

COURSE TITLE : CONSTRUCTION MATERIAL AND ENGINEERING
COURSE CODE : 3023
COURSE CATEGORY : B
PERIODS/WEEK : 6
PERIODS/SEMESTER : 108
CREDITS : 5

TIME SCHEDULE

| MODULE | TOPIC | PERIODS |
|---------------|--|----------------|
| I | Structural building materials Stones, Clay products, Lime, Cement, Puzzolanas, Aggregates, Concrete and Mortar, Timber and Metals | 26 |
| | Test I | 1 |
| II | Ornamental materials for finishing Paints and Varnishes, Plastic, Rubber, Ceramic products, Aluminium, Glass, Miscellaneous materials, Wood products | 26 |
| | Test II | 1 |
| III | Construction Technology Masonry, Modern methods of constructions , DPC, Prestressed Concrete, Form work, Shoring, Underpinning, Plastering and Pointing | 26 |
| | Test III | 1 |
| IV | Building Components Parts of a building- Foundation, Flooring, Doors and windows, Arches and lintels, shading devices, Vertical Transportation, Ceilings, Roofing | 26 |
| | Test IV | 1 |
| | TOTAL | 108 |

RATIONALE: This subject is indented to give an overall view of the building materials currently in use and the general construction practices. It also aims at introducing the recent trends in building materials and the advancements in construction technology. The topic also covers the various building components and the basics of planning and designing these elements. This course covers various building materials in use, construction practices and building components including the ornamental works. It will serve as a pre-requisite for all courses in civil Engg.

OBJECTIVES

MODULE – I

- 1.1.0 Understand the materials generally used for construction.
- 1.2.0 Study the classification of stones and characteristics of good building stone
 - 1.2.1 Know the varieties of stones
 - 1.2.2 Know the Values of load bearing capacity of stones.
 - 1.2.3 Know the methods of Quarrying of stones
 - 1.2.4 Study Dressing of stones.
- 1.3.0 Understand Clay Products:
 - 1.3.1 Know the Raw materials and Composition of brick earth.
 - 1.3.2 Study manufacturing methods and IS specifications of bricks.
 - 1.3.3 Know characteristics of good brick used for building purpose.
 - 1.3.4 Know uses and qualities of Earthenware and stoneware pipes.
- 1.4.1 Study Sources, Classification and methods of manufacturing of lime.
- 1.5.1 Understand Types, Properties and Manufacturing methods of Cement.
- 1.5.2 Understand characteristics of cement.
- 1.5.3 Perform Tests on cement – Lab tests & Field tests
- 1.5.4 Understand the use of puzzolona as admixtures
- 1.6.1 Know Sources of sand, classification & grading
- 1.6.2 Understand Limitations of mining of sand from rivers and sea shore and alternatives of sand.
- 1.6.3 To understand the materials used as coarse aggregate, their sizes for different applications.
- 1.7.1 Know Preparation lime and cement mortar.
- 1.7.2 Understand Proportions of mortar for various items of work.
- 1.7.3 Perform tests on cement mortar cubes.
- 1.8.1 Know Ingredients of concrete, requirements and grading of aggregates.
- 1.8.2 Know methods of proportioning
- 1.8.3 Define Water cement ratio – effects on strength and workability
- 1.8.4 Know the preparation of cement concrete-procedure and methods
 - 1.8.5 Understand Plain and Reinforced Cement Concrete
- 1.8.6 Know types and characteristics of reinforcement used.
- 1.8.7 To perform Wet state properties of cement concrete – Slump test & Compaction factor test
- 1.8.8 Understand the preparation of Concrete cube and perform the compression test.
- 1.9.1 Study Timber and wood products
- 1.9.2 Understand the methods of seasoning of timber
- 1.9.3 Know Structural classification of Timber
- 1.9.4 Know defects and preservation of timber
- 1.10.1 Know the classes of metals. Know Properties and uses of ferrous metals such as Wrought iron, Cast iron, Mild steel- -Special steels-High carbon steel, High tensile Steel and stainless steel.
- 1.10.2 Know Properties and uses of non ferrous metals such as Aluminum, Copper, Lead, Zinc and Titanium.
- 1.10.3 Know properties and uses of important alloys.

MODULE – II

- 2.1.1 Study Types, Constituents, Preparation, characteristics and application of Paints and Varnishes.
- 2.2.1 Know uses and Limitations of plastics.
- 2.2.2 Know types, characteristics and properties of P V C.
- 2.3.1 Know Characteristics, properties and uses of Rubber.
- 2.4.1 Know Types of porcelain, ceramic and vitrified tiles and their characteristics
- 2.5.1 Understand use of aluminum sections and its use in building construction.
- 2.6.1 Understand the type & use of glass.
- 2.6.2 Glass products used in building construction
- 2.7.2 Study the uses and properties of Abrasives, Adhesives and Asbestos.
- 2.8.1 Study Uses and properties of Asphalt and Bitumen.
- 2.9.1 Study Uses and properties of insulating materials such as Plaster of Paris, Thermocole and Cork.
- 2.10.1 Know wood products such as veneers, ply wood, fiber board, hard board, etc.

Module – III

Masonry, DPC, Prestressed Concrete, Form work, Shoring, Underpinning, Plastering and Pointing

- 3.1.0 Understand the component parts of a building and their functions.
- 3.1.1 Define Masonry.
- 3.1.2 Know Classification of masonry.
- 3.1.3 Understand Stone masonry.
- 3.1.4 Understand Brick masonry.
- 3.1.5 Understand Laterite masonry.
- 3.1.6 Understand composite masonry.
- 3.1.7 Know General principles and specifications for stone masonry as per I S code and NBC
- 3.1.8 Know Specification of brick masonry as per IS Code and N B C.
- 3.1.9 Know Hollow block masonry, solid block and inter locking block masonry.
- 3.1.10 Know Advantages and Disadvantages of Hollow block masonry with reference to other types of masonry.
- 3.1.11 Understand Composite Masonry-general description.
- 3.1.12 Study use and methods of construction of composite masonry.
- 3.1.13 Understand Types-use-requirements of good partition wall
- 3.1.14 Understand modern techniques of earth quake resistant construction
- 3.2.1 Understand Dampness and its effects.
- 3.2.2 Study causes and effects of dampness.
- 3.2.3 Know methods of damp prevention and surface treatment.
- 3.2.4 Know impregnated water proofing treatment
- 3.2.5 Know modern methods of DPC construction.
- 3.2.6 Know Water proofing of Cement Concrete using waterproofing admixtures.
- 3.3.1 Understand the concept of pre stressing in concrete
- 3.3.2 Study the types and methods of pre stressing
- 3.4.1 Understand the use of form work, materials & requirements of formwork
- 3.4.2 Understand Modern types of form work
- 3.5.1 Understand the use of Scaffolding, shoring and under pinning
- 3.5.6 Study the Types of scaffolding & materials used

- 3.5.7 Understand the methods of shoring and underpinning
- 3.6.1 Understand Plastering, types and its Specification.
- 3.6.2 Understand Pointing, types and its Specification.

MODULE – IV

- 4.0 Understand the functions of Components of a building
 - 4.1.1 Understand the functions and types of foundation
 - 4.1.2 Understand Floors and Floorings.
- 4.2.2 Know Types of floors and Floor finishes.
- 4.3.1 Understand Positioning of Doors and windows with respect to lighting and Ventilation.
- 4.3.2 Know Types and Size as per IS and NBC Specification.
- 4.3.3 Know Special types of doors such as Flush, Revolving, collapsible, Rolling and sliding.
- 4.3.4 Know Different types of Windows and Ventilators.
- 4.3.5 Know Fittings for doors and windows.
- 4.4.1 Understand Types of lintels.
- 4.4.2 Understand Types of Arches.
- 4.5.1 Know Sunshades, Canopy and sun breakers.
- 4.6.1 Know Functions of staircase, lift and escalators
- 4.6.2 Understand the types and component parts of staircases
- 4.6.2 Understand the planning and location of lifts and staircase
- 4.7.1 Understand Ceiling and its types.
- 4.8.1 Define Roof.
- 4.8.2 Understand importance of roofing with respect to climatic conditions.
- 4.8.3 Study classification of roofs.
- 4.8.4 Understand Different types of trusses for pitched roof
- 4.8.5 Know Roof covering for pitched roof.
- 4.8.6 Know method of arranging and fixing to the battens rafters and purlins.
- 4.8.7 Understand RCC roof.
- 4.8.8 Study Weather proof course to flat roof-

COURSE CONTENT

MODULE - I Structural building materials

Stone – classification – geological, Physical and chemical classification – characteristics of good building stone – varieties of stones – granite – trap - basalt – sand stone – Laterite. Values of load bearing capacity of stones. Quarrying of stones – methods – wedging and blasting – explosives used.

Dressing of stones. Clay Products:

Bricks: Raw materials used – Composition of brick earth, manufacturing methods (Description only) – IS specifications of bricks – characteristics of good brick used for building purpose.

Tiles: Types of tiles-characteristics-uses-Porcelain and glazed tiles

Earthenware and stoneware pipes -uses-qualities.

Lime: Sources of lime-Classification-methods of manufacturing (Description only)

Cements: Composition, Compounds present, Manufacturing methods-characteristics of cement, Types of cement-Properties of each-characteristics of cement-Tests on cement-Consistency test, fineness test, Sp.gravity test, Setting time test, Soundness test.

Puzzolona- definition-Common puzzolonas used as admixtures in cement.

Aggregates: Sand: Sources of sand-River sand, Sea sand and pit sand-Limitations of mining of sand from rivers and sea shore- M-sand,alternatives of sand.

Coarse aggregates: Materials generally used, requirements of good coarse aggregates, commonly used sizes for different applications.

Cement Concrete: Plain concrete-Water cement ratio-Ingredients and proportioning methods-characteristics-preparation-workability-Tests on Cement concrete-Laboratory tests and field tests-

Slump test, compaction factor test-Qualities of water used for mixing. Reinforced cement concrete- Qualities of materials-Types of reinforcement used-characteristics of reinforcing material- waterproofing compounds.

Mortar: Preparation of lime and cement mortar-Proportions of mortar for various items of work-tests on cement mortar.

Timber and wood products: Structural classification- Soft wood and hard wood-defects in timber- seasoning of timber-preservation of timber

Metals: Ferrous metals-Wrought iron, Cast iron, Mild steel- -Special steels-High carbon steel, High tensile steel and stainless steel (Properties and uses only)-Non ferrous metals: Aluminum, Copper, Lead, Zinc and Titanium-important alloys- properties and uses.

MODULE - II Ornamental materials for finishing

Paints and Varnishes: Types-Constituents-Preparation-characteristics and application.

Plastics: types-characteristics and properties of P V C-uses-Limitations of using plastics.

Rubber: Characteristics and properties, uses.

Aluminium : Aluminium sections used for building construction- Hand rail and baluster, Doors and windows, Paneling and false ceiling, building façade.

Glass-Types-Uses and properties. Glass used for Structural applications.

Miscellaneous: Abrasives-Adhesives-asbestos-asphalt-bitumen-cork-Plaster of Paris insulating materials- fibre glass- thermo Cole

wood products-veneers, ply wood, particle board-fibreboard, hard board, etc.

MODULE - III Construction Technology

Masonry: Classification- Stone masonry-Brick masonry-Laterite masonry – composite masonry. Different types of stone masonry-General principles and specifications for stone masonry as per relevant codes.

Brick masonry: Different types of bonds for walls, piers and junctions of walls for equal and unequal thickness - English, Flemish (Single and Double Flemish)-Specification for brick masonry as per relevant codes.

Hollow block masonry: Types of hollow blocks used in construction and methods of construction- Advantages and Disadvantages with reference to other types of masonry. Solid block masonry and inter locking block masonry.

Partition walls-Types- materials- requirements.

Modern methods of constructions- Framed – Prefabricated -Earthquake resistant

Damp proof courses: Definition of dampness – causes and effects – methods of prevention – surface treatment – internal water proofing courses.

Pre stressed concrete: Principle of pre stressing- Types- Internal & External and different methods-pre-tensioning & post tensioning.

Form work: Functions- materials used – Requirements of good form work – modern trends in material & technology- slip forms.

Scaffolding, Shoring and Under pinning : Definition – purpose and function – Requirements - materials used

Plastering and Pointing: Materials and proportion – Functions – general specifications – types

MODULE – IV Building Components

Different components of building from foundation to roof and their functions

Foundations: Functions, Classification, Shallow-Deep ,Types- Spread footing- raft-mat-column footing-pile foundation- well foundation.

Flooring: Requirements of a good floor – materials used for flooring, Floor finishes –Types - Mosaic, Marble, Granite, Ceramic tiles, Vitrified tiles, Glass, Wooden, and other types of modern floor finishes

Doors and Windows: Positioning of Doors and windows with respect to lighting and ventilation- Types and Size -Special types of doors-Flush, Revolving, and collapsible, Rolling and sliding - Windows-Different types-Ventilator Different types-Fittings for doors and windows.

Lintels and sunshades: Types of lintels- Wooden, Stone, brick, RCC and RSJ lintels-Sunshades- Canopy and sun breakers.

Arches- Types, terms used.

Vertical Transportation: Staircases, Lifts and Escalators - Planning and location – Component parts of staircase and lift – Types of staircase

Ceiling: Materials used for Ceiling – False ceiling.

Roof: Definition – importance of roofing with respect to climatic conditions – classification – pitched and flat – Couple,couple closed and collar roof.Different types of trusses for pitched roof – wood and steel trusses – roof covering for pitched roof – AC sheets, GI corrugated sheets, Aluminium sheets- PVC sheets – method of arranging and fixing to the battens rafters and purlins – RCC roof – slab with beams – flat and sloped slabs –Flat slab construction- weather proof course to flat roof.

Requirements of good floor finish, Selection of materials

Ceiling: Types , Requirements of good ceiling, Selection of materials

Stairs and staircases: Location – Types – Standards for stair case as per KBR – Tread , Rise, Going ,Riser, Nosing – Width of stair — Head room – Flight– Landing – Hand rails .

Lift and escalators- Component parts and requirements as per NBC

REFERENCE

1. National Building Code Bureau of Indian Standards
2. Students support material on Materials of Construction- NITTTR, Chennai
3. Building Science & Planning S V Deodhar, Khanna publications
4. Civil Engineering Materials Parbin Singh
5. Engineering Materials Rangawala, Charotar Publications

6. Building technology and Valuation NiTTTR, Chennai.
7. Building construction B C Punmia, Laxmi Publishers.
8. Building construction Rangawala, Charotar Publications
9. Building Technology and foundations Jha, Khanna publications
10. Planning and design of Residential Buildings RajaRao Y N
11. Building Planning Designing and Scheduling Standard Publishers