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

COURSE CONTENT

DESIGN OF MASONRY STRUCTURES								
II Semester: ST								
Course Code	**Category**	**Hours/Week**			**Credits**	**Maximum Marks**		
BSTE17	Elective	**L**	**T**	**P**	**C**	**CIA**	**SEE**	**Total**
		3	0	0	3	40	60	100
Contact Classes: 45	**Tutorial Classes: Nil**	**Practical Classes: Nil**				**Total Classes: 45**		
Prerequisite: Probability and Statistics								

I. COURSE OVERVIEW:

This course provides in-depth knowledge of masonry as a structural material and its applications in building design. Students will learn the behavior of masonry under compression, flexure, and shear, as well as the design principles of load-bearing and earthquake-resistant masonry buildings. Special emphasis is given to codal provisions, construction practices, and the performance of historical masonry structures such as arches, domes, and vaults.

II. COURSE OBJECTIVES:

The students will try to learn:

I. Characteristics and properties of masonry units and mortars.
II. Strength and failure mechanisms of masonry under compression, flexure, and shear.
III. Codal provisions for the design of load-bearing masonry walls and buildings.
IV. Principles and practices for earthquake-resistant masonry construction, including arches, domes, and vaults.

III. COURSE OUTCOMES:

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

CO 1 Explain the properties of masonry units and mortars and their role in masonry strength and durability.
CO 2 Analyze the behavior of masonry under compression, considering unit properties, slenderness, eccentricity, and workmanship.
CO 3 Examine flexural bond, shear bond, and orthotropic strength properties of masonry using test methods.
CO 4 Design load-bearing masonry walls and buildings up to multiple storey’s as per BIS codal provisions.
CO 5 Apply principles of earthquake-resistant design to masonry buildings, arches, domes, and vaults.
CO 6 Assess the performance of masonry structures under vertical, lateral, and seismic loads for safe and economical construction.

IV. COURSE CONTENT:

MODULE –I: INTRODUCTION (9)
History of masonry Characteristics of Brick, stone, clay block, concrete block, stabilized mud block masonry units – strength, modulus of elasticity and water absorption. Masonry materials – Classification and properties of mortars, selection of mortars.

MODULE -II: STRENGTH OF MASONRY IN COMPRESSION (9)
Behaviour of Masonry under compression, strength and elastic properties, influence of masonry unit and mortar characteristics, effect of masonry unit height on compressive strength, influence of masonry bonding patterns on strength, prediction of strength of masonry in Indian context, Failure theories of masonry under compression. Effects of slenderness and eccentricity, effect of rate of absorption, effect of curing, effect of ageing, workmanship on compressive strength.

MODULE -III: FLEXURAL AND SHEAR BOND, FLEXURAL STRENGTH AND SHEAR STRENGTH (9)
Bond between masonry unit and mortar, tests for determining flexural and shear bond strengths, factors affecting bond strength, effect of bond strength on compressive strength,

Orthotropic strength properties of masonry in flexure, shear strength of masonry, test procedures for evaluating flexural and shear strength.

MODULE -IV: DESIGN OF LOAD BEARING MASONRY BUILDINGS (10)
Permissible compressive stress, stress reduction and shape reduction factors, increase in permissible stresses for eccentric vertical and lateral loads, permissible tensile and shear stresses, Effective height of walls and columns, opening in walls, effective length, effective thickness, slenderness ratio, eccentricity, load dispersion, arching action, lintels; Wall carrying axial load, eccentric load with different eccentricity ratios, wall with openings, freestanding wall; Design of load bearing masonry for buildings up to 3 to 8 storey using BIS codal provisions.

MODULE -V: EARTHQUAKE RESISTANT MASONRY BUILDINGS (8)
Behaviour of masonry during earthquakes, concepts and design procedure for earthquake resistant masonry, BIS codal provisions. Masonry arches, domes and vaults: Components and classification of masonry arches, domes and vaults, historical buildings, construction procedure.

V. TEXTBOOKS:

1. Hendry, A.W., "*Structural Masonry*", Palgrave Macmillan, 2nd Edition, 1988.
2. Dayaratnam, P., "*Brick and Reinforced Brick Structures*", Oxford & IBH Publishing Co. Pvt. Ltd., New Delhi, 1987.
3. Jagadish, K.S., Venkatarama Reddy, B.V., & Nanjunda Rao, K.S., "*Alternative Building Materials and Technologies*", New Age International Publishers, New Delhi, 2007.

VI. REFERENCE BOOKS:

1. Sinha, B. P., and A. W. Hendry. "*Design of Masonry Structures",* Granada Publishing Ltd., London, 2nd Edition, 1979.
2. Liauw, T. C., and K. H. Kwan. "*Design of Reinforced and Prestressed Masonry".* Longman Scientific & Technical, UK, 1984.
3. Morton, R. "*Structural Design of Masonry Buildings*". BRE Press, UK, 2005
4. Bureau of Indian Standards. IS 1905: Code of Practice for Structural Use of Unreinforced Masonry. New Delhi: Bureau of Indian Standards, 1987.
5. Bureau of Indian Standards. IS 4326: Earthquake Resistant Design and Construction of Buildings – Code of Practice. New Delhi: Bureau of Indian Standards, 2013.

VII. ELECTRONICS RESOURCES:

1. https://nptel.ac.in/courses/105106197
2. https://nptel.ac.in/courses/105102088

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