INSTITUTE OF AERONAUTICAL ENGINEERING

(Autonomous)
Dundigal, Hyderabad-500043

CIVIL ENGINEERING

TUTORIAL QUESTION BANK

Course Title	**REINFORCED CONCRETE STRUCTURES DESIGN AND DRAWING**				
Course Code	ACE009				
Programme	B.Tech				
Semester	V	CE			
Course Type	Core				
Regulation	**IARE - R16**				
Course Structure	**Theory**			**Practical**	
	Lectures	**Tutorials**	**Credits**	**Laboratory**	**Credits**
	3	-	3	-	-
Chief Coordinator	Mr. G. Ramakrishna, Associate Professor				
Course Faculty	Mr. G. Ramakrishna, Associate Professor Mr. P. Vinay Kumar, Assistant Professor				

COURSE OBJECTIVES:

The course should enable the students to:	
I	Identify, formulate and solve engineering problems of RC elements.
II	Differentiate between working stress design and limit state design.
III	Understand the importance of limit state design in reinforced concrete structures.
IV	Design of different structural members like beam, slab, column, footing and stair case.

COURSE OUTCOMES (COs):

CO 1	Describe the Concepts of RC design, material Stress–Strain curves, Safety factors, characteristic values, Stress block parameters, Working Stress Method, Limit state analysis and design of singly reinforced, doubly reinforced T, and L beam sections.
CO 2	Understand Limit state analysis and design of section for shear and torsion, concept of bond, anchorage and development length, I.S. code provisions.
CO 3	Explore the design concept of two-way Slabs, one-way slabs, continuous slabs using I.S. coefficients, Cantilever slab/ Canopy slab.
CO 4	Design of short and long column, Axial loads, uni-axial and bi-axial bending I.S. Code provisions.
CO 5	Design footings–Isolated (square, rectangle) and Combined Footings. Design of Stair Case.

COURSE LEARNING OUTCOMES (CLOs):

ACE009.01	Describe the basic concepts of RC design.
ACE009.02	Understand the concept material Stress–Strain curves, Safety factors.
ACE009.03	Understand the concept Stress block parameters.
ACE009.04	Use the design concept of Working Stress Method.
ACE009.05	Design of singly reinforced, doubly reinforced sections.
ACE009.06	Design of, T, and L beam sections.
ACE009.07	Understand Limit state analysis and design of section for shear.
ACE009.08	Understand Limit state analysis and design of section for torsion.
ACE009.09	Concept of bond, anchorage.
ACE009.10	Concept of development length.
ACE009.11	Illustrate the deflection limits as per IS: 456–2000
ACE009.12	Understand the design concept of one-way slabs.
ACE009.13	Understand the design concept of two-way Slabs.
ACE009.14	Understand the design concept of continuous slabs.
ACE009.15	Calculate the I.S. coefficients for Cantilever slab.
ACE009.16	Calculate the I.S. coefficients for Canopy slab.
ACE009.17	Discuss the concept of short and long column
ACE009.18	Understand the concept of Axial loading.
ACE009.19	Understand the concept of uni-axial and bi-axial bending.
ACE009.20	Apply I.S. Code provisions.
ACE009.21	Design concept for isolated footing.
ACE009.22	Design concept for Combined footing.
ACE009.23	Understand the Design procedure for Stair Case.
ACE009.24	Types of stair Case.

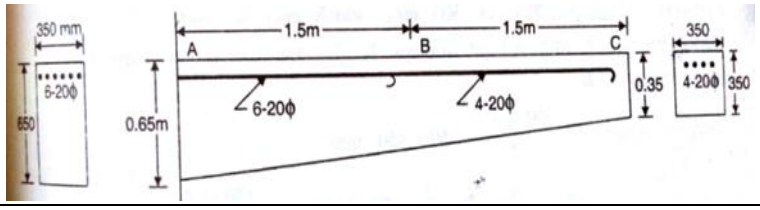
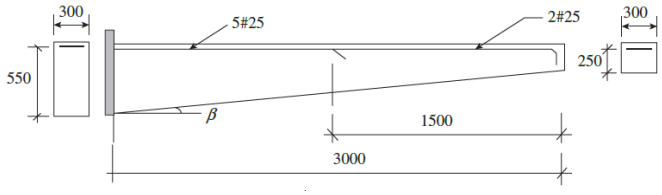
TUTORIAL QUESTION BANK

	UNIT-I			
	DESIGN OF BEAMS			
	Part - A (Short Answer Questions)			
S No	**QUESTIONS**	**Blooms Taxonomy Level**	**Course Outcomes**	**Course Learning Outcomes (CLOs)**
1	List different methods of design for reinforced concrete structural elements.	Remember	CO 1	ACE009.01
2	State four objectives of the design of reinforced concrete structure.	Understand	CO 1	ACE009.01
3	Explain the working stress method.	Remember	CO 1	ACE009.04
4	What do you mean by characteristic strength and characteristic load?	Remember	CO 1	ACE009.01
5	What are the different kinds of loads?	Remember	CO 1	ACE009.02
6	What are the Limiting strength of concrete and steel in Reinforced Concrete Beams?	Remember	CO 1	ACE009.03
7	Explain the limit state method of design.	Remember	CO 1	ACE009.01
8	Differentiate between WSM and LSM.	Remember	CO 1	ACE009.04
9	List the different categories of limit state design.	Remember	CO 1	ACE009.04
10	Define the factored load.	Remember	CO 1	ACE009.03
11	Write a note on partial safety factors for material.	Remember	CO 1	ACE009.03
12	Explain the limiting moment of resistance.	Remember	CO 1	ACE009.02
13	What is a doubly reinforced beam?	Understand	CO 1	ACE009.05
14	What do you mean by neutral axis?	Understand	CO 1	ACE009.05
15	What are the merits and demerits of Working stress method?	Remember	CO 1	ACE009.04
16	State assumptions made in limit state of design in shear?	Understand	CO 1	ACE009.05
17	Give the idealized stress-strain curve for concrete and steel.	Understand	CO 1	ACE009.02
18	State the assumption for limit state design in flexure.	Remember	CO 1	ACE009.02
19	Explain the stress block parameters with necessary diagrams.	Understand	CO 1	ACE009.03
20	What is the difference the singly and doubly reinforced beam?	Remember	CO 1	ACE009.05
	Part - B (Long Answer Questions)			
1	Enumerate the five limit states commonly used in limit state design and state briefly how they are provided in the design.	Understand	CO 1	ACE009.05
2	Draw the cross-section of singly reinforced rectangular beam and show the strain and stress diagrams.	Understand	CO 1	ACE009.05
3	Explain the limiting moment of resistance and give the expression for the Fe 250 and Fe415 grade steel?	Understand	CO 1	ACE009.05
4	Explain the terms balanced, over-reinforced and under-reinforced section in bending. Explain which of these should be recommended in design.	Understand	CO 1	ACE009.05
5	Explain with figure balanced, under reinforced, over reinforced sections	Understand	CO 1	ACE009.04
6	What do you mean by neutral axis and leaver arm? Explain briefly with neat sketches.	Understand	CO 1	ACE009.03
7	Find the moment resistance of a singly reinforced concrete beam of 200 mm width and 400 mm effective depth, reinforced with 4 bars of 16 mm dia. of Fe 415 steel. Take M20 concrete	Understand	CO 1	ACE009.05
8	A singly reinforced concrete beam having a width of 250 mm is reinforced with steel bars of area 3600 mm^2 at an effective depth of 400 mm. if M 20 grade of concrete and Fe-415 HYSD bars are used, compute the ultimate flexural strength of the section.	Understand	CO 1	ACE009.05

9	A reinforced concrete beam of a rectangular section 300 mm wide by 600 mm deep is reinforced with 4 bars of 25 mm diameter at an effective depth of 550 mm. the effective span of the beam is 7m, f_y = 415 N/mm2 and f_{ck} = 20 N/mm^2, find the uniformly distributed ultimate load on the beam.	Understand	CO 1	ACE009.05
10	Find the moment resistance of a singly reinforced concrete beam of 200 mm width and 400 mm effective depth, reinforced with 3 bars of 16 mm dia. of Fe 415 steel. Take M20 concrete	Understand	CO 1	ACE009.04
11	Determine the depth of neutral axis of abeam 250 mmx 400 mm, reinforced with 3 bars of 20 mm diameter. Also check for the type of section. Use M20 concrete and Fe 415 steel.	Understand	CO 1	ACE009.05
12	Design a balanced singly reinforced concrete beam section for an applied moment of 60kN-m. The width of the beam is limited to 175 mm. use M20 concrete and Fe 415 steel bars.	Understand	CO 1	ACE009.05
13	A Singly Reinforced R.C.C. beam is subjected to a moment of 80kN-m. The width of the beam is 200 mm. calculate the depth of beam and area of steel reinforcement required for balance design. Use M20 concrete and Fe 415 steel.	Understand	CO 1	ACE009.05
14	A reinforced concrete beam is 300 mm x 700 mm is subjected to a bending moment of 150 Kn-m. Determine the area of reinforcement if M20 concrete and Fe 415 steel is used. Take effective cover as 40 mm.	Understand	CO 1	ACE009.05
15	A beam simply supported over an effective span of 7m carries alive load of 20 kN/m. Design the beam, using M20 concrete and HYSD bars of grade Fe415.keep the width equal to half the effective depth. Assume unit weight of concrete as $25Kn/m^3$.	Understand	CO 1	ACE009.06
16	Enumerate the steps of design of doubly reinforced beam.	Understand	CO 1	ACE009.05
17	Determine the factored moment of resistance of a beam 230 mm x 460 mm (effective). The beam is reinforced with 2-16 mm diameter bars on compression side and 4-20 mm diameter bars on tension side. The compression bars are placed at a distance of 40 mm from top. Use M 20 concrete and Fe 415 steel.	Understand	CO 1	ACE009.04
18	Find the factored moment of resistance of an R.C.C beam 300 mm x 450 mm (effective).the beam is reinforced with 43-25 mm diameter bars in the tension zone 2-20 mm diameter bars are p[laced at a distance of 50 mm from top in the compression zone. Use M20 concrete and Fe 415 steel.	Understand	CO 1	ACE009.05
19	A rectangular beam has a width of 250 mm and effective depth of 500 mm. The beam is provided with tension steel of 5 bars of 28 mm diameter and compression steel of 2 bars of 25 mm diameter. The effective cover to the compression steel being 50 mm. Calculate the ultimate moment capacity of the section, if f_{ck} = $20N/mm^2$ and f_y = 250 N/mm^2	Understand	CO 1	ACE009.05
20	Determine the moment of resistance of the beam having the following data. b = 350 mm; d = 900 mm, d' =50 mm Tension reinforcement = 5- 20 mm dia bars Compression reinforcement = 2-20 mm dia bars. Use M 15 concrete and Fe 415 steel.	Understand	CO 1	ACE009.03
Part - C (Problem Solving and Critical Thinking Questions)				
1	Find out the ultimate moment of resistance of a rectangular beam 300 mmx 550 mm. the area of tension and compression reinforcement are $250mm^2$ and 400 mm^2 respectively. Take effective cover as 50 mm. Assume M 25 grade of concrete and Fe 415 steel.	Understand	CO 1	ACE009.05
2	Determine the ultimate moment of resistance of a doubly reinforced beam of rectangular section having a width of 300 mm and reinforced with 5 bars of 25 mm diameter at an effective depth of 600 mm. the compression steel is made up of 2 bars of 25 mm diameter at an effective cover of 60 mm. adopt M-20 grade concrete and Fe 415 HYSD bars.	Understand	CO 1	ACE009.05

3	A rectangular reinforced concrete beam of width 400 mm and effective depth 600 mm is to be designed to support an ultimate moment of 600kN-m. using M-20 grade concrete and Fe-415 HYSD bars design suitable reinforcements in the beam at effective cover of 60 mm.	Understand	CO 1	ACE009.05
4	A Concrete beam has 350 mm breadth and 700 mm effective depth. Design the beam if it is subjected to a super imposed bending moment of 400kN-m. Use HYSD bars of Fe 415 grade and concrete of M20 grade. Take d'=50 mm.	Understand	CO 1	ACE009.04
5	Design reinforcement of a reinforced concrete beam a of 300 mm wide and 400 mm deep of grade M 20 to resist an ultimate moment of 150 kN-m. using mild steel bars of grade Fe 250.	Understand	CO 1	ACE009.06
6	A reinforced concrete beam of M 20 grade concrete, 300 mm wide and 500 mm deep is required to resist a super imposed moment of 152kN-m at an intermediate support of a continuous beam. Using mild steel bars, calculate A_{sc} at top, if 4 No. 16 mm dia bars are required to be continued at bottom from one span to the other. Assume effective cover to compressive steel as 45 mm dia and that to tension steel as 50 mm	Understand	CO 1	ACE009.05
7	Find the moment of resistance of a T- beam having a web width of 240 mm, effective depth of 400 m, flange width of 740 mmand flange thickness equal to 100 mm. The beam is reinforced with 5-16 mm diameter, Fe 415 bars. Use M 20 concrete.	Understand	CO 1	ACE009.06
8	Calculate the moment of resistance of a existing T- beam b_f= 740 mm and effective depth d= 400 mm, width of web b_w=240 mm, D_f= 100 mm. 5 No of 20 mm dia bars is inserted in beam. Use M15 grade concrete and Fe 415 bars.	Understand	CO 1	ACE009.06
9	A T- beam Floor system has 120 mm thick slab supported on beams is 300 mm and effective depth is 580 mm. the beam is reinforced with 8 bars of 20 mm diameter. Use M 20 grade of concrete and Fe 415 steel. The beams are spaced 3m centre to centre.	Understand	CO 1	ACE009.06
10	Design a T-beam whose dimensions are b_f= 700 mm and effective depth = 300 mm, width of web b_w=200 mm, D_f= 100 mm. Applied moment of 350 kNm. Use M20 grade concrete and Fe415 grade steel.	Understand	CO 1	ACE009.06
	UNIT-II			
	SHEAR, TORSION AND BOND			
	Part – A (Short Answer Questions)			
1	For design of continuous beam what is the span to depth ratio adopted?	Understand	CO 2	ACE009.07
2	What is the expression for spacing of vertical stirrups in R.C. beams for shear?	Understand	CO 2	ACE009.07
3	What are the limits for spacing of shear reinforcement?	Understand	CO 2	ACE009.07
4	What are the types of reinforcements used to resist shear? Explain the action of different types of shear steel.	Understand	CO 2	ACE009.07
5	What is the purpose of splicing of reinforcement? What are the different ways by which this can be achieved?	Remember	CO 2	ACE009.08
6	Define 'development length'. What is its significance?	Understand	CO 2	ACE009.10
7	Explain the loading conditions for checking Serviceability.	Remember	CO 2	ACE009.11
8	Under what situations do the following modes of cracking occur in reinforced concrete beams: (a) flexural cracks, (b) diagonal tension cracks, (c) flexural-shear cracks and (d) splitting cracks?	Understand	CO 2	ACE009.11
9	List out the factors influencing the short term deflection, long term deflection of RC beams.	Understand	CO 2	ACE009.11
10	What are the various remedial measures for control of cracking?	Understand	CO 2	ACE009.11
11	What are the different regions of cracks in the beam?	Remember	CO 2	ACE009.11
12	What do you understand by nominal shear stress? Write the formula for uniform formulae for rectangular section?	Remember	CO 2	ACE009.07
13	What are the stresses produced by torsion?	Understand	CO 2	ACE009.08
14	State the spacing of shear reinforcement as per IS 456:2000.	Understand	CO 2	ACE009.07

15	When do we require splicing in steel reinforcement?	Understand	CO 2	ACE009.07
16	Explain the terms bond and anchorage?	Remember	CO 2	ACE009.09
17	Explain the terms average bond stress and local bond stress?	Remember	CO 2	ACE009.09
18	Sketch the pattern of cracking in a beam under torsional moment. Explain the term torsional stiffness.	Remember	CO 2	ACE009.08
19	What is short term deflection and what are the factors affecting it.	Remember	CO 2	ACE009.11
20	What are the major factors that affect deflection?	Remember	CO 2	ACE009.11
	Part - B (Long Answer Questions)			
1	Explain modes of failures in R.C beams?	Understand	CO 2	ACE009.07
2	Explain the Step by step design procedure for shear reinforcement.	Understand	CO 2	ACE009.07
3	A simply supported reinforced concrete beam is 250 mm wide and 500mm effective depth and is reinforced with 4-20 mm diameter as tensile steel. If the beam is subjected to a factored shear of 65 KN at the support. Find the nominal shear stress at the support. Use M20 concrete and Fe 250 steel.	Understand	CO 2	ACE009.07
4	What are the various remedial measures for control of cracking?	Understand	CO 2	ACE009.11
5	Explain the different types of shear reinforcement with neat sketches.	Understand	CO 2	ACE009.07
6	What is the IS 456:2000 code requirements for bond?	Understand	CO 2	ACE009.09
7	Design the torsional reinforcement in a rectangular beam section, 350 mm wide and 750 mm deep, subjected to an ultimate twisting moment of 140 kNm, combined with an ultimate (hogging) bending moment of 200 kNm and an ultimate shear force of 110kN. Assume M 25 concrete, Fe 415 steel and mild exposure conditions.	Understand	CO 2	ACE009.08
8	A simply supported beam 300 mm x 600 mm (effective) is reinforced with 5 bars of 25 mm diameter. It carries a uniformly distributed load of 80 kN/m(including its own weight) over an effective span is 6 m. out of 5 main bars can be bent up safely near the supports. Design the shear reinforcement for the beam. Use M20 grade of concrete and Fe415 steel.	Understand	CO 2	ACE009.07
9	A simply supported rectangular beam 300 x 500 mm of effective span 7.0 m, is reinforced with 5 bars of 20 mm diameter on tension side no. 4 bars of 16 mm diameter on compression side. Check the deflection criteria. use Fe415 steel.	Understand	CO 2	ACE009.11
10	Explain the critical sections for design shear as per IS 456 with requisite sketches.	Understand	CO 2	ACE009.07
11	Explain the approaches for control of deflection in bending members as per IS 456. What are the measures for reducing deflection?	Understand	CO 2	ACE009.11
12	An R.C.C beam 300 mm x 600 mm in section reinforce with 5-25 mm dia. bars (effective) it is subjected to a design shear force of 200 kN. Comment on its shear design. Use M 20 concrete Fe415 steel.	Understand	CO 2	ACE009.07
13	An R.C.C. Beam 250 x400 mm effective depth is carried a uniformly distributed load of 15kN/m. The beam is reinforced with 4 bars of 22 mm dia. The clear span of the beam is 4m. Design the shear reinforcement; use M 20 concrete and plain mild steel bars.	Understand	CO 2	ACE009.07
14	Explain IS456 method of design of reinforced concrete members subjected to torsional moment.	Understand	CO 2	ACE009.08
15	What is nominal shear reinforcement? Give the reasons for providing minimum shear reinforcement.	Understand	CO 2	ACE009.07
16	A R.C.C beam 200 mm x 400 mm effective carries a uniformly distributed load of 70 kN/m clear span of 6 m. the beam is reinforced with 1%steel on tension side comment on the shear design of the beam. Use M 20 concrete and load factor = 1.5.	Understand	CO 2	ACE009.07

17	A simply supported beam, 300 mm wide and 500 mm effective depth carries a uniformly distributed load of 50 kN/m, including its own weight over an effective span of 6 m. Design shear reinforcement in the form of vertical stirrups. Assume that the beam contains 0.75% reinforcement throughout the length. The concrete is of M 20 grade and steel for stirrups is of Fe 250 grade. Take width of supports as 40 mm.	Understand	CO 2	ACE009.10
18	A R.C.C. beam 250 mm x 500 mm has a clear span of 5.5 m. The beam has 2-20 dia. Bars are going into the support. Factored shear force is 140 kN. Check for development length if Fe415 and M20 grade of concrete is used.	Understand	CO 2	ACE009.10
19	A rectangular beam, 300mm wide and 400mm deep is reinforced with 2 nos. 12mm dia bars at top and 2 nos. 16mm dia bars at the bottom, each provided at an effective cover of 40mm. Assuming concrete of M20 grade and steel of Fe 415 grade, determine the resistance of the beam in pure torsion.	Understand	CO 2	ACE009.08
20	Determine the reinforcement required for a rectangular beam section with the following data: Width of section= 250mm Depth of section=450mm Factored BM=75KNm Factored torsional moment= 50KNm Factored shear force=90KN, use M15 grade concrete and Fe415 grade steel.	Understand	CO 2	ACE009.08
	Part - C (Problem Solving and Critical Thinking Questions)			
1	Design the shear reinforcement for a RC cantilever beam carrying a UDL of 80 KN/m inclusive of its own weight. Consider M20 grade of concrete and Fe415 steel. Assume a cover 50mm to the center of reinforcement. 	Understand	CO 2	ACE009.07
2	Design shear reinforcement for a tapered cantilever beam of span 3 m, having a section of 250 mm effective depth and 300 mm width at the free end, and 550 mm effective depth and 300 mm width at the support (see Fig.). The beam has to support a factored uniform load of 80 kN/m, including its self-weight. Assume an effective cover of 50 mm, Fe 415 steel, and M25 concrete. 	Understand	CO 2	ACE009.07
3	A cantilever canopy is made up of monolithically constructed beam of 8 m span with a cantilever slab of 4m. The beam section is 400mm wide by 1200 mm deep. The live load on slab is 1.5 kN/m. Determine the torsion and shear due to live load for which the beam should be designed.	Understand	CO 2	ACE009.08
4	An R.C.C. Section 200 x400 mm is subjected to a characteristic torsional moment of 2.5 kN.m and a transverse shear of 60 kN. Assuming the use of M-25 grade concrete and Fe-415 HYSD bars determine the reinforcements required according to the IS: 456 code provisions, using the following data.	Understand	CO 2	ACE009.08

5	A reinforced concrete beam of rectangular section with a width of 350 mm and overall depth of 800 mm is subjected to a factored bending moment of 215 kNm, ultimate torsional moment of 105 kNm an ultimate shear forcec of 150 kN. Using M-20 grade concrete and Fe 415 HYSD bars and side, top and bottom covers of 50 mm, design suitable reinforcement in the section.	Understand	CO 2	ACE009.07
6	A rectangular beam section 200 mm wide and 450 mm overall depth is reinforced with 3 bars of 16 mm diameter at an effective depth of 420 mm. Two hanger bars of 12 mm diameter are provided at the compression face. The effective span of the beam is 5 m. The beam supports a service load of 10 kN/m. If f ck = 20 N/mm ^{2} and f y = 415 N/mm ^{2}. Compute short term deflection.	Understand	CO 2	ACE009.11
7	Design for Torsion. Determine the reinforcement required for a rectangular beam section with the following data: Width of section: 300 mm Depth of section: 500 mm Factored B.M: 65 kN-m Factored torsional moment: 40 kN-m Factored shear force: 70 kN. Use M 15 grade concrete and Fe 415 grade steel.	Understand	CO 2	ACE009.08
8	A cantilever beam having a width of 200mm and effective depth 300mm supports a uniformly distributed load and is reinforced with four bars of 16mm diameter. If the factored total load is 80 kN, calculate a) The maximum local bond stress. b) The anchorage length required. c) If the anchorage length provided is 900 mm, the average bond stress. Assume M-20 Grade Concrete and Fe-415 HYSD bars.	Understand	CO 2	ACE009.09
9	A simply supported rectangular beam of 12m span has a effective depth of 800mm. The area of tension reinforcement required to support the loads is designed as 1.6%. Check the deflection control of the beam by empirical method if a) Fe 415 grade steel is used and b) Fe 500 grade steel is used	Understand	CO 2	ACE009.11
10	A doubly reinforced beam of rectangular section 250 mm wide by 5 mm overall depth is reinforced with 4 bars of 22 mm diameter on tension face and 2 bars of 16 mm diameter at the compression face. The effective cover is 50 mm. The beam spans over 8 m. If Fe-415 HYSD bars are used, check for the deflection control using the empirical method.	Understand	CO 2	ACE009.11
	UNIT -III			
	DESIGN OF SLABS			
	Part - A (Short Answer Questions)			
1	What is difference between one-way and two-way slabs?	Remember	CO 3	ACE009.12
2	Why do we need to provide cover in the design of reinforced concrete structures?	Remember	CO 3	ACE009.12
3	Give the unit weight of PCC and RCC.	Understand	CO 3	ACE009.13
4	What are the specifications as per IS code for Minimum and maximum reinforcement requirement for slabs	Remember	CO 3	ACE009.12
5	What are the considerations that govern thickness of one way and two way slabs?	Remember	CO 3	ACE009.13
6	Which is the critical section to be considered for checking of shear in a slab support on beams?	Understand	CO 3	ACE009.12
7	What are the Reinforcement requirement for One-way slabs as per IS:456 ?	Understand	CO 3	ACE009.12
8	What are the Reinforcement requirement for Two-way slabs as per IS:456?	Remember	CO 3	ACE009.13
9	What are the Torsional reinforcement is required in which type of slabs and why?	Understand	CO 3	ACE009.14
10	What is the maximum size of coarse aggregate in slab?	Understand	CO 3	ACE009.14
11	What is the minimum Flexural Reinforcement in Slabs in either direction?	Understand	CO 3	ACE009.12
12	Give the steps for checking deflection of two way slabs?	Remember	CO 3	ACE009.13
13	How is the maximum shear in two way slabs calculated?	Remember	CO 3	ACE009.13

14	Sketch the reinforcement detailing of one way slab.	Understand	CO 3	ACE009.12
15	Sketch the reinforcement detailing of two-way slab.	Remember	CO 3	ACE009.13
16	Explain about canopy slabs?	Remember	CO 3	ACE009.16
17	What are the specifications for the design of slabs for shear as per IS 456?	Understand	CO 3	ACE009.15
18	Explain the need for corner reinforcement in two-way rectangular slabs whose corners are prevented from lifting up.	Remember	CO 3	ACE009.15
19	What type of slabs is usually used in practice, under-reinforced or over-reinforced?	Remember	CO 3	ACE009.15
20	Write any two general features of two way slab?	Understand	CO 3	ACE009.13
	Part – B (Long Answer Questions)			
1	Write the procedure for design two way simply supported slabs.	Understand	CO 3	ACE009.13
2	Explain the check for deflection control in the design of slabs?	Understand	CO 3	ACE009.13
3	Design a simply supported roof slab for a room 7.5 m x 3.5 m clear in size. The slab is carrying an imposed load of 5 kN/m^2. Use M20 mix and Fe 415 Steel.	Understand	CO 3	ACE009.13
4	Design a simply supported R.C.C. slab for an office floor having clear dimensions of 4m by 10 m with 230 walls all-round. Adopt M - 20 grade concrete & Fe-415 grade HYSD bars.	Understand	CO 3	ACE009.12
5	Design a one way slab with clear span 6m simply supported on 230mm thick wall subjected to a live load of 10 kN/m^2 and floor finish is 1.5 kN/m^2. Use M 20 grade concrete and Fe 415 steel. Assume slab is subjected to moderate exposer.	Understand	CO 3	ACE009.12
6	Design a one way slab with clear span 4.8m simply supported on 230mm thick wall subjected to a live load of 5 kN/m^2 and floor finish is 1.5 kN/m^2. Use M 20 grade concrete and Fe 415 steel. Assume slab is subjected to moderate exposer.	Understand	CO 3	ACE009.13
7	Discuss the Design procedure for one way slab?	Understand	CO 3	ACE009.12
8	Design a one way slab with a clear span of 5m, simply supported on 230mm thick masonry walls and subjected to a live load of $4kN/m^2$ and a surface finish of $1kN/mm^2$.Assume Fe 415 steel. Assume that the slab is subjected to moderate exposure conditions.	Understand	CO 3	ACE009.12
9	Design a slab over a room 5m x 7m as per I.S code. The slab is supported on masonry walls all round with adequate restraint and the corners are held down. The live load on the corners is held down. The live load on the slab is 330N/m2. The slab has a bearing of 150 mm on the supporting walls.	Understand	CO 3	ACE009.13
10	A T-beam slab floor of an office comprises of a slab 150 mm thickness spanning between ribs spaced at 3 m centres. The effective span of the beam is 8 m. Live load on floor is 4 kN/m2. Using M20 grade and Fe 415 HYSD bars. Design one of the intermediate tee beams. Use limit state method	Understand	CO 3	ACE009.13
11	Explain the difference in the behavior of one-way and two-way slabs.	Understand	CO 3	ACE009.13
12	Write any two general features of two way slab.	Understand	CO 3	ACE009.13
13	Discuss the Design procedure for two way slab?	Understand	CO 3	ACE009.13
14	Explain IS: 456 code method for design of slab?	Understand	CO 3	ACE009.14
15	Give neat sketches for the reinforcement details for one way simply support and two way continuous slabs.	Understand	CO 3	ACE009.13
16	Design a simply supported slab to cover a hall with internal dimensions 4.0 m× 6.0 m. The slab is supported on masonry walls 230 mm thick. Assume a live load of 3 kN/m2 and a finish load of 1 kN/m^2. Use M 20 concrete and Fe 415 steel. Assume that the slab corners are free to lift up.	Understand	CO 3	ACE009.13
17	Design continuous RC slab for a class room 7 m wide and 14 m long. The slab is supported on rcc beams spaced at 3.5 m intervals. The width of each beam is 230mm. Design the slab for LL of $3KN/m^2$ Assume weight of roof finishing as 1 KN/m^2 use M20 grade concrete and Fe 415 grade steel.	Understand	CO 3	ACE009.14
18	Design a reinforced concete slab for a room having internal dimension 3m x 7m supported on walls of 300 mm thickness. The slab carries 75mm thick lime concrete at its top, the unit weight of which may be taken as 20 kN/m^3. The slab has to carry a LL of 2 KN/m^2. Assume slab to be simply supported at the ends. Use M 20 grade concrete and Fe 415 steel.	Understand	CO 3	ACE009.14

19	Design a floor slab of T-beam floor of room 8.5mX14.5 m (clear) resting on 230 mm thick walls all around. 3 intermediate beams are provided with equal spacing in shorter span. The floor loading consists of live load of 4 kN/m^2 & dead load (floor finish) 1.5 kN/m^2 apart from self weight. Assume M 20 grade concrete and Fe 415 steel.	Understand	CO 3	ACE009.16
20	Design a two way slab for an office floor size 35 mx4.5 m discontinuous and simply supported edges on all the sides with the corners prevented from lifting and supporting a service live load of 4.4 kN/m2. Adopt M 20 grade and Fe 415 HYSD bars.	Understand	CO 3	ACE009.13
	Part – C (Problem Solving and Critical Thinking)			
1	Design a one−way slab, with a clear span of 4.0 m, simply supported on 230 mm thick masonry walls, and subjected to a live load of 4 kN/m^2 and a surface finish of 1 kN/m^2. Assume Fe 415 steel. Assume the beam is subjected to moderate exposure conditions.	Understand	CO 3	ACE009.12
2	Design a one-way slab, with a clear span of 5.0m, simply supported on 230 mm thick masonry walls, and subjected to a live load of 3 kN/m^2 and a surface finish load of 1 kN/m^2, using Fe 415 steel. Assume that the beam is subjected to (a) mild exposure and (b) very severe exposure, and compare the results.	Understand	CO 3	ACE009.12
3	Design A cantilever slab having an overhang of 1.25m take load of intensity of 1000 N/m^2 on the cantilever and the weight of the finishing as 800 N/m^2 use M20 and Fe415 steel.	Understand	CO 3	ACE009.15
4	Design continuous RC slab for a hall 6.5 m wide and 13.5 m long. The slab is supported on rcc beams, each 240 mm wide which are monolithic. The ends of the slab are supported on walls 300 mm wide. Design the slab for LL of 2 KN/m^2 Assume weight of roof finishing equal to 1.5 KN/m^2 use M20 grade concrete and Fe 415 grade steel.	Understand	CO 3	ACE009.14
5	The floor of a hall measures 16m X 6m from inside and has walls 400mm thick. Design a suitable R.C. T- beam roof to carry a super imposed load of 2000 N/m^2. Use M20 grade concrete and Fe 415 grade steel.	Understand	CO 3	ACE009.14
06	Design a simply supported RCC slab for a roof of a hall 5m x 10 m with 230 mm walls all around assume a LL of 4 KN/m^2 and finish 1 KN/m^2. Use M 25 and Fe 415 steel.	Understand	CO 3	ACE009.12
07	Design a slab of room of clear size 5.5 m X 4 m. The superimposed load is 5 kN/m^2 use M-20 and Fe 415 grade of steel. The four edges of the slab are simply supported and there is no provision of torsion reinforcement (corners not held down). The width of the support is 300 mm.	Understand	CO 3	ACE009.13
08	Design a RC slab for a room measuring 5m x 6m size. The slab is simply supported on all four edges, with corners held down and carries a superimposed load of 3000N/m^2, inclusive of floor finishes, etc, use M20 mix, Fe415 steel and IS code method.	Understand	CO 3	ACE009.12
09	Design a reinforced concrete slab for a room of clear dimensions 4 m x 5 m. The slab is supported on walls of width 300 mm. The slab is carrying a live load of 4 kN/m^2 and floor finish 1 kN/m^2. Use M20 concrete and Fe 415 steel. The corners of slab are held down.	Understand	CO 3	ACE009.13
10	Design a two way slab for a room of size 4 m X 5 m with discontinuous and simply supported edges on all the sides with corners prevented from lifting to support a live load of 4kN/m^2.Use M20 grade concrete & Fe415 steel bars.	Understand	CO 3	ACE009.12
	UNIT – IV			
	DESIGN OF COLUMNS			
	Part – A (Short Answer Questions)			
1	What are the design strengths of steel in tension or bending compression and axial compression?	Remember	CO 4	ACE009.19
2	What are the limits of percentage of the longitudinal reinforcement in a column?	Remember	CO 4	ACE009.17
3	What is the purpose of lateral ties in a RC column?	Remember	CO 4	ACE009.17

4	What is the difference between behavior of a short and long column?	Remember	CO 4	ACE009.17
5	Explain unsupported length of column?	Understand	CO 4	ACE009.18
6	Define crushing and buckling.	Remember	CO 4	ACE009.20
7	What is the role of transverse steel ties in reinforced concrete columns?	Understand	CO 4	ACE009.17
8	What is slenderness ratio? Explain.	Understand	CO 4	ACE009.20
9	Differentiate between short and long column.	Understand	CO 4	ACE009.17
10	Define equivalent length of a column.	Understand	CO 4	ACE009.17
11	What is the maximum slenderness ratio of reinforced columns allowed by IS:456-2000	Remember	CO 4	ACE009.17
12	Explain braced and un braced column.	Understand	CO 4	ACE009.18
13	What is minimum diameter of bars used in longitudinal steel for columns?	Understand	CO 4	ACE009.17
14	What is the minimum eccentricity specified for design of column?	Understand	CO 4	ACE009.17
15	What are the methods available in IS: 456-2000 to determine the effective length of column?	Remember	CO 4	ACE009.20
16	What are the assumptions for limit state design of columns failing in pure compression as given in IS456?	Understand	CO 4	ACE009.20
17	Explain the modes of failure of columns.	Understand	CO 4	ACE009.17
18	Show the reinforcement detailing of spirally reinforced column.	Remember	CO 4	ACE009.18
19	What are the three methods available for design of columns subjected to P and M?	Remember	CO 4	ACE009.18
20	What are the factors that affect the behaviour of slender columns?	Understand	CO 4	ACE009.18
Part – B (Long Answer Questions)				
1	Write the design procedure for slender columns for both braced and unbraced column.	Understand	CO 4	ACE009.17
2	Outline the procedure for design of axially loaded reinforced concrete column?	Understand	CO 4	ACE009.18
3	Design the reinforcement in a column of size 450 mm × 600 mm, subject to an axial load of 2000 kN under service dead and live loads. The column has an unsupported length of 3.0 m and is braced against sideway in both directions. Use M 20 concrete and Fe 415 steel.	Understand	CO 4	ACE009.18
4	A reinforced concrete short column is 400 mm x 400 mm and has 4 bars of 20 diameter. Determine the ultimate load carrying capacity of column if M20 concrete and Fe 415 steel is used. Assume e_{min} <0.05 D.	Understand	CO 4	ACE009.18
5	Find the ultimate load carrying capacity and allowable load for a short colum size 500 mm x 500 mm. The column is reinforced with 4-25 mm diameter bars. Use M20 concrete and HYSD grade Fe 415 steel. Assume e_{min} < 0.05 D.	Understand	CO 4	ACE009.19
6	Design a short R.C.C. column to carry an axial load of 1600 kN. It is 4 m long, effectively held in position and restrained against rotation at both ends. Use M20 concrete and Fe 415 steel.	Understand	CO 4	ACE009.20
7	Design a column of size 450 mm x 600 mm and having 3 m unsupported length. The column is subjected to a load of 2000 kN and is effectively held in position but not restrained against rotation. Use M20 concrete and Fe 415 steel.	Understand	CO 4	ACE009.20
8	Design a circular column of diameter 400 mm subjected to a load of 1200 kN. The column is having spiral ties. The column is 3 m long and is effectively held in position at both ends but not restrained against rotation. Use M25 concrete and Fe 415 steel.	Understand	CO 4	ACE009.17
9	Design the reinforcement to be provided for a short column 400 mm x 500 mm subjected to following forces: P_u= 1600 kN M_{ux}= 200 kNm. M_{uy} =150 kNm. Use M25 concrete and Fe 415 steel.	Understand	CO 4	ACE009.17

10	Design a square footing of uniform an axially loaded column thickness of 450 mm x 450 mm size. The safe bearing capacity of soil is 190 kN/m2. Load on column is 850 kN.Use M20 concrete and Fe 415 steel.	Understand	CO 4	ACE009.18
11	Design a symmetrically reinforced short column 450 x 450mm under bi axial bending with a load of 1000 KN and Mx = 75 KN-m and My =60 KN-m use M20 grade concrete and fe 415 grade steel.	Understand	CO 4	ACE009.19
12	Design a column of unsupported length 3m to carry an axial load of 2000 kN and a BM of 150kNm at service conditions. Design the column as a short column. The column is subjected to severe exposure condition and grade of steel is Fe500. Provide equal reinforcement on all the faces. Use M30 concrete. Sketch reinforcement details.	Understand	CO 4	ACE009.19
13	Derive the expression for the ultimate load for axially loaded short column.	Understand	CO 4	ACE009.19
14	Explain the step-by-step procedure for design of centrally loaded short columns.	Understand	CO 4	ACE009.19
15	Determine the longitudinal steel required for column for 400 x 600 mm carrying Pu=166 KN, factored moment M(major axis)=120 KN-m and factored M(minor axis)= 90KN-m, assume f_{ck}=15 N/mm^2 and f_y =415 N/mm^2 assume d'=60mm.	Understand	CO 4	ACE009.20
16	Design a column having an effective length of 4.75 m to support factored load of 1600kN. Consider the reinforcement ratio ρ to be in the range 1.5 to 2.0 percent and the effective cover to longitudinal steel of 55mm. The materials to be used are M25 grade of concrete and HYSD steel bars of grade Fe415.	Understand	CO 4	ACE009.19
17	A braced reinforced concrete column of circular cross-section of 500mm diameter is to support a factored axial load of 2250 kN along with a factored moment of 160 kNm. The unsupported length of the column is 6.3m effective length of 5.5m. Design the column when it is to be provided with: Lateral ties and Spiral reinforcement. The M25 grade of concrete and HYSD steel bars of grade Fe415.	Understand	CO 4	ACE009.17
18	Design the reinforcements in a circular column of diameter 300 mm to support a service axial load of 800 kN. The column has unsupported length of 3 m and is braced against side sway. The column is reinforced with helical ties. The material to be used is M 25 grade of concrete and HYSD steel bars of grade Fe 415.	Understand	CO 4	ACE009.18
19	Design the reinforcements in as column 530mmx450mm at the corner of a multistoreyed building to support an axial factored load of 1500 kN, together with biaxial moments of 50 kNm acting in perpendicular planes. Adopt M20 grade of concrete and steel grade Fe415 HYSD bars	Understand	CO 4	ACE009.18
20	A braced reinforced concrete column of circular cross-section of 500mm diameter is to support a factored axial load of 2300 kN along with a factored moment of 165 kNm. The unsupported length of the column is 6.3m effective length of 5.5m. Design the column when it is to be provided with: i. Lateral ties and ii. Spiral reinforcement. The M25 grade of concrete and HYSD steel bars of grade Fe415.	Understand	CO 4	ACE009.19
Part – C (Problem Solving and Critical Thinking)				
1	A column 300mm X 400 mm has a unsupported length of 3m & effective length of 3.6 m. It is subjected to a axial load of 1100 kN & moment of 230 kNm about major axis. Determine the longitudinal steel using M25 grade concrete & Fe 415 grade steel. Assume d' = 60 mm.	Understand	CO 4	ACE009.17
2	A column 300mm X 400 mm has a length of 3.6 m. It is subjected to a axial load of 1100 kN & moment of 150 kNm about major axis. Design a column using M25 grade concrete & Fe 415 grade steel. a) Reinforcement on two sides b) Reinforcement on four sides. Assume cover as 60 mm.	Understand	CO 4	ACE009.18
3	Determine the longitudinal steel required for a column 400 X 600 mm carrying a axial load of 1600 kN and moment of 120 kNm along major axis and 60 kNm along minor axis. Use M15 grade concrete & Fe 415 grade steel. Assume d' = 60 mm.	Understand	CO 4	ACE009.19

4	A concrete column of 400mm diameter, reinforced with 8 bars of 20 mm diameter bars is braced & hinged at both ends, 8 m apart. Check the safety of the column if it carries a factored axial load of 1100 kN. Use M20 grade concrete & Fe 415 grade steel. Assume d' = 60 mm.	Understand	CO 4	ACE009.18
5	Design the reinforcements in a column of size 400 mm X 600 mm subjected to axial working load of 2000 kN. The column has a unsupported length of 3m and is braced against side sway in both directions. Adopt M 20 grade concrete & Fe 415 steel bars.	Understand	CO 4	ACE009.17
6	Design the reinforcement in a circular column of diameter 300 mm with helical reinforcement to support a factored load of 1500 kN. The column has an unsupported length of 3m and is braced against sideway. Adopt M20 grade concrete & Fe415 grade steel	Understand	CO 4	ACE009.18
7	Design the longitudinal and lateral reinforcement in a rectangular reinforced concrete column of size 400 mm X 300 mm subjected to a design ultimate load of 1200 kN and ultimate moment of 200 kNm with respect to major axis. Adopt M 20 grade concrete & Fe 415 steel bars.	Understand	CO 4	ACE009.19
8	Design a short reinforced concrete rectangular column of size 300 X 500 mm is subjected to an axial compressive factored load of 200 kN and a factored moment of 250 kNm about major axis. Adopt M 25 grade concrete & Fe 415 steel bars. Determine the reinforcement in the column section.	Understand	CO 4	ACE009.19
9	Design a short circular column of diameter 400 mm to support a factored axial load of 900 kN together with a factored moment of 100 kNm. Adopt M 20 grade concrete & Fe 415 steel bars. Determine the reinforcement in the column section.	Understand	CO 4	ACE009.19
10	Design the reinforcements in a short column 400mm X 600mm subjected to an ultimate axial load of 1600 kN together with ultimate moments of 120 kNm and 90 kNm about the major and minor axis respectively. Adopt M 20 grade concrete & Fe 415 steel bars.	Understand	CO 4	ACE009.20
	UNIT -V			
	DESIGN OF FOOTING AND STAIR CASE			
	Part - A (Short Answer Questions)			
1	What are the conditions to be satisfied during the design of a combined footing?	Understand	CO 5	ACE009.22
2	Explain about one-way and two-way shear in footings?	Remember	CO 5	ACE009.21
3	Explain about the Minimum cover required in a footing?	Understand	CO 5	ACE009.22
4	What are the situations in which combined footings are preferred to isolated footings?	Remember	CO 5	ACE009.21
5	Under what circumstances is a trapezoidal shape preferred to a rectangular shape for a two-column combined footing?	Remember	CO 5	ACE009.22
6	Describe briefly the load transfer mechanism in a two-column combined footing.	Remember	CO 5	ACE009.22
7	Name five types of staircases based on geometrical configurations. Draw a typical flight and show: (a) trade, (b) nosing, (c) riser, (d) waist and (e) going.	Understand	CO 5	ACE009.24
8	Explain about the following stair cases (A) A stair case (B) A dog legged stair	Understand	CO 5	ACE009.23
9	Draw schematic diagrams of different types of staircases based on different structural systems. Mention four general considerations for the design of a staircase.	Understand	CO 5	ACE009.23
10	Explain the method of determining the effective spans of stairs.	Understand	CO 5	ACE009.23
11	Classify the foundation.	Remember	CO 5	ACE009.21
12	Explain about combined footing.	Understand	CO 5	ACE009.22
13	Explain about isolated footing.	Remember	CO 5	ACE009.21
14	Give the provision of dowel bars as per IS: 456-2000 code of practice.	Understand	CO 5	ACE009.23
15	Draw the pressure distribution beneath footings.	Remember	CO 5	ACE009.21
16	Enumerate proportioning of footings.	Understand	CO 5	ACE009.21

17	What are the causes for failure of footing?	Remember	CO 5	ACE009.21
18	What are the specifications for diameter of transverse links?	Understand	CO 5	ACE009.22
19	List out the IS recommendations regarding longitudinal reinforcements.	Remember	CO 5	ACE009.21
20	What are the advantages of providing a pedestal?	Understand	CO 5	ACE009.21
	Part - B (Long Answer Questions)			
1	Design a footing for a 500 x 350 mm column using 20 mm bars as dowels to transmit characteristic loads of 600 KN as dead load and 400 KN as live load to a foundation with SBC = 120 KN/m2, assume M20 and Fe415.	Understand	CO 5	ACE009.21
2	Give the procedure for one way and punching shear with necessary diagrams.	Understand	CO 5	ACE009.21
3	Explain the design procedure for isolated footing of uniform depth.	Understand	CO 5	ACE009.21
4	Design a combined footing with strap beam for two reinforced concrete columns of size 300 mm X 300 mm spaced 4m c/c and each supporting a service load of 500 kN. The safe bearing capacity of soil is 150 kN/m^2.	Understand	CO 5	ACE009.22
5	A reinforced concrete column 400 mm X 400 mm supports a axial service load of 1000 kN. Use M20 grade concrete & Fe 415 steel. The safe bearing capacity of soil is 200 kN/m^2. Sketch the details of reinforcement. Use M20 grade concrete & Fe 415 steel,	Understand	CO 5	ACE009.21
6	A solid footing has to transfer a dead load 1000 KN and imposed load of 400 KN from a square column 400 x 400 mm with 16 mm bars. Assuming f_y = 415 N/mm^2, f_{ck}20 N/mm^2 safe bearing capacity = 200 kN/m^2. Design the footing	Understand	CO 5	ACE009.21
7	Design a rectangular isolated sloped footing for a column of size 250 mm x 750 mm carrying an axial load of 2600 kN. The S.B.C. of the soil is 300 kN/m^2. Use M 25 grade concrete and Fe 415 grade steel	Understand	CO 5	ACE009.21
8	Design an isolated footing for a square column, 450 mm × 450 mm, reinforced with 8–25 φ bars, and carrying a service load of 2300 kN. Assume soil with a safe bearing capacity of 300 kN/m^2 at a depth of 1.5 m below ground. Assume M 20 grade concrete and Fe 415 grade steel for the footing, and M 25 concrete and Fe 415 steel for the column.	Understand	CO 5	ACE009.21
9	A straight staircase is made of structurally independent tread slabs, cantilevered from a reinforced concrete wall. Given that the riser is 150 mm, tread is 300 mm, and width of flight is 1.75 m, design a cantilevered slab using M 20 concrete and Fe 250 steel. Assume mild exposure conditions. Apply the live loads specified in the IS Loading Code for stairs liable to be overcrowded.	Understand	CO 5	ACE009.23
10	(a)Explain the distribution of loading on stairs with fig. (b) Explain the procedure for estimation of dead weight of stairs.	Understand	CO 5	ACE009.24
11	What are the different types of foundations? Explain with fig.	Understand	CO 5	ACE009.21
12	What are the Indian standard code recommendations for design of footings as per IS: 456-2000?	Understand	CO 5	ACE009.21
13	Explain design procedure for footing as per IS: 456.	Understand	CO 5	ACE009.21
14	Explain the design of sloped square footing with reinforcement detailing.	Understand	CO 5	ACE009.21
15	A Staircase has following dimension: Waist W= 75 mm; Nosing N=25 mm; Rise R =175 mm; Going G=225mm. the LL is $2KN/m^2$. calculate the factored load and effective depth if (a) Stair slab spanning longitudinal (b) Stair slab spanning horizontally	Understand	CO 5	ACE009.23
16	Design a square footing for a short axially loaded column of size 300 mm X 300 mm carrying a 600 kN load. Use M20 grade concrete & Fe 415 steel. Safe bearing capacity of soil is 180 kN/m^2. Sketch the details of reinforcement.	Understand	CO 5	ACE009.21
17	A rectangular column 400 mm X 600 mm carries a live load of 2000 kN. The safe bearing capacity of the soil is 150 kN/m^2. Use M20 grade concrete & Fe 415 steel; design a rectangular footing to support the column. Sketch the details of reinforcement.	Understand	CO 5	ACE009.21

18	A reinforced concrete wall 250 mm thick carries a load of 500 kN/m inclusive of its own weight. Design a reinforced concrete footing on soil having safe bearing capacity of 160 kN/m^2. Use M20 grade concrete & Fe 415 steel,	Understand	CO 5	ACE009.21
19	A Rectangular column 600x400 mm carries a load of 800kN. Design a rectangular footing to support the column. The safe bearing capacity of the soil is 200 kN/m2. Use M20 grade concrete.	Understand	CO 5	ACE009.21
20	A 230mm thick masonry wall is to provided with a reinforced concrete footing on a site having soil with SBC, unit weight and angle of repose of 125 kN/m2, 17.5 kN/m3 and 300 respectively. The M20 grade of concrete and HYSD steel bars of grade Fe 415. Design the footing when the wall supports at service state: a load of 150 kN/m length	Understand	CO 5	ACE009.22
Part – C (Problem Solving and Critical Thinking)				
1	Design an isolated footing of uniform thickness of a R.C. column bearing a vertical load of 600 kN and having a base of size 500 X 500 mm. The safe bearing capacity of soil may be taken as 120 kN/m^2. Use M20 grade concrete & Fe 415 steel	Understand	CO 5	ACE009.21
2	Design a rectangular isolated footing of uniform thickness of reinforced concrete column bearing a vertical load of 600 kN, and having a base size of 400 X 600 mm. The safe bearing capacity of soil may be taken as 120 kN/m^2. Use M20 grade concrete & Fe 415 steel	Understand	CO 5	ACE009.21
3	Design a isolated square sloped footing for a column 500 mm X 500 mm, transmitting an axial load of 1200 kN. The column is reinforced with 8 bars of 20 mm diameter. The safe bearing capacity of soil is 120 tonnes/m^2. Use M20 grade concrete & Fe 415 steel	Understand	CO 5	ACE009.21
4	Design an isolated unsymmetrical square footing for a column 500 mm X 500 mm, transmitting a load of 600 kN and a moment of 30 kNm. The safe bearing capacity of soil is 120 kN/m^2. Use M20 grade concrete & Fe 415 steel.	Understand	CO 5	ACE009.21
5	Design a combined rectangular footing for a two columns A and B, carrying loads of 500 and 700 kN respectively. Column A is 300 mm X 300 mm in size and column B is 400 mm X 400 mm in size. The c/c spacing of the columns is 3.4 m. The safe bearing capacity of soil may be taken as 150 kN/m^2. Use M20 grade concrete & Fe 415 steel.	Understand	CO 5	ACE009.22
6	Design a combined rectangular footing with central joining beam two columns 400 mm X 400 mm in section carry a load of 1000 kN each inclusive of the self weight. Design a combined footing having central beam joining the columns. The c/c spacing of the columns is 4 m. The safe bearing capacity of soil is 150 kN/m^2. Use M20 grade concrete & Fe 415 steel.	Understand	CO 5	ACE009.22
7	Design a combined trapezoid footing for a two columns A and B, spaced 5m c/c. Column A is 300 X 300 mm in size and transmits a load of 600 kN. Column B is 400 X 400 mm in size and carries a load of 900 kN. The maximum length of footing is restricted to 7m only. The safe bearing capacity of soil may be taken as 120 kN/m^2. Use M20 grade concrete & Fe 415 steel.	Understand	CO 5	ACE009.22
8	Deign a dog- legged stair for a building in which the vertical distance between floors is 3.6 m. The stair hall measures 2.5 m X 5m. The live load may be taken as 2500 N/m^2.use M 20 concrete and Fe415 steel bars.	Understand	CO 5	ACE009.24
9	A straight stair in a residential building supported on wall on one side and stringer beam on the other side. The risers are 150 mm and treads are 250 mm and the horizontal span of the stairs may be taken as 1.2 m. design the steps. Use M 20 concrete and Fe 415 steel bars.	Understand	CO 5	ACE009.23
10	A longitudinal type of staircase spans a distance of 3.75 m c/c beams, R=175 mm, G=250mm, T=270 mm. The treads have 15 mm granolithic finish and consists of 50 steps. Assume M25 and Fe 415. Design a staircase for a LL of 5KN/m2. Assume breadth of staircase of 1.5 m.	Understand	CO 5	ACE009.23

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