

Branch Name:	Civil Engineering
Program Code:	ET106
Course Name:	Design of Special Structure (Program Elective - III)
Course Code:	2ET1060704T
Pre-requisite Course:	Knowledge of Structural Analysis, Reinforced Cement Concrete Design, and basic understanding of Steel Structures.

Course Objective:

1. To understand the behavior and design principles of special structural systems
2. To analyze loads and structural response in non-conventional structures
3. To apply design concepts for tanks, silos, retaining structures, and tall structures
4. To evaluate structural systems considering safety, serviceability, and economy

Teaching and Examination Scheme:

Credit	Teaching Scheme Hours per week				Evaluation Scheme (Marks)								
					Theory (Marks)				Practical (Marks)				Total (Marks)
	L	T	P	Total	SEE		CCA		SEE		CCA		
					Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	
4	3	1	-	4	24	60	16	40	-	-	-	-	100

Subject Contents:

Sr. No	Topic	Total Hours	Weightage (%)
1	Introduction to Special Structures Introduction to special structures and their need in modern construction, classification of special structures, difference between conventional and special structures, types of loads acting on special structures including dynamic and environmental loads, design philosophy, relevant IS codes and design considerations for safety, serviceability, and durability.	6	13
2	Design of Water Tanks Design principles of liquid retaining structures, types of water tanks including circular and rectangular tanks, overhead and underground tanks, analysis of stresses due to hydrostatic pressure, design of tank components such as walls, base slab, dome and staging, cracking considerations and water tightness requirements as per IS provisions.	10	22
3	Design of Silos and Bunkers Classification and function of silos and bunkers, properties of stored materials, pressure theories including Rankine and Janssen's theory, analysis of loads acting on silos, design of silos for storage of granular materials, and structural design considerations including wall pressure and flow characteristics.	8	18
4	Retaining Structures and Earth Pressure Types of retaining walls including gravity, cantilever, and counterfort retaining walls, earth pressure theories, stability analysis against sliding,	8	18

	overturning and bearing capacity failure, structural design of retaining walls, and introduction to reinforced earth structures.		
5	Design of Tall Structures Introduction to tall buildings and their structural systems, types of loads including wind and seismic forces, behavior of tall structures under lateral loads, load distribution mechanisms, structural systems such as framed tube, shear wall, and braced systems, and basic design considerations for stability and serviceability.	7	15
6	Chimneys and Miscellaneous Structures Design considerations for RCC and steel chimneys, loads acting on chimneys including wind and temperature effects, analysis and design principles, and introduction to other special structures such as transmission towers and cooling towers with basic design concepts	6	14

Course Learning Outcome:

CO1 (L3 – Apply)

Apply principles of structural design to water tanks and liquid retaining structures.

CO2 (L4 – Analyze)

Analyze the behavior and design requirements of silos and bunker structures.

CO3 (L3 – Apply)

Apply design concepts for retaining walls and foundation-related special structures.

CO4 (L4 – Analyze)

Analyze the structural behavior of tall buildings under lateral loads.

CO5 (L5 – Evaluate)

Evaluate different special structural systems considering safety, economy, and serviceability.

CO6 (L3 – Apply)

Apply relevant IS codes and standards in the design of special structures.

Reference Books:

1. B. C. Punmia, Ashok Kumar Jain and Arun Kumar Jain, Reinforced Concrete Structures, Laxmi Publications, New Delhi
2. Pillai and Menon, Reinforced Concrete Design, Tata McGraw Hill Publishing Company Ltd., New Delhi
3. N. Krishna Raju, Structural Design and Drawing (Reinforced Concrete and Steel), Universities Press, Hyderabad
4. Arthur H. Nilson, David Darwin and Charles W. Dolan, Design of Concrete Structures, Tata McGraw Hill Publishing Company Ltd., New Delhi
5. Park and Paulay, Reinforced Concrete Structures, John Wiley & Sons, New York
6. S. Ramamrutham, Design of Reinforced Concrete Structures, Dhanpat Rai Publishing Company, New Delhi

Codes of Practice

1. IS 456:2000, Plain and Reinforced Concrete – Code of Practice, Bureau of Indian Standards, New Delhi
2. IS 3370 (Part I to IV), Code of Practice for Concrete Structures for Storage of Liquids, Bureau of Indian Standards, New Delhi
3. IS 4995 (Part I & II), Criteria for Design of Reinforced Concrete Bunkers and Silos, Bureau of Indian Standards, New Delhi
4. IS 875 (Part I to V), Code of Practice for Design Loads (Other than Earthquake), Bureau of Indian Standards, New Delhi
5. IS 1893 (Part I), Criteria for Earthquake Resistant Design of Structures, Bureau of Indian Standards, New Delhi

6. IS 800:2007, General Construction in Steel – Code of Practice, Bureau of Indian Standards, New Delhi

List of Open-Source Software/learning website:

1. NPTEL (<https://nptel.ac.in/>)

Courses on Design of Special Structure

Course Learning Outcomes (CLO): On completion of this course, the students will be able to:

CLO	Description	Bloom's Taxonomy Level
CLO1	Apply principles of structural design to water tanks and liquid retaining structures.	L-3
CLO2	Analyze the behavior and design requirements of silos and bunker structures.	L-4
CLO3	Apply design concepts for retaining walls and foundation-related special structures.	L-3
CLO4	Analyze the structural behavior of tall buildings under lateral loads.	L-4
CLO5	Evaluate different special structural systems considering safety, economy, and serviceability.	L-5
CLO6	Apply relevant IS codes and standards in the design of special structures.	L-3

L1- Remember, L2- Understand, L3- Apply, L4- Analyze, L5- Evaluate, L6- Create

Mapping of CLOs with POs & PSOs

Course Learning Outcomes	Program Outcomes (POs)												Program Specific Outcomes (PSOs)					
	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PS O1	PS O2	PS O3	PS O4	PS O5	PS O6
CLO1	H	M	H		M	L	L					L	H	H		M	L	
CLO2	H	H	M	M	M	L	L					L	H	M	M	M	L	
CLO3	H	M	H		M	L	L					L	H	H		M	L	
CLO4	H	H	M	M	M	L	L					L	H	M	M	M	L	
CLO5	H	H	H	M	M	M	M	L			L	M	H	H	M	M	M	L
CLO6	H	M	H		M	M	L	M			L	M	H	H		M	M	L

H: High, M: Medium, L: Low