INSTITUTE OF AERONAUTICAL ENGINEERING

(Autonomous)
Dundigal, Hyderabad-500043

CIVIL ENGINEERING

TUTORIAL QUESTION BANK

Course Title	**ADVANCED STRUCTURAL ANALYSIS AND DESIGN**				
Course Code	ACE016				
Programme	B.Tech				
Semester	VII				
Course Type	Core				
Regulation	IARE - R16				
Course Structure	**Theory**			**Practical**	
	Lectures	**Tutorials**	**Credits**	**Laboratory**	**Credits**
	3	1	4	-	-
Chief Coordinator	Mr. Ashok Kumar, Assistant Professor				
Course Faculty	Dr. Venu M, Professor				

COURSE OBJECTIVES:

The course should enable the students to:	
I	Enhance knowledge of matrix stiffness and flexibility methods for analyzing continuous beams, portal frames and trusses.
II	Design advanced structures such as retaining walls against lateral earth pressure.
III	Analyze and design the different types of piles and flat slabs as per the recommendations of Indian Standard codes.
IV	Explore and interpret the basic design concepts of water tanks, silos and bunkers.

COURSE OUTCOMES (COs):

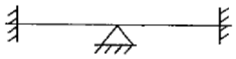
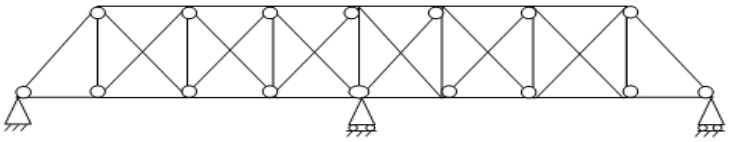
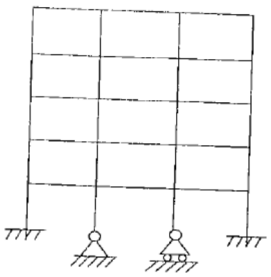
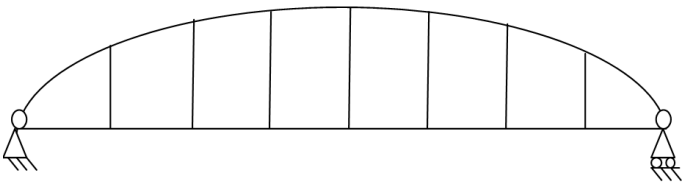
CO 1	Understand the basic concepts of static and kinematic indeterminacy. Know the concepts of stiffness method and flexibility method and analysis of various structural elements using these methods.
CO 2	Understand the concepts of different approximate methods of analysis for lateral loads. Analysis of multi storey frame using portal method, cantilever method and substitute frame method.
CO 3	Know the design concepts and IS code provisions for the retaining walls and water tanks. Design retaining walls and water tanks.
CO 4	Know the design concepts and IS code provisions for the flat slabs and deep foundations. Design of flat slab, raft foundation and pile foundation.
CO 5	Know the design concepts and IS code provisions for the chimneys, bunker and silos. Design of chimneys, bunker and silos.

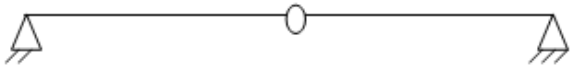
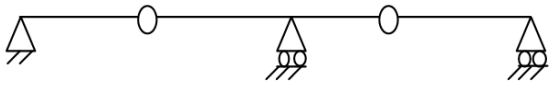
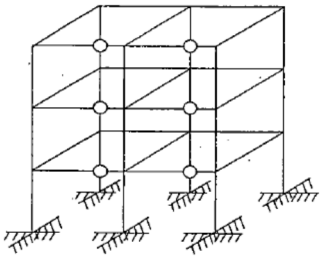
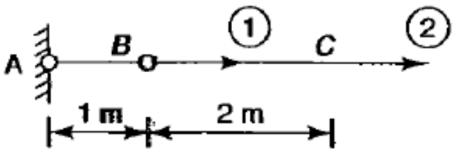
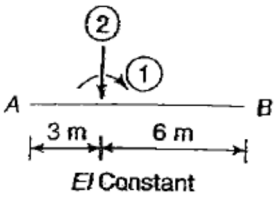
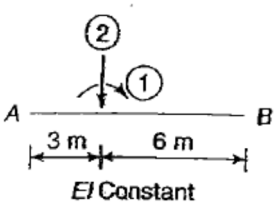
COURSE LEARNING OUTCOMES (CLOs):

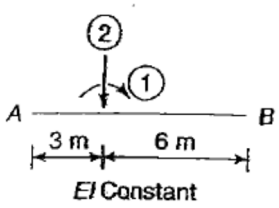
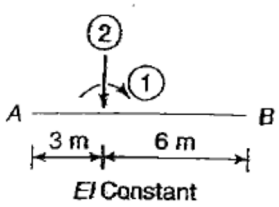
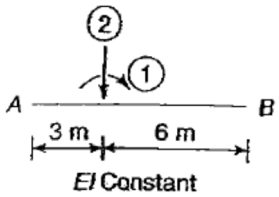
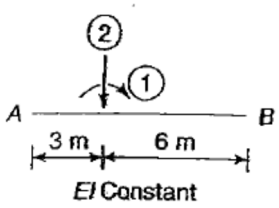
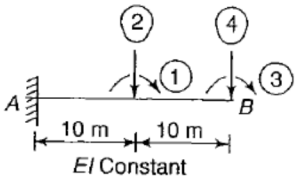
ACE016.01	Understand the concepts of static and kinematic indeterminacy.
ACE016.02	Know the concepts of stiffness method and flexibility method.
ACE016.03	Analysis of continuous beam with and without settlement of supports using stiffness method.
ACE016.04	Analysis of single storey portal frames including side sway using stiffness method.
ACE016.05	Analysis of pin jointed determinate plane frames using stiffness method.
ACE016.06	Analysis for continuous beams up to three degree of indeterminacy using flexibility method
ACE016.07	Understand the concepts of different approximate methods of analysis for lateral loads.
ACE016.08	Analysis of multi storey frame using portal method.
ACE016.09	Analysis of multi storey frame using cantilever method.
ACE016.10	Analysis of multi storey frame using substitute frame method.
ACE016.11	Know the design concepts and IS code provisions for the retaining walls and water tanks.
ACE016.12	Understand the design of retaining walls.
ACE016.13	Understand the design of water tanks.
ACE016.14	Know the design concepts and IS code provisions for the flat slabs and deep foundations.
ACE016.15	Understand the design of flat slab.
ACE016.16	Understand the design of raft foundation.
ACE016.17	Understand the design of pile foundation.
ACE016.18	Know the design concepts and IS code provisions for the chimneys, bunker and silos.
ACE016.19	Understand the design of chimney.
ACE016.20	Understand the design of bunkers.
ACE016.21	Understand the design of silos.

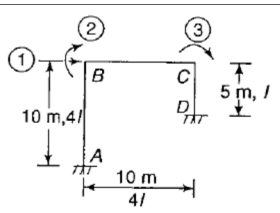
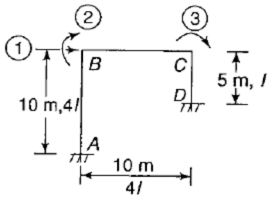
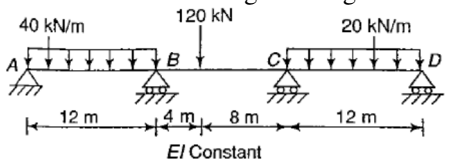
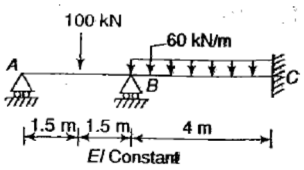
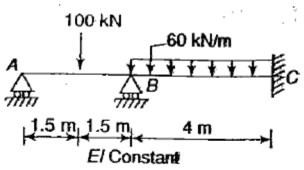
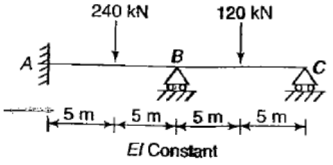
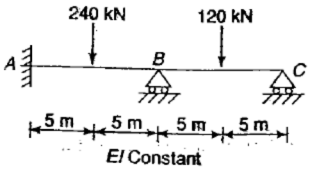
TUTORIAL QUESTION BANK

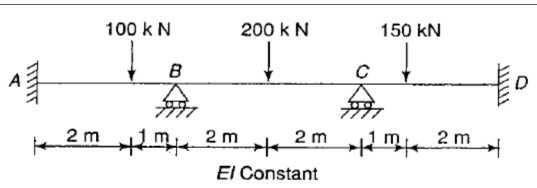
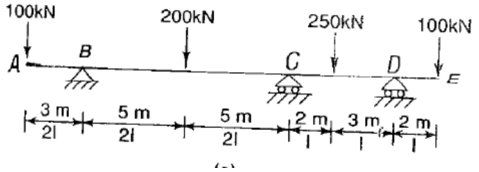
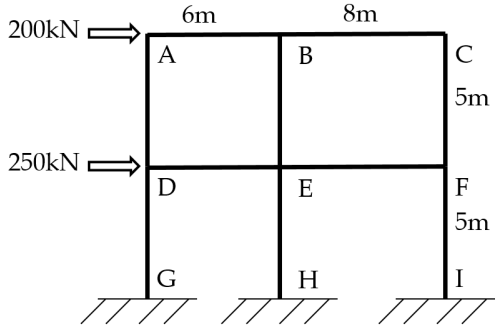
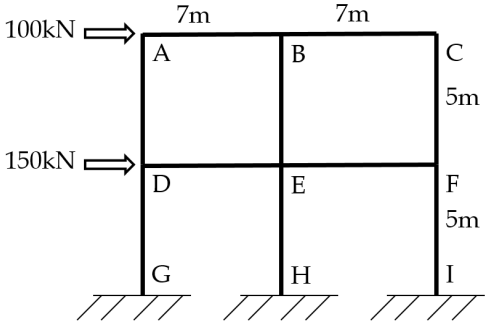
	UNIT- I			
	MATRIX METHODS OF ANALYSIS			
	Part - A (Short Answer Questions)			
S. No.	**QUESTIONS**	**Blooms Taxonomy Level**	**Course Outcomes**	**Course Learning Outcomes (CLOs)**
1	Distinguish between static and kinematic indeterminacy.	Remember	CO 1	ACE016.01
2	Differentiate between determinate and indeterminate structures.	Understand	CO 1	ACE016.01
3	Define stiffness.	Remember	CO 1	ACE016.02
4	Define internal and external indeterminacies.	Remember	CO 1	ACE016.02
5	Distinguish between plane truss and space truss.	Remember	CO 1	ACE016.02
6	What is transformation matrix?	Remember	CO 1	ACE016.01
7	Find the degree of redundancy for a propped cantilever beam and a fixed beam.	Remember	CO 1	ACE016.02
8	State the conditions of equilibrium.	Remember	CO 1	ACE016.01
9	Find the static indeterminacy of beam shown below. 	Remember	CO 1	ACE016.01

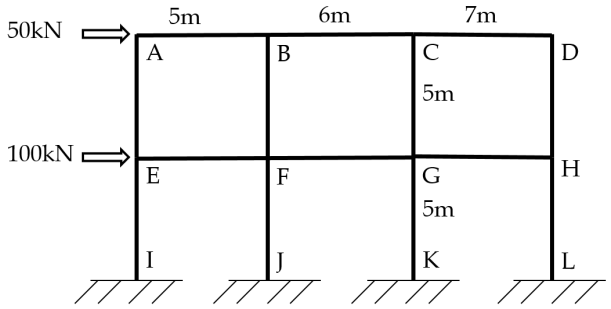
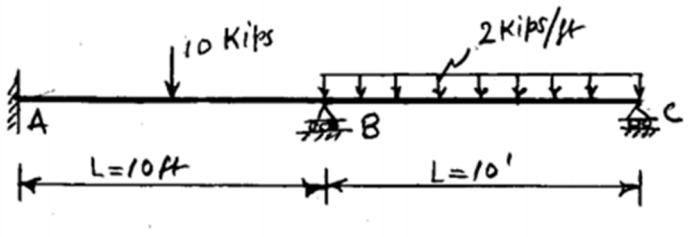
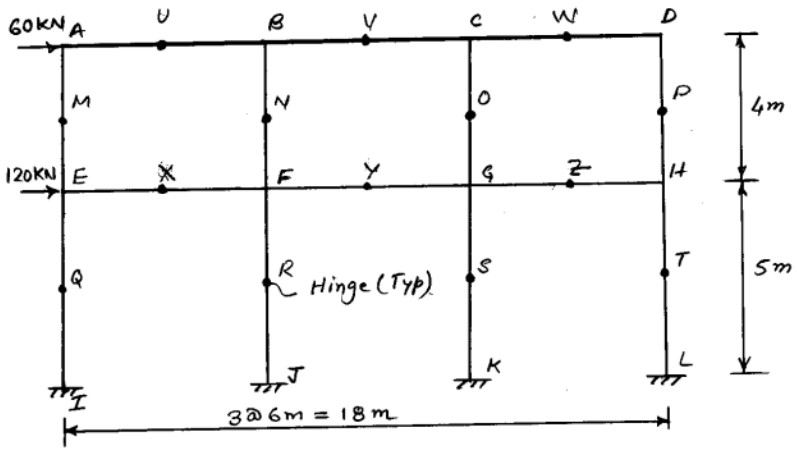
10	Find the kinematic indeterminacy of beam shown below. 	Remember	CO 1	ACE016.01
11	Define flexibility coefficient	Remember	CO 1	ACE016.02
12	What do mean by force or flexibility method?	Remember	CO 1	ACE016.02
13	What is the relationship between flexibility and stiffness equations?	Understand	CO 1	ACE016.02
14	Is it possible to develop a flexibility matrix for a determinate structure?	Understand	CO 1	ACE016.03
15	Write the relation between flexibility and stiffness.	Remember	CO 1	ACE016.03
16	Find the static and kinematic indeterminacy of a fixed beam.	Understand	CO 1	ACE016.03
17	Find the static and kinematic indeterminacy of a propped cantilever beam.	Understand	CO 1	ACE016.01
18	Calculate the static indeterminacy of a continuous beam ABC of two spans of support A is fixed and B,C are simply supported.	Remember	CO 1	ACE016.03
19	Find the static and kinematic indeterminacy of a cantilever beam.	Understand	CO 1	ACE016.03
20	Find the static and kinematic indeterminacy of a two side overhanging beam.	Remember	CO 1	ACE016.03
	Part - B (Long Answer Questions)			
1	Derive the stiffness influence coefficients of prismatic member AB by giving a unit displacement i.e. slope at A and B	Understand	CO 1	ACE016.02
2	Derive the stiffness influence coefficients of prismatic member AB by giving a unit displacement i.e. deflection at A and B	Understand	CO 1	ACE016.02
3	Derive the stiffness influence coefficients of prismatic member AB by giving a unit axial displacement at A and B	Understand	CO 1	ACE016.02
4	Determine the degree of redundancy for the following structures: (a)  (b) 	Understand	CO 1	ACE016.01
5	Formulate the stiffness matrices for a cantilever beam and fixed beam.	Understand	CO 1	ACE016.03
6	What is the degree of kinematic indeterminacy for a simply supported beam? If the effects of axial deformations are neglected, what is the degree of kinematic indeterminacy?	Understand	CO 1	ACE016.03
7	Determine the degree of static and kinematic indeterminacy for the following structures: 	Understand	CO 1	ACE016.01

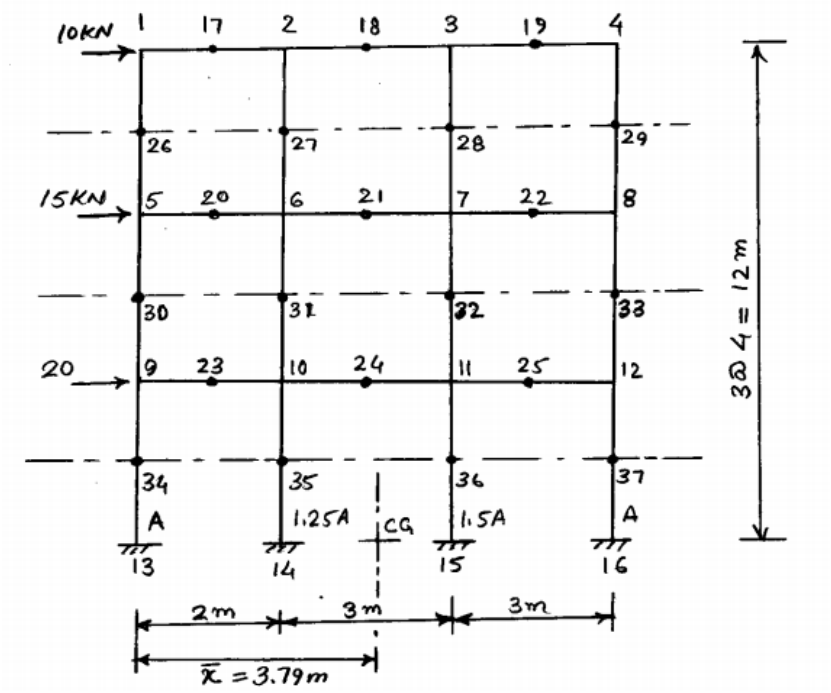
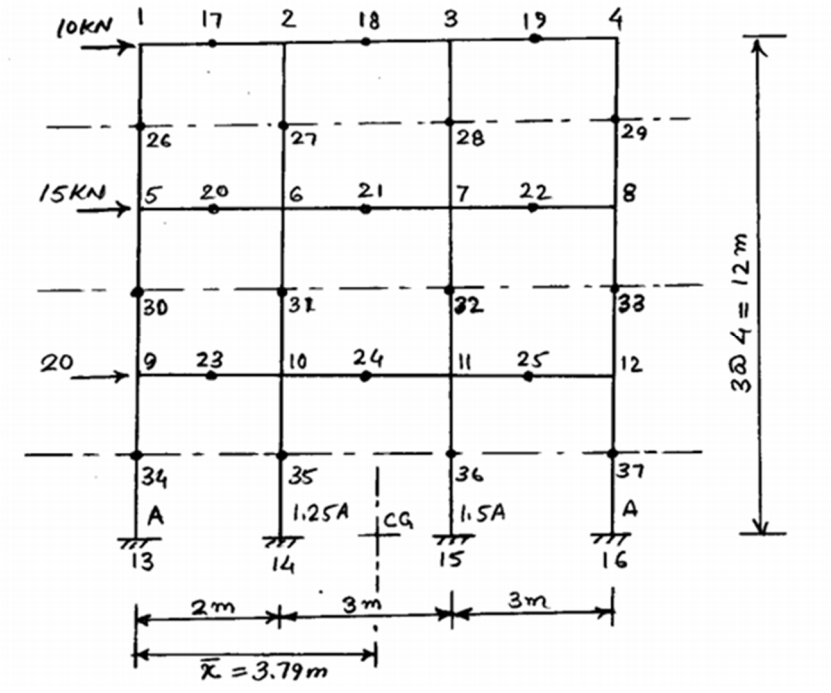
8	Which of the beams are statically determinate? For these beam, calculate the degrees of redundancy.  (a)  (b)	Understand	CO 1	ACE016.01
9	Determine the degree of static indeterminacy for the following structure. 	Understand	CO 1	ACE016.01
10	Two steel bars AB and BC, each having a ross sectional are of 20mm2, are connected in series as shown in figure. Develop the flexibility and stiffness matrices with reference to coordinates 1 and 2 shown in the figure. Verify that the two matrices are the inverse of each other. Take E = 200kN/mm2. 	Understand	CO 1	ACE016.03
11	Develop the flexibility matrix for a prismatic member AB with reference to the coordinates shown in figure with hinged support at A and roller support at B. 	Understand	CO 1	ACE016.03
12	Develop the flexibility matrix for a prismatic member AB with reference to the coordinates shown in figure with fixed supports at A and B. 	Understand	CO 1	ACE016.03
13	Develop the flexibility matrix for a prismatic member AB with reference to the	Understand	CO 1	ACE016.03

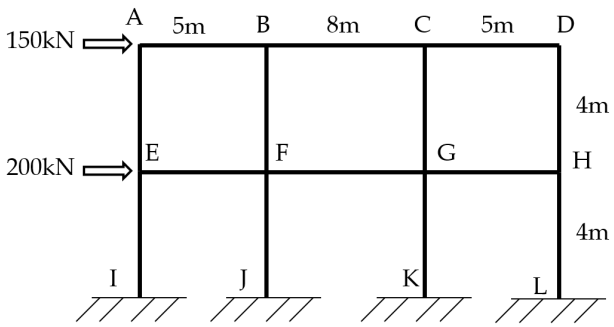
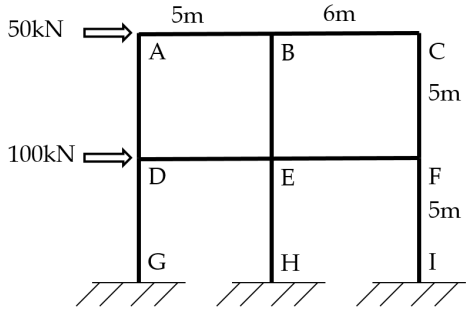
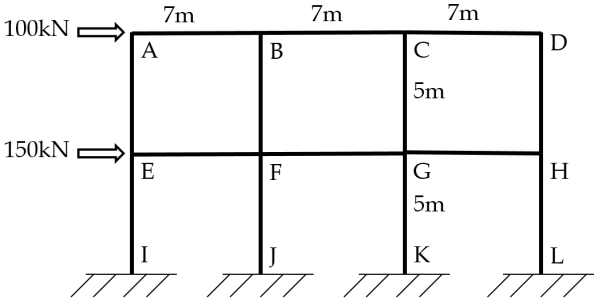
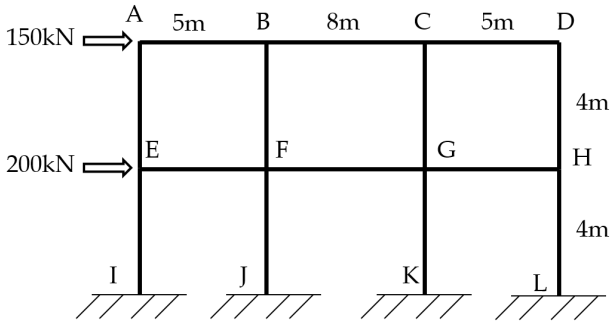
	coordinates shown in figure with fixed support at A and roller support at B.  			
14	Develop the stiffness matrix for a prismatic member AB with reference to the coordinates shown in figure with hinged support at A and roller support at B.  	Understand	CO 1	ACE016.03
15	Develop the stiffness matrix for a prismatic member AB with reference to the coordinates shown in figure with fixed supports at A and B.  	Understand	CO 1	ACE016.03
16	Develop the stiffness matrix for a prismatic member AB with reference to the coordinates shown in figure with fixed support at A and roller support at B.  	Understand	CO 1	ACE016.03
17	Write the similarities and dis-similarities of force method and displacement method.	Understand	CO 1	ACE016.02
18	What is relationship between stiffness matrix and flexibility matrix.	Understand	CO 1	ACE016.03
19	Explain the procedure for flexibility method.	Remember	CO 1	ACE016.03
20	Explain the procedure of analysis using force and displacement method.	Understand	CO 1	ACE016.03
Part - C (Problem Solving and Critical Thinking Questions)				
1	Develop the flexibility and stiffness matrices for a beam AB with reference to the coordinates shown in figure.  	Understand	CO 1	ACE016.03
2	Develop the flexibility matrix for portal frame ABCD with reference to the coordinates shown in figure.	Understand	CO 1	ACE016.04

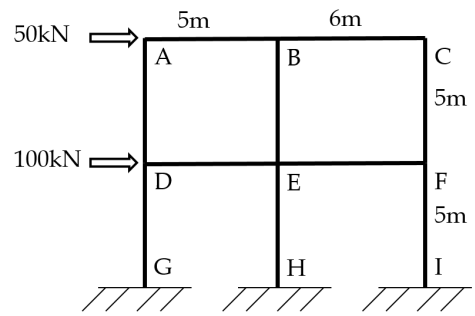
				
3	Develop the stiffness matrix for portal frame ABCD with reference to the coordinates shown in figure. 	Understand	CO 1	ACE016.04
4	Analyze the continuous beam shown in figure using flexibility method. 	Analyze	CO 1	ACE016.04
5	Analyze the continuous beam shown in figure using flexibility method. 	Analyze	CO 1	ACE016.03
6	Analyze the continuous beam shown in figure using stiffness method. 	Analyze	CO 1	ACE016.06
7	Analyze the continuous beam shown in figure using stiffness method. 	Analyze	CO 1	ACE016.06
8	Analyze the continuous beam shown in figure using stiffness method, if the downward settlement of supports B and C in kN-m units are 2000/EI and 1000/EI respectively. 	Analyze	CO 1	ACE016.05
9	Analyze the continuous beam shown in figure using stiffness method.	Analyze	CO 1	ACE016.06

				
10	Analyze the continuous beam shown in figure using stiffness method. 	Analyze	CO 1	ACE016.06
	UNIT-II			
	APPROXIMATE METHODS OF ANALYSIS			
	Part – A (Short Answer Questions)			
1	What is the use of approximate methods?	Understand	CO 2	ACE016.07
2	What are the different methods of approximate methods of analysis?	Understand	CO 2	ACE016.07
3	Write the assumptions made in portal methods.	Understand	CO 2	ACE016.08
4	Write the assumptions made in cantilever method.	Understand	CO 2	ACE016.09
5	What are the different types of substitute frames?	Remember	CO 2	ACE016.10
6	Draw the loading condition of maximum positive bending moment in substitute frames.	Understand	CO 2	ACE016.10
7	Draw the loading condition of maximum negative bending moment in substitute frames.	Remember	CO 2	ACE016.10
8	Draw the loading condition of maximum negative bending moment at supports in substitute frames.	Understand	CO 2	ACE016.10
9	Draw the various types of substitute frames.	Understand	CO 2	ACE016.10
10	What is the difference between portal method and cantilever method.	Understand	CO 2	ACE016.8
	Part - B (Long Answer Questions)			
1	Analyze the portal frame using portal method. 	Analyze	CO 2	ACE016.08
2	Analyze the portal frame using cantilever method. Assume all columns are having same cross sectional area. 	Analyze	CO 2	ACE016.09
3	Analyze frame using cantilever method. The area of columns are A, 1.25 A, 1.5A and A respectively.	Analyze	CO 2	ACE016.09

				
4	Explain the approximate method for analysis of portal frames, in case of very stiff girders.	Understand	CO 2	ACE016.07
5	Explain the approximate methods of analysis of beams and frames with examples.	Understand	CO 2	ACE016.07
6	Explain the behavior of low rise buildings and medium height buildings.	Understand	CO 2	ACE016.07
7	Explain the approximate method for analysis of portal frames, in case of flexible girders.	Understand	CO 2	ACE016.08
8	Explain the approximate method for analysis of portal frames, in case of stiff girders and state the assumptions.	Understand	CO 2	ACE016.09
9	Describe the approximate analysis methods for building frames to 1) Subjected to vertical loads only 2) Subjected to lateral loads	Understand	CO 2	ACE016.08
10	Write the assumptions made for the analysis of frame for horizontal loads using portal method.	Understand	CO 2	ACE016.08
	Part - C (Problem Solving and Critical Thinking Questions)			
1	Analyze the beam by approximate method 	Analyze	CO 2	ACE016.10
2	Analyse the laterally loaded frame as shown below by approximate analysis. 	Analyze	CO 2	ACE016.08
3	Analyse the building frame by cantilever method of approximate	Analyze	CO 2	ACE016.09

	analysis the area of columns are A, 1.25 A, 1.5A and A respectively. 			
4	Write the assumptions made for the analysis of frame for horizontal loads using cantilever method.	Understand	CO 2	ACE016.09
5	Analyze the building frame by cantilever method of approximate analysis the area of columns are A. 	Analyze	CO 2	ACE016.09
6	Analyze the frame using portal method.	Analyze	CO 2	ACE016.08

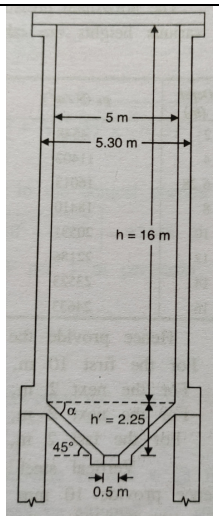
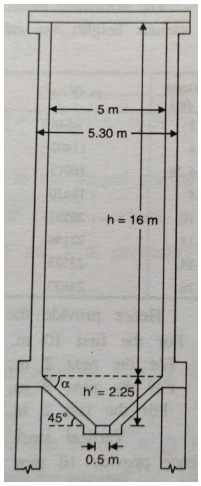
				
7	Analyze the frame using portal method 	Analyze	CO 2	ACE016.08
8	Analyze the frame using portal method. 		CO 2	ACE016.08
9	Analyze the frame using cantilever method. The area of columns are 2A, 1.25 A, 1.5A and A respectively 	Analyze	CO 2	ACE016.09
10	Analyze the frame using cantilever method.	Analyze	CO 2	ACE016.09

				
	UNIT –III			
	DESIGN OF RETAINING WALLS AND TANKS			
	Part - A (Short Answer Questions)			
1	What is meant by retaining wall?	Remember	CO 3	ACE016.11
2	Write the different types of retaining walls?	Remember	CO 3	ACE016.12
3	Explain the importance of retaining walls?	Understand	CO 3	ACE016.12
4	Draw a neat sketch of counterfort retaining wall and mention all the parts.	Remember	CO 3	ACE016.12
5	What are the different types of liquid retaining structures.	Remember	CO 3	ACE016.12
6	Write the different types of water tanks based on its location.	Understand	CO 3	ACE016.13
7	Write the different types of water tanks based on materials used.	Understand	CO 3	ACE016.13
8	What are the advantages and dis advantages of overhead water tank.	Remember	CO 3	ACE016.13
9	What the different types of forces to be considered while designing of water tanks.	Understand	CO 3	ACE016.13
10	Write the different types of water tanks based on its shape.	Understand	CO 3	ACE016.13
	Part – B (Long Answer Questions)			
1	What is the purpose of a retaining wall? List and sketch the different types of retaining walls encountered in practice.	Understand	CO 3	ACE016.12
2	Write short notes on segmental retaining walls.	Understand	CO 3	ACE016.12
3	What are the two theories for calculating earth pressure on retaining walls?	Understand	CO 3	ACE016.12
4	Compare active, passive, and at rest earth pressures.	Understand	CO 3	ACE016.12
5	What are the factors that affect the active or passive pressure applied on a wall?	Understand	CO 3	ACE016.12
6	Why is clay not used as backfill material?	Understand	CO 3	ACE016.12
7	What are the expressions for active and passive earth pressure coefficients for a retaining wall with sloping backfill as per Rankine's theory?	Understand	CO 3	ACE016.13
8	What is meant by surcharge? How is it considered in earth pressure calculations?	Understand	CO 3	ACE016.12
9	Why is it important to consider drainage of backfill? What methods are adopted for the effective drainage of backfill?	Understand	CO 3	ACE016.13
10	How the check for overturning is performed on retaining walls? State the equation f or the factor of safety against overturning for level backfill.	Understand	CO 3	ACE016.12
	Part – C (Problem Solving and Critical Thinking)			
1	A cantilever-retaining wall is required to retain earth 3.8 m high above the ground level. The backfill surface is inclined at an angle of 15^o with the horizontal and the backfilled soil has a unit weight of 18 kN/m3 and an angle of internal friction of 30^o. The exposure condition is moderate. Assume that the SBC of soil is 150 kN/m2 and that the coefficient of friction between the soil and concrete is 0.5. Design the RC retaining wall.	Analyze	CO 3	ACE016.12
2	Design a counterfort-type retaining wall to retain a 6.8 m high backfill above the ground level. The unit weight and SBC of the soil at site are 18 kN/m3 and 170 kN/m2, respectively. The angle of internal friction of soil and coefficient of friction are 30^o and 0.6, respectively. The exposure condition is moderate.	Analyze	CO 3	ACE016.12
3	A cantilever-retaining wall is required to retain earth 3.8 m high above the ground level. The backfill surface is inclined at an angle of 15 ^{o} with the horizontal and the backfilled soil has a unit weight of 15 kN/m3 and an angle of internal friction of 30 ^{o}. The exposure condition is moderate. Assume that	Analyze	CO 3	ACE016.12

	the SBC of soil is 100 kN/m2 and that the coefficient of friction between the soil and concrete is 0.5. Design the RC retaining wall.			
4	Design a counterfort-type retaining wall to retain a 6.8 m high back fill above the ground level. The unit weight and SBC of the soil at site are 14 kN/m3 and 140 kN/m2, respectively. The angle of internal friction of soil and coefficient of friction are 30 ^{o} and 0.6, respectively. The exposure condition is moderate.	Analyze	CO 3	ACE016.12
5	Design a circular tank with flexible base for a capacity of 400000 litres. The depth of water is to be 4m, including a free board of 200mm. Use M20 concrete.	Analyze	CO 3	ACE016.13
06	A circular water tank has an internal diameter of 10m and has maximum height of water as 4m. The walls of the tank are restrained at the base. Determine the values of maximum hoop tension and its location, and the maximum cantilever bending moment using Ressner's method.	Analyze	CO 3	ACE016.13
07	A circular water tank has an internal diameter of 10m and has maximum height of water as 4m. The walls of the tank are restrained at the base. Determine the values of maximum hoop tension and its location, and the maximum cantilever bending moment using Carpenter's method.	Analyze	CO 3	ACE016.13
08	Design a circular water tank with flexible connection at the base for a capacity of 4 lakh liters. The tank rests on a firm lever ground. The height of tank including a free board of 200mm should not exceed 3.5m. The tank is open at top. Use M20 concrete and Fe415 steel.	Analyze	CO 3	ACE016.13
09	A circular water tank has an internal diameter of 8m and has maximum height of water as 5m. The walls of the tank are restrained at the base. Determine the values of maximum hoop tension and its location, and the maximum cantilever bending moment using Carpenter's method.	Analyze	CO 3	ACE016.13
10	Design a circular water tank with flexible connection at the base for a capacity of 5 lakh liters. The tank rests on a firm lever ground. The height of tank including a free board of 200mm should not exceed 4.5m. The tank is open at top. Use M20 concrete and Fe415 steel.	Analyze	CO 3	ACE016.13
	UNIT –IV			
	DESIGN OF SLABS AND FOUNDAITONS			
	Part – A (Short Answer Questions)			
1	What is difference between one-way and two-way slabs?	Remember	CO 4	ACE016.14
2	Why do we need to provide cover in the design of reinforced concrete structures?	Remember	CO 4	ACE016.15
3	Give the unit weight of PCC and RCC.	Remember	CO 4	ACE016.14
4	What are the specifications as per IS code for Minimum and maximum reinforcement requirement for slabs	Remember	CO 4	ACE016.14
5	What are the considerations that govern thickness of one way and two way slabs?	Understand	CO 4	ACE016.15
6	Which is the critical section to be considered for checking of shear in a slab support on beams?	Remember	CO 4	ACE016.15
7	Reinforcement requirement for One-way slabs as per IS: 456.	Understand	CO 4	ACE016.14
8	Reinforcement requirement for Two-way slabs as per IS: 456.	Understand	CO 4	ACE016.14
9	Torsional reinforcement is required in which type of slabs and why?	Understand	CO 4	ACE016.14
10	What is the maximum size of coarse aggregate in slab?	Understand	CO 4	ACE016.15
11	What are the conditions to be satisfied during the design of a combined footing?	Remember	CO 4	ACE016.16
12	Explain about one-way and two-way shear in footings?	Understand	CO 4	ACE016.17
13	Explain about the Minimum cover required in a footing?	Understand	CO 4	ACE016.17
14	What are the situations in which combined footings are preferred to isolated footings?	Understand	CO 4	ACE01616.
15	Under what circumstances is a trapezoidal shape preferred to a rectangular shape for a two-column combined footing?	Remember	CO 4	ACE016.16
16	Describe briefly the load transfer mechanism in a two-column combined footing.	Understand	CO 4	ACE016.17
17	Classify the foundation.	Understand	CO 4	ACE016.16
18	Explain about combined footing.	Remember	CO 4	ACE016.16
19	Explain about isolated footing.	Remember	CO 4	ACE016.17

20	Give the provision of dowel bars as per IS: 456-2000 code of practice.	Understand	CO 4	ACE016.16
	Part – B (Long Answer Questions)			
1	Under what circumstances are pile foundations preferred?	Understand	CO 4	ACE016.17
2	What is meant by pile and what different piles generally used in construction?	Understand	CO 4	ACE016.17
3	In what way does the reinforcement detailing of driven precast concrete piles differ from other types of piles?	Understand	CO 4	ACE016.17
4	Write short notes on under-reamed piles and grade beams.	Understand	CO 4	ACE016.17
5	Sketch the economical pile layout for (a) five piles, (b) six piles, and (c) eight piles.	Understand	CO 4	ACE016.17
6	Write short notes on the following: (a) Column head (b) Shear cap (c) Behavior of flat slabs under increasing loads	Understand	CO 4	ACE016.15
7	What are the two methods of analysis prescribed in the codes for flat slabs?	Understand	CO 4	ACE016.15
8	What are the different types of deep foundation explain with sketches.	Understand	CO 4	ACE016.15
9	What is raft foundation? Under what circumstances these foundations are preferred.	Understand	CO 4	ACE016.16
	Part – C (Problem Solving and Critical Thinking)			
1	Design a precast pile of diameter 400 mm carrying an axial load of 275 kN, placed in submerged medium dense sandy soil having an angle of internal friction of 32°. The density of soil is 18 kN/ m^3 and the submerged density of soil is 10 kN/m^3.Angle of wall friction between concrete pile and soil, d is $0.75f = 24°$. Assume the following data: Depth of top of pile cap below ground level is 500 mm, thickness of pile cap is 1.5 m, grade of concrete in pile is M25, Fe 415 steel is used, and clear cover to reinforcement is 75 mm. Determine the vertical carrying capacity of the pile in accordance with IS 2911 (Part 1, Section 1) and design the pile.	Analyze	CO 4	ACE016.17
2	An RC column of size 500 mm X 500 mm is supported on four piles of 300 mm diameter (bored cast in sit piles). The column carries a load of 1000 kN, a moment of 300 kNm in the x–x direction, and a shear force of 50 kN on top of the pile. Design the pile cap assuming M25 concrete and Fe 415 steel. Further, assume that the piles are capable of resisting the reaction from the pile cap.	Analyze	CO 4	ACE016.17
3	Design a flat plate supported on columns spaced at 5.5 m in both directions. The size of the column is 500 mm by 500 mm and the imposed load on the panel is 4 kN/m2. The height of each floor is 3.5 m. The floor slab is exposed to moderate environment. Assume floor finishing load to be 1 kN/m^2 and use M25 concrete and Fe 415 grade steel.	Analyze	CO 4	ACE016.15
4	Design the interior panel of a large single-storey warehouse flat slab roof with a panel size of 6 m X 6 m supported by columns of size 500 mm X 500 mm. The height of the columns is 5 m. Take live load as 3.0 kN/m2 and the weight of finishes including waterproof treatment as 2.5 kN/m2. Use M25 concrete and Fe 415 steel. Assume mild environment.	Analyze	CO 4	ACE016.15
5	Design a pile under a column transmitting an axial load o 800kN. The pile is to be driven to a hard stratum available at a depth of 8m. Use M20 and Fe415 steel.	Analyze	CO 4	ACE016.17
6	A RC column, 400X400mm carrying a load of 600kN is supported on three piles 400X400mm in section. The center to center distance between the piles is 1.5m. Design a suitable pile cap. Use M20 and Fe415 steel.	Analyze	CO 4	ACE016.17
7	Design the interior panel of a flat slab 5.6mX6.6m in size, for a superimposed load of 7.75kN/m^2. Provide two way reinforcement. Use M20 and Fe415 steel.	Analyze	CO 4	ACE016.15
8	Design the interior panel of a flat slab 4.6mX5.6m in size, for a superimposed load of 6.75kN/m^2. Provide two way reinforcement. Use M20 and Fe415 steel.	Analyze	CO 4	ACE016.15
9	A RC column, 500X500mm carrying a load of 500kN is supported on three piles 500X500mm in section. The center to center distance between the piles is 1.5m. Design a suitable pile cap. Use M20 and Fe415 steel.	Analyze	CO 4	ACE016.17
10	Design the interior panel of a flat slab 7.6mX6.6m in size, for a superimposed load of 8.75kN/m^2. Provide two way reinforcement. Use M20 and Fe415 steel.	Analyze	CO 4	ACE016.15

	UNIT -V			
DESIGN OF CHIMNEY, BUNKER AND SILOS				
Part - A (Short Answer Questions)				
1	What is a bunker?	Understand	CO 5	ACE016.20
2	What is a shallow bin?	Remember	CO 5	ACE016.20
3	Explain using sketch when a bin is said to be Bunker?	Understand	CO 5	ACE016.20
4	What is the Angle of Repose?	Remember	CO 5	ACE016.20
5	At what places, the steel bunkers are used?	Remember	CO 5	ACE016.20
6	What are the components of a bunker?	Remember	CO 5	ACE016.20
7	Write a note on openings in bunkers.	Understand	CO 5	ACE016.20
8	Write a note on stiffeners used in bunkers.	Understand	CO 5	ACE016.20
9	What are the parameters which influence the design of bunkers?	Understand	CO 5	ACE016.20
10	What is the basis of Airy's theory?	Understand	CO 5	ACE016.21
11	What are the assumptions made in Janssen's theory?	Remember	CO 5	ACE016.21
12	Where the Bunkers are generally employed?	Understand	CO 5	ACE016.21
13	What are the two main characteristics that make a bin to act as as Bunker?	Remember	CO 5	ACE016.20
14	In bunkers, how the total loads and lateral pressure are resisted?	Understand	CO 5	ACE016.21
15	What is a Silo?	Remember	CO 5	ACE016.21
16	What is a deep bin?	Understand	CO 5	ACE016.21
17	When a bin is said to be silo?	Remember	CO 5	ACE016.21
18	Explain using sketch when a bin is said to be silo?	Understand	CO 5	ACE016.21
19	Provide the expression, which is used to classify the Bin structure as Silo.	Remember	CO 5	ACE016.19
20	What are the different types of steel chimneys?	Understand	CO 5	ACE016.19
Part - B (Long Answer Questions)				
1	Explain briefly about the forces acting on steel chimney.	Understand	CO 5	ACE016.19
2	A self-supporting steel chimney is 80 m high and its diameter at the top is 3 metres. Design breech (flue) opening. Adopt the wind force as per IS: 875. The location of the place is such that the intensity of wind pressure up to 30 m height is 130 kN/m^2.	Analyze	CO 5	ACE016.19
3	Sketch with mentioning the components (a)A self-supporting chimney (b) Guyed Steel Chimneys.	Understand	CO 5	ACE016.19
4	Design a circular steel silo of 10m height and 4m internal diameter to store cement of unit weight 15.5kN/mm^2 and $\phi=25^O$	Analyze	CO 5	ACE016.21
5	Design a bunker of size 12m length X 6m width. It has 4m depth vertical plate and height of trough is 4m. Use coal for storing.	Analyze	CO 5	ACE016.20
6	A self-supporting steel chimney is 70 m high and its diameter at the top is 4 meters. Design breech (flue) opening. Adopt the wind force as per IS: 875. The location of the place is such that the intensity of wind pressure up to 30 m height is 130 kN/m^2.	Analyze	CO 5	ACE016.19
7	Design a circular steel silo of 12m height and 4m internal diameter to store cement of unit weight 15.5kN/mm^2 and $\phi=25^O$	Analyze	CO 5	ACE016.21
8	Design a bunker of size 10m length X 5m width. It has 4m depth vertical plate and height of trough is 4m. Use coal for storing.	Analyze	CO 5	ACE016.20
9	Design a circular steel silo of 15m height and 6m internal diameter to store cement of unit weight 15.5kN/mm^2 and $\phi=25^O$	Analyze	CO 5	ACE016.21
10	Design a bunker of size 15m length X 8m width. It has 5m depth vertical plate and height of trough is 4m. Use coal for storing.	Analyze	CO 5	ACE016.20
Part – C (Problem Solving and Critical Thinking)				
1	Design a bunker to store 300kN of coal, for the following data: Unit weight of coal = 8.34kN/m^3; Angle of repose = 30^O. The stored coal is to be surcharged at its angle of repose. Take permissible stress in steel as 140N/mm^2.	Analyze	CO 5	ACE016.20
2	Design a bunker to store 250kN of coal, for the following data: Unit weight of coal = 8.34kN/m^3; Angle of repose = 20^O. The stored coal is to be surcharged at its angle of repose. Take permissible stress in steel as 140N/mm^2.	Analyze	CO 5	ACE016.20
3	Design a silo for storing wheat, with the overall dimensions as shown in figure. The conical dome has central opening of 50cm diameter. Use Airy's theory and the concrete mix M20 grade and mild steel bars. For wheat, take w=7850N/m^3, μ=0.466 and μ'=0.444.	Analyze	CO 5	ACE016.21

				
4	Design a silo for storing wheat, with the overall dimensions as shown in figure. The conical dome has central opening of 70cm diameter. Use Airy's theory and the concrete mix M20 grade and mild steel bars. For wheat, take w=7850N/m^3, μ=0.466 and μ'=0.444. 	Analyze	CO 5	ACE016.21
5	Design a chimney of 66m height, having external diameter of 4m throughout the height. The chimney has fire brick lining of 100mm thickness, provided upto a height of 42m above ground level, with an air gap of 100mm. The temperature of gases above surrounding air is 200^{O}C. Take coefficient of expansion of concrete and steel = 11X10^{-6} / ^{O}C, and E_s=2.05X10^{5}MPa. Use M25 grade of concrete.	Analyze	CO 5	ACE016.19
6	Design a chimney of 60m height, having external diameter of 5m throughout the height. The chimney has fire brick lining of 100mm thickness, provided up to a height of 35m above ground level, with an air gap of 90mm. The temperature of gases above surrounding air is 200^{O}C. Take coefficient of expansion of concrete and steel = 11X10^{-6} / ^{O}C, and E_s=2.05X10^{5}MPa. Use M25 grade of concrete.	Analyze	CO 5	ACE016.19
7	Design a bunker to store 400kN of coal, for the following data: Unit weight of coal = 8.34kN/m^3; Angle of repose = 30^O. The stored coal is to be surcharged at its angle of repose. Take permissible stress in steel as 140N/mm^2.	Analyze	CO 5	ACE016.20
8	Design a bunker to store 350kN of coal, for the following data: Unit weight of coal = 8.34kN/m^3; Angle of repose = 20^O. The stored coal is to be surcharged at its angle of repose. Take permissible stress in steel as 140N/mm^2.	Analyze	CO 5	ACE016.20

Prepared by:

Dr. Venu M, Professor

HOD, CE