle of Repose is 30° , Coefficient of friction between soil and concrete is 0.57, SBC of soil is 180 kPa. Show stability checks. Design the stem and counter-fort. **14**
- OR**
- Q.3** A retaining wall has to retain 4 m earth above ground level. The unit weight of soil is 18 kN/m^3 , Angle of Repose is 30° , Coefficient of friction between soil and concrete is 0.60, SBC of soil is 150 kPa. Show stability checks. Design the stem and heel. **14**
- Q.4** Design an under-ground circular tank for capacity of 5 Lac Liter. Unit weight of soil is 16 kN/m^3 and unit weight of water is 10 kN/m^3 . Use M-30 grade concrete and Fe-415 grade steel. The wall and base slab are not monolithic. Water table is high up to ground level. Use IS-3370 method for design. **14**
- OR**
- Q.4** Design and detail the flat slab interior panel of size 4.2 m x 3.2 m. The slab carries live load of 4 kN/m^2 and floor finish of 1 kN/m^2 . The size of column is 450 mm x 450 mm. The slab is without drop and column is without capital (column head). **14**
- Q.5** Design a slab type rectangular combined footing to support the columns carrying 800 kN and 1200 kN load at 4 m spacing. Their square column sizes are 450 mm and 500 mm respectively. The SBC of soil is 250 kPa and width of footing is 2 m. **14**
- OR**
- Q.5** Design and show reinforcement detail for a Rectangular on ground water tank for the capacity of 4 Lac Liter. Use M-30 grade concrete and Fe-415 grade steel. Use IS-3370 method for design. **14**

GUJARAT TECHNOLOGICAL UNIVERSITY
PDDC - SEMESTER-VIII EXAMINATION – WINTER 2015

Subject Code: X80602**Date: 11/12/2015****Subject Name: Structural Design-II****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.
4. Use of IS 456:2000, IS 875 (Part I,II,III), IS 3370 (Part I,II,III,IV) and SP-16 is allowed.
5. Use M-20 grade concrete and Fe-415 grade steel if not mentioned.

Q.1 (a) Prepare a typical structural lay out for G+3 storey building having 4 bays of 4m in X-direction and 3 bays of 5 m in Y-direction. Design an interior panel two way slab. Floor height is 3 m. Live load on floor is 4 kN/m². Floor finish is 1 kN/m². Draw neat sketch of reinforcement detailing. **14**

Q.2 (a) Explain provision of drainage in retaining wall with neat sketch. Also explain types of retaining wall with their use in various conditions. **07**

(b) Design a circular water tank with flexible base for 400000 liter. Depth of the tank is 4 m. Assume concrete grade M25 and Fe415 grade steel. Tank is situated on the ground. **07**

OR

(b) Design a circular water tank for the same data as above but with fixed base. No need to design the base slab. Use approximate method. **07**

Q.3 (a) For the cantilever retaining wall of height 5m, fix the basic dimensions of the various elements. Angle of repose of soil is 30° and density of soil is 17 kN/m³. SBC of soil is 150kN/m². Friction coefficient between soil and concrete is 0.55. Design stem of the retaining wall. Show the Stability check for sliding and overturning. **14**

OR

Q.3 (a) For the counterfort retaining wall of height 7m above G.L., fix the basic dimensions of the various elements. Angle of repose of soil is 30°. SBC of soil is 200 kN/m² and density of soil is 17 kN/m³. Friction coefficient between soil and concrete is 0.60. Design and detail the heel of retaining wall. **14**

Q.4 (a) Fix the dimensions of circular overhead water tank container with flat bottom for a capacity of 5 lakh liters. Design and detail top spherical dome, top ring beam and cylindrical wall of the container. Take live load 1 kN/m² and diameter of tank 10m. Use M25 grade concrete and Fe 415 steel. **14**

OR

Q.4 (a) Design a RCC water tank of 6 m × 4 m with a maximum depth of 4 m of water using IS 3370 for fixed base condition. Use M30 concrete and Fe 415 grade of steel. **14**

- Q.5 (a)** Estimate wind load and plot wind pressure diagram for a multi storey building of plan area 12 m X 12 m situated on flat topography for the following data. **14**
- Height of building = 28 m
Bottom Storey height = 4 m
All other storey height = 3 m
Bay width in both direction = 4 m
location of Building = Ahmedabad,
Terrain Category= II
Design life 100 years.

OR

- Q.5 (a)** Design and detail a slab type rectangular combined footing to support the columns carrying 800 kN and 1000 kN at 4 m spacing. Their square column sizes are 400 mm and 500 mm respectively. The SBC of soil is 230 kPa and width of footing is 1.8 m. **14**

GUJARAT TECHNOLOGICAL UNIVERSITY
PDDC - SEMESTER-VIII • EXAMINATION – SUMMER • 2015

Subject code: X-80602**Date: 11/05/2015****Subject Name: Structural Design-II****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. Use of IS 456:2000, IS 875 (Part I,II,III), IS 3370 (Part I,II,III,IV) and SP-16 is allowed.
5. Use M-20 grade concrete and Fe-415 grade steel if not mentioned.

Q.1 (a) A G+9 storey building having 6 bays at 5 m spacing in one direction and 10 bays at 3.5 m spacing in the perpendicular direction is situated on a hill near Bhuj with upwind slope of 8° . The storey height is 3 m. The height of crest point from mean ground level is 600 m. The building is located at 150 m on the upwind side from the crest point. Showing the variation of wind pressure, calculate the nodal forces due to wind in both directions. **14**

Q.2 (a) Explain Limit state method and working stress method in detail. **07**

(b) Explain stability criteria of retaining wall in detail. **07**

OR

(b) Explain significance of shear key and weep holes in retaining wall. **07**

Q.3 Calculate preliminary sizes of all the components of a retaining wall to retain 7.5 m earth above ground level. The unit wt of soil is 17 kN/m^3 , Angle of Repose is 30° , Coefficient of friction between soil and concrete is 0.57, SBC of soil is 180 kPa. Show stability checks. Design stem and toe. **14**

OR

Q.3 Design a retaining wall to retain 5 m earth above ground level. The unit weight of backfill, angle of internal friction, coefficient of friction and soil bearing capacity are 16 kN/m^3 , 30° , 0.62 and 180 kPa respectively. Show stability checks and design all components. **14**

Q.4 Design and show reinforcement detail for an under-ground circular tank considering following data. Capacity = 5 Lac Litre. Unit Wt. soil = 16 kN/m^3 . Unit wt. of water = 10 kN/m^3 Use M-30 grade concrete and Fe-415 grade steel. The wall and base slab are not monolithic. Water table is high up to ground level. **14**

OR

Q.4 Design and detail the flat slab interior panel with 4 m x 3 m dimensions. The slab carries live load of 3.5 kPa and floor finish of 1.2 kPa. The square columns are 0.4 m size. **14**

Q.5 Design and detail a slab type rectangular combined footing to support the columns carrying 800 kN and 1200 kN at 4 m spacing. Their square column sizes are 450 mm and 500 mm respectively. The SBC of soil is 250 kPa and width of footing is 2 m. **14**

OR

Q.5 Design and show reinforcement detail a Rectangular on ground water tank for the capacity of 4 Lac Litre. Use M-30 grade concrete and Fe-415 grade steel. **14**

GUJARAT TECHNOLOGICAL UNIVERSITY
PDDC - SEMESTER-VIII • EXAMINATION – WINTER • 2014

Subject Code: X 80602

Date: 01-12-2014

Subject Name: Structural Design - II

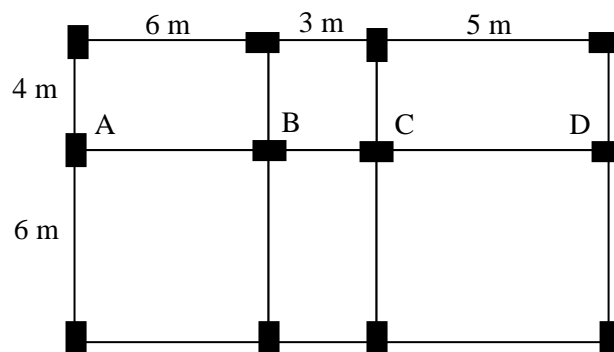
Time: 02:30 pm - 05:00 pm

Total Marks: 70

Instructions:

1. Attempt all questions.
2. Make suitable assumptions wherever necessary.
3. Figures to the right indicate full marks.
4. Use of IS 456:2000, IS 875 (Part I to V), IS 13920, IS 3370 (Part I to IV), SP -34 and SP-16 is allowed.
5. Use M-20 grade concrete and Fe-415 grade steel if not mentioned.

- Q.1** Fig. 1 shows typical floor plan (layout) of building. Find load (in terms of UDL) on beam A-B-C-D. Assume slab thickness of 110 mm, Floor finish of 0.35 kN/m^2 and Live load of 2.7 kN/m^2 . All exterior walls are of 230 mm thick and interior wall of 1150 mm thick. Assume beam size of 230 x 400 mm throughout. Show also load distribution diagram from slab to beam. **14**



- Q.2** (a) Explain detail guidelines for preparation of structural layout of buildings. **07**
 (b) Explain Limit state method and working stress method in detail. **07**
- OR**
- (b) Draw neat ductile detailing sketch for beam column joint and footing as per codal provision. **07**

- Q.3** Estimate wind forces for a water tank for the following data. Total height of tank = 27 m, Which includes height of the supporting shaft=20 m, height of the bottom conical portion= 2m, height of cylindrical portion = 4 m and rise of top spherical dome= 1 m, diameter of supporting shaft= 4 m and diameter of cylindrical portion= 10 m, location is Ahmedabad, Terrain Category= II and class= B, Ground slope= 1 vertical to 7 horizontal, hill height= 280 m, location from crest 100 m windward, Design life 100 years. **14**

OR

- Q.3** Design and detail a slab type rectangular combined footing to support the columns carrying 1000 kN and 1300 kN at 4.0 m spacing. Their square column sizes are 400 mm and 450 mm respectively. The SBC of soil is 200 kPa and width of footing is 1.5 m. **14**

Q.4 Design and detail following components of overhead circular water tank with flat bottom and supported on ring beam having water storage capacity of 3 lacs litre. (i) Top spherical dome (ii) Top ring beam (iii) Cylindrical wall. (iv) base slab. Use M-25 concrete and Fe 415 steel. **14**

OR

Q.4 Design a RCC water tank of 6.0 m × 4.5 m with a maximum depth of 3.5 m of water using IS 3370 for fixed base condition. Use M20 concrete and Fe 415 grade of steel. **14**

Q.5 Design a suitable cantilever type retaining wall to retain 5.5 m soil above ground level. The unit weight of backfill, angle of internal friction, coefficient of friction and soil bearing capacity are 18 kN/m³, 30°, 0.50 and 200 kPa respectively. **14**

OR

Q.5 Design and detail stem and toe of counterfort retaining wall to retain 7.0 m height of earth above ground level using following data. **14**
Angle of repose = 25°
Unit weight of earth material = 18 kN/m³
S.B.C. of earth = 160 kPa
Coefficient of friction between the base and soil = 0.60
Use M20 concrete and Fe 415 steel.

GUJARAT TECHNOLOGICAL UNIVERSITY
PDDC - SEMESTER-VIII • EXAMINATION – SUMMER • 2014

Subject Code: X 80602**Date: 29-05-2014****Subject Name: Structural Design - II****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. Use of IS 456:2000, IS 875 (Part I,II,III), IS 3370 (Part I,II,III,IV) and SP-16 is allowed.
5. Use M-20 grade concrete and Fe-415 grade steel if not mentioned.

Q.1 Fig. 1 shows typical floor plan (layout) of building. Find load (in terms of UDL) on beam A-B-C-D. Assume slab thickness of 120 mm, Floor finish of 0.4 kN/m^2 and Live load of 2.5 kN/m^2 . All exterior walls are of 230 mm thick and interior wall of 1150 mm thick. Assume beam size of 230 x 400 mm throughout. Show also load distribution diagram from slab to beam. **14**

Q.2 (a) A rectangular beam 230 mm wide \times 535 mm effective depth is subjected to a bending moment of 88.5 kNm at working loads. Find the steel area required. Use M15 and Fe415. **07**

(b) Discuss guideline for the preparation of structural layout. **07**

OR

(b) What do you mean by ductile detailing of structural member? Show ductile detailing for beam column joint and footing using figure as per IS. **07**

Q.3 A 10 storied building having 8 bays at 3 m spacing in one direction and 4 bays at 4 m spacing in orthogonal direction is situated on a hill near Pune with upwind slope of 8° and factor $S = 0.15$. The storey height is 3.0 m along with 1.5 m parapet is provided at top. Showing the variation of wind pressure, calculate the nodal forces due to wind in both directions. **14**

OR

Q.3 Design and detail a slab type rectangular combined footing to support the columns carrying 1100 kN and 1350 kN at 4.5 m spacing. Their square column sizes are 450 mm and 500 mm respectively. The SBC of soil is 225 kPa and width of footing is 1.6 m. **14**

Q.4 Design and detail following components of overhead circular water tank with flat bottom and supported on ring beam having water storage capacity of 5 lacs litre. (i) Top spherical dome (ii) Top ring beam (iii) Cylindrical wall. Use M-25 concrete and Fe 415 steel. **14**

OR

Q.4 Design a rectangular RCC water tank of 6.5 m \times 3.5 m with a maximum depth of 3.2 m of water. The tank rest on brick masonry walls all around, use M20 concrete and Fe 415 grade of steel. **14**

Q.5 Design a suitable cantilever type retaining wall to retain 5 m soil above ground level. The unit weight of backfill, angle of internal friction, coefficient of friction and soil bearing capacity are 17 kN/m^3 , 25° , 0.60 and 200 kPa respectively. **14**

OR

Q.5

Design and detail stem and toe of counterfort retaining wall to retain 6.5 m height of earth above ground level using following data.

Angle of repose = 30°

Unit weight of earth material = 17 kN/m^3

S.B.C. of earth = 150 kPa

Coefficient of friction between the base and soil = 0.62

Use M20 concrete and Fe 415 steel.

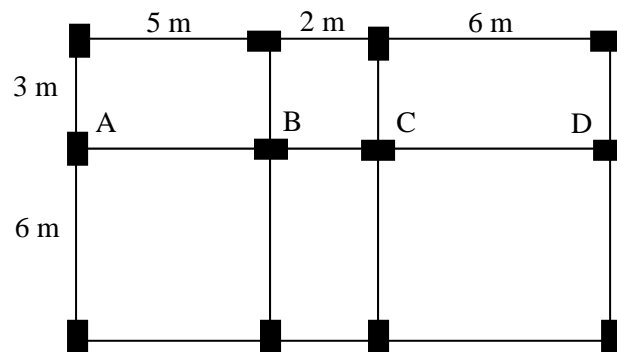


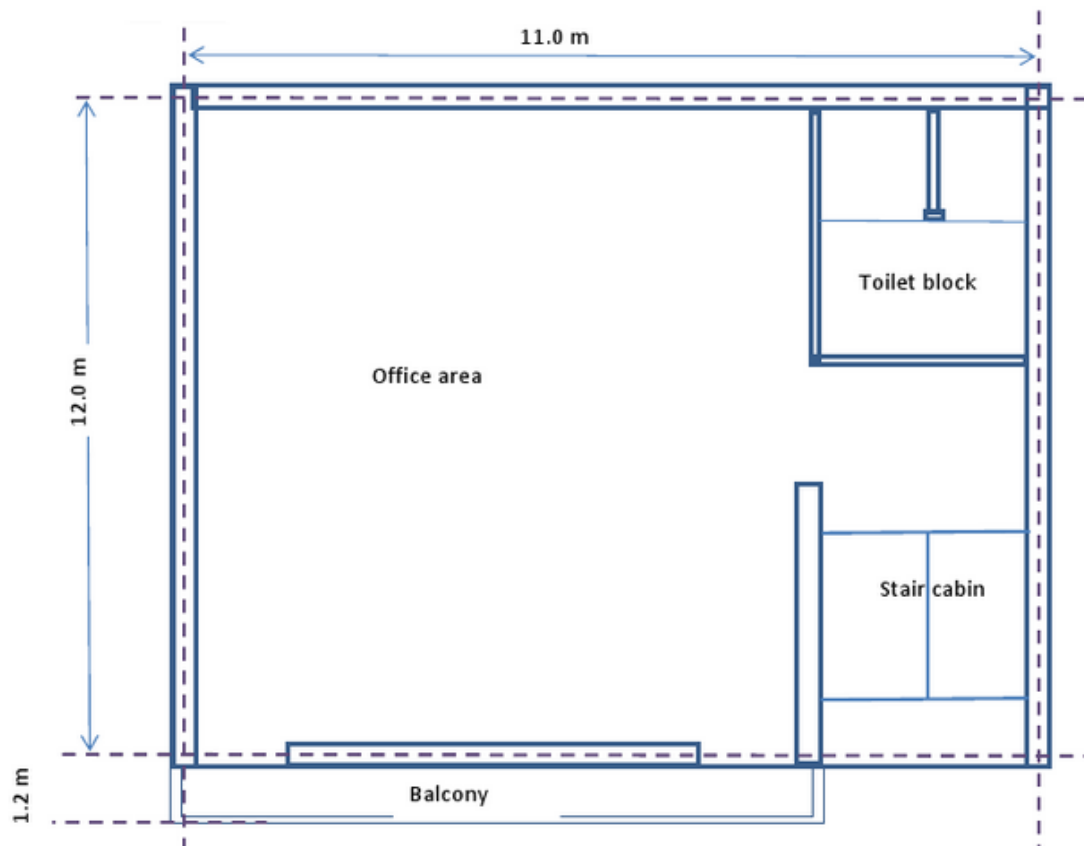
Fig. 1

GUJARAT TECHNOLOGICAL UNIVERSITY
PDDC - SEMESTER-VIII • EXAMINATION – SUMMER 2013

Subject Code: X-80602**Date: 13-05-2013****Subject Name: Structural Design-II****Time: 10.30 pm - 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. Use of IS 456:2000, IS 875 (Part I,II,II), IS 3370 (Part I,II,III,IV) and SP-16 is allowed.
5. Use M-20 grade concrete and Fe-415 grade steel if not mentioned.

- Q.1 (a)** A 12 storied building having 8 bays at 3 m spacing in one direction and 10 bays at 4 m spacing in orthogonal direction is situated on a hill near Bhopal with upwind slope of 8° and factor $s = 0.15$. The storey height is 3.2 m. 1.2 m parapet is provided at top. Showing the variation of wind pressure, calculate the nodal forces due to wind in both directions, **14**
- Q.2 (a)** Prepare a structural layout showing location of beams, columns & slabs with their tentative sizes for the building as shown in figure. Assume suitable dimensions for stair case and toilet block. **07**



- (b) Explain Limit state method and working stress method in detail. **07**
- OR**
- (b) Define retaining wall. Explain various types of retaining wall in detail. **07**
- Q.3** Design a counterfort type retaining wall to retain 7 m earth above ground level. The unit weight of backfill, angle of internal friction, coefficient of friction, spacing of counterforts and soil bearing capacity are 18 kN/m^3 , 30° , 0.62, 3.0 m and 200 kPa respectively. Design stem and toe only. **14**
- OR**
- Q.3** Design a Cantilever type retaining wall to retain 5 m earth above ground level. The unit weight of backfill, angle of internal friction, coefficient of friction and soil bearing capacity are 16 kN/m^3 , 30° , 0.62 and 180 kPa respectively. **14**
- Q.4** Design and show reinforcement detail for an under-ground circular tank considering following data. Diameter of tank= 7 m. Depth of water= 4.75 m. Unit Wt. soil = 16 kN/m^3 . Unit wt. of water = 10 kN/m^3 Use M-30 grade concrete and Fe-415 grade steel. The wall and base slab are not monolithic. Water table is high up to ground level. **14**
- OR**
- Q.4** Design and detail the flat slab interior panel with 4.8 m x 3 m dimensions. The slab carries live load of 3.5 kPa and floor finish of 1.2 kPa. The square columns are 0.4 m size. **14**
- Q.5** Design and detail a slab type rectangular combined footing to support the columns carrying 900 kN and 1.1 MN at 4 m spacing. Their square column sizes are 450 mm and 500 mm respectively. The SBC of soil is 250 kPa and width of footing is 160 kPa. **14**
- OR**
- Q.5** Design and show reinforcement detail a Rectangular on ground water tank for the capacity of 2 Lac Liter. Use M-30 grade concrete and Fe-415 grade steel. **14**
