Tunnels, Universities Press

5. Bindra S P, "A Course in Docks and Harbour Engineering", Dhanpat Rai and Sons, New Delhi,

Reference Books:

1. Oza.H.P. and Oza.G.H., "A course in Docks & Harbour Engineering". Charotar Publishing Co.,
2. Mundrey J.S. "A course in Railway Track Engineering". Tata McGraw Hill,
3. Srinivasan R. Harbour, "Dock and Tunnel Engineering", 26th Edition 2013

Course Title: Masonry Structures

Professional Elective-1

[As per Choice Based Credit System (CBCS) scheme]

SEMESTER:V

Subject Code	15CV553	IA Marks	20
Number of Lecture Hours/Week	03	Exam Marks	80
Total Number of Lecture Hours	40	Exam Hours	03
	CREDITS – 03	**Total Marks-100**	

Course Objectives: This course will enable students to

1. Understand properties of masonry units, strength and factors affecting strength.
2. Understand design criteria of various types of wall subjected to different load system.
3. Impart the culture of following the codes for strength, serviceability and durability as an ethics.
4. Provide knowledge in analysis and design of masonry elements for the success in competitive examinations.

Modules	**Teaching Hours**	**Revised Bloom's Taxonomy (RBT) Level**
Module -1		
Masonry Units, Materials, types and masonry construction: Bricks, Stone and Block masonry units- strength, modulus of elasticity and water absorption of masonry materials – classification and properties of mortars. Defects and Errors in masonry construction – cracks in masonry, types, reason for cracking, methods of avoiding cracks. **Strength and Stability:** Strength and stability of axially loaded masonry walls, effect of unit strength, mortar strength, joint thickness, rate of absorption, effect of curing, effect of ageing, workmanship. Compressive strength formulae based on elastic theory and empirical formulae.	8 hours	L1,L2,L3
Module -2		
Permissible stresses: 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. **Design Considerations:** 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.	8 Hours	L1,L2,L3

Module -3		
Load considerations and design of Masonry subjected to axial loads: Design criteria, design examples of walls under UDL, solid walls, cavity walls, solid wall supported at the ends by cross wall, walls with piers.	8 Hours	L1,L2,L3
Module -4		
Design of walls subjected to concentrated axial loads: Solid walls, cavity walls, solid wall supported at the ends by cross wall, walls with piers, design of wall with openings. **Design of walls subjected to eccentric loads**: Design criteria – stress distribution under eccentric loads – problems on eccentrically loaded solid walls, cavity walls, walls with piers.	8 Hours	L2,L3,L4,L5
Module -5		
Design of Laterally and transversely loaded walls: Design criteria, design of solid wall under wind loading, design of shear wall – design of compound walls. Introduction to reinforced brick masonry, lintels and slabs. **In-filled frames**: Types – modes of failures – design criteria of masonry retaining walls.	8 Hours	L2,L3,L4,L5

Course Outcomes: After studying this course, students will be able to:

1. Explain engineering properties and uses of masonry units, defects and crack in masonry and its remedial measures.
2. Summarize various formulae's for finding compressive strength of masonry units.
3. Explain permissible stresses and design criteria as per IS: 1905 and SP-20.
4. Design different types of masonry walls for different load considerations.

Program Objectives:

- Engineering knowledge
- Problem analysis
- Interpretation of data

Question Paper Pattern:

- The question paper will have Ten questions, each full question carrying 16 marks.
- There will be two full questions (with a maximum three sub divisions, if necessary) from each module.
- Each full question shall cover the topics under a module.
- The students shall answer Five full questions selecting one full question from each module.
- If more than one question is answered in modules, best answer will be considered for the award of marks limiting one full question answer in each module.
- Use of **IS 1905–1987** "Code of practice for structural use of un-reinforced masonry" may be permitted.

Text Books:

1. Henry, A.W., "**Structural Masonry"**, Macmillan Education Ltd., 1990.

2. Dayaratnam P, **"Brick and Reinforced Brick Structures",** Oxford & IBH, 1987.

3. M. L. Gambhir, "**Building and Construction Materials",** Mc Graw Hill education Pvt. Ltd.