GUJARAT TECHNOLOGICAL UNIVERSITY

Programme Name: Master of Engineering
Level: PG
Subject Code : ME02000221
Subject Name: Design of Masonry Structures

w.e.f. Academic Year:	2024-25
Semester:	2
Category of the Course:	Professional Elective Course

Prerequisite:	Building Construction, Strength of Materials, Structural Analysis, Structural Design
Rationale:	Masonry structure is one of the low cost structural form for low rise buildings up to G+3 storey and it is one of the major structural form used in rural India and to some extent in urban part too. Hence this subject will help in developing understanding of use of masonry in terms of materials, mechanical properties, behaviors under different types of loads, analysis & design methodology, testing, construction practices etc. for safe, stable and durable masonry structure.

Course Outcome:

After Completion of the Course, Student will able to:

Sr. No.	CO statement	Marks % weightage
CO-1	Describe about masonry construction,	05
CO-2	Characterize masonry materials.	20
CO-3	Assess the strength and stability of masonry walls	25
CO-4	Design of load bearing masonry buildings using indian standard codal provision	35
CO-5	Describe the fundamentals of behavior of reinforced masonry and confined masonry in composite action	15

Teaching and Examination Scheme:

Teaching Scheme			Credits	Examination Marks				Total Marks
				Theory Marks		Practical Marks		
L	T	P	C	ESE (E)	PA (M)	ESE (V)	PA (I)	
3	0	2	4	70	30	30	20	150

IS 1905-1987, “Code of practice for structural use of unreinforced masonry”is permitted in examination.

Course Content:

Sr. No.	Content	Total Hrs	% Weightage
1	**Introduction:** Historical Perspective , Types of Masonry structure, Masonry Materials, Overview of load conditions, Masonry wall configurations	03	05
2	**Characteristics of masonry constituents:** Types of masonry units such as stone, bricks, concrete blocks, ACC block, clay blocks and stabilized mud blocks. Properties of masonry units like strength, modulus of elasticity and water absorption. Masonry mortars – Classification and properties of mortars, selection of mortars.	08	20
3	**Strength and Behavior of Masonry:** **Behavior of Masonry under compression:** Strength and elastic properties, factors influencing the compressive strength of masonry, effects of slenderness and eccentricity, water absorption, curing, ageing and workmanship on compressive strength, masonry strength variation in various region of India. **Shear and Flexure Behavior of Masonry :** Bond between masonry unit and mortar, flexural and shear bond strengths flexural and shear strength of masonry, factors affecting bond strength, effect of bond strength on compressive strength, flexure and shear strength of masonry, behavior of masonry due to in- plane and out-of-plane lateral loads	11	25
4	**Design of load bearing masonry buildings:** **Permissible stresses & Design Considerations:** Types of walls, permissible compressive stress, stress reduction and shape modification factors, increase in permissible stresses for eccentric vertical and lateral load, permissible tensile stress and shear stresses, Effective height of walls and columns, openings in walls, effective length, effective thickness, slenderness ratio, eccentricity, load dispersion, arching action in lintels. Problems on design considerations for solid walls, cavity walls, wall with pillars. **Load considerations and design of Masonry subjected to axial loads:** Design criteria, design examples of walls under axial load ,eccentric load with different eccentricity ratios, wall with openings, freestanding wall; Design of load bearing masonry for buildings up to 3 stories using BIS codal provisions	17	35
5	**Introduction to reinforced and confined masonry:** **Reinforced masonry:** Introduction, methods of reinforcing masonry **Confined masonry:** Introduction, comparison of confined masonry and	06	15

	reinforced masonry, construction challenges, performance of confined masonry, introduction to analysis methods, introduction to design methodologies.		
	TOTAL	**45**	**100**

Suggested Specification Table with Marks (Theory):

Distribution of Theory Marks					
R Level	U Level	A Level	N Level	E Level	C Level
10	**30**	**30**	**20**	**5**	**5**

Legends: R: Remembrance; U: Understanding; A: Application, N: Analyze and E: Evaluate C: Create and above Levels (Revised Bloom's Taxonomy)

Note: This specification table shall be treated as a general guideline for students and teachers. The actual distribution of marks in the question paper may vary slightly from above table.

Reference Books:

- K. S. Jagdish "Structural Masonry",I.K. International Publishing House Pvt. Ltd. ,2015
- Henry,A.W, "Structural masonry", Macmillan Education Ltd., 1990.
- Dayarathnam.P, "Brick and reinforced brick structures", Oxford & IBH Publication, 1987
- Sinha, B.P and Davies, S.R, "Design of Masonry Structures", E & FN spon, 1997.
- IS 1905-1987, "Code of practice for structural use of unreinforced masonry", 3rd Revision, BIS, New Delhi.
- SP 20 (S&T), "Hand book on Masonry Design and Construction", 1st Revision, BIS, New Delhi, 1991.

Open source website:
https://nptel.ac.in/courses/105106197

Suggested Course Practical List:

Design & detail at least one full load bearing masonry building. The report shall consist of full analytical treatment, design procedure, references and all necessary drawings in the form of neat dimensioned. sketches.

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