# INSTITUTE OF AERONAUTICAL ENGINEERING
## (Autonomous)
### Dundigal - 500 043, Hyderabad, Telangana

## COURSE CONTENT

| DESIGN OF ADVANCED CONCRETE STRUCTURES | | | | | | | |
|---|---|---|---|---|---|---|---|
| **II Semester: STE** | | | | | | | |
| **Course Code** | **Category** | **Hours/Week** | | | **Credits** | **Maximum Marks** | |
| | | **L** | **T** | **P** | **C** | **CIA** | **SEE** | **Total** |
| BSTE15 | **Elective** | 3 | 0 | 0 | 3 | 40 | 60 | 100 |
| **Contact Classes: 45** | **Tutorial Classes: Nil** | **Practical Classes: Nil** | | | | **Total Classes: 45** | |
| **Prerequisite: Design of RC Structural Elements** | | | | | | | |

## I. COURSE OVERVIEW:

The course Design of Advanced Concrete Structures builds upon the fundamentals of reinforced and prestressed concrete design to prepare students for handling complex, real-world structural systems. Unlike basic reinforced concrete design, this course focuses on special structural elements and systems such as deep beams, corbels, grid floors, flat slabs, shear walls, silos, bunkers, water tanks, and prestressed members that are frequently encountered in high-rise buildings, bridges, silos, reservoirs, and industrial facilities.

## II. COURSE OBJECTIVES:

### The students will try to learn:

- I.  The design of reinforced and prestressed concrete structural elements using advanced concepts.
- II.  Codal provisions (IS 456:2000, IS 1343:2012, SP 16) for advanced structural design applications.
- III.  The design of special structural elements by understanding their behavior under shear and bending moments.

## III. COURSE OUTCOMES:

### After successful completion of the course, students should be able to:

- CO 1  Explain the behavior of reinforced concrete under flexure and shear for designing beams, slabs and columns under various load condition.
- CO 2  Explain the concepts of plastic hinge and plastic moment for understanding the redistribution of moments and moment rotation characteristics of reinforced concrete members.
- CO 3  Analyse flat and ribbed slabs under given loading for designing and obtaining the reinforcement detailing in end and middle strips of the slab.
- CO 4  Analyse the load distribution in deep beams for designing and fixing of reinforcement details in deep beams.
- CO 5  Develop the concept of axial, uni-axial and bi-axial loading on compression members for designing the same to meet the safety and serviceability conditions.
- CO 6  Analyse the soil properties for designing various types of footings for transferring the superimposed loads safely to the soil beneath.

**MODULE –I: BASIC DESIGN CONCEPTS (9)**

Behavior in flexure, design of singly reinforced rectangular sections, design of doubly reinforced rectangular sections, design of flanged beams, design of shear, design for torsion, Limit state of serviceability: Deflections of reinforced concrete beams and slabs, short term deflection and long-term deflection, estimation of crack width in RCC members, calculation of crack widths.

**MODULE -II: LIMIT ANALYSIS OF R.C. STRUCTURES (9)**

Rotation of a plastic hinge, redistribution of moments, moment rotation characteristics of RC member, I.S. code provisions, applications for fixed and continuous beam. Yield line analysis for slabs: Upper bound and lower bound theorems, yield line criterion, virtual work and equilibrium methods of analysis for square and circulars labs with simple and continuous end conditions.

**MODULE -III: DESIGN OF RIBBED SLABS, FLAT SLABS (10)**

Analysis of the slabs for moment and shears, ultimate moment of resistance, design for shear, deflection, arrangement of reinforcements. Flat slabs: Direct design method, distribution of moments in column strips and middle strip moment.

Shear transfer from slabs to columns, shear in flat slabs, check for one way and two-way shears, introduction to equivalent frame method. Limitations of direct design method, distribution of moments in column strips and middle strip.

**MODULE -IV: DESIGN OF REINFORCED CONCRETE DEEP BEAMS & CORBELS (08)**

Steps of designing deep beams, design by IS 456, checking for local failures, detailing of deep beams, design of curved beams, analysis of forces in a corbel, design of procedure of corbels, design of nibs.

**MODULE -V: DESIGN OF CHIMNEY, BUNKER AND SILOS (09)**

Design of chimneys: parts of chimney, design factors, stresses in RC shafts due to self-weight, wind load and temperature difference, reinforcement details, Design of bunkers and silos: Difference between bunker and silo, design of square or rectangular bunkers, design of circular bunkers, design of silos, Design concepts and IS code provisions.

## V. TEXTBOOKS:

1. Pillai S. U. and Menon D, "*Reinforced Concrete Design*", Tata McGraw-Hill, 3rd edition, 1999.
2. S. Unnikrishna Pillai & Menon, "*Reinforced concrete design*", Tata McGraw Hill, 3rd edition, 2009
3. Park R. and Paulay T, "*Reinforced Concrete Structures*", John Wiley & Sons, 1995.

## VI. REFERENCE BOOKS:

1. Varghese P. C, "*Advanced Reinforced Concrete Design*", Prentice Hall of India, New Delhi, 1995.
2. Hsu T. T. C. and Mo Y. L, "*Unified Theory of Concrete Structures*", John Wiley & Sons, 2010.
3. Salmon C. G., Johnson J. E. and Malhas F. A. "*Steel Structures Design and Behavior Emphasizing Load and Resistance Factor Design*", Pearson Education, 5th Edition, 2009.
4. Ramchandra, "*Design of Steel Structures*", Vol. II, Standard Book House, Delhi, 1999.

## VII. ELECTRONICS RESOURCES:

1. https://lecturenotes.in/course/179/design-of-advanced-concrete-structures-dacs?utm_source=chatgpt.com
2. https://nptel.ac.in/downloads/105105104/?utm_source=chatgpt.com

## VIII. MATERIAL ONLINE:

1. Course Outline Description
2. Tutorial Question Bank
3. Assignments
4. Model Question Paper – I
5. Model Question Paper - II
6. Lecture Notes
7. Early Lecture Readiness Videos
8. Power point presentation