

2.5 CONSTRUCTION MATERIALS

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RATIONALE

Civil Engineering diploma holders have to supervise construction of various types of civil works involving use of various materials like stones, bricks and tiles, cement and cement based products, lime, timber and wood based products, paints and varnishes, metals and other miscellaneous materials. The students should have requisite knowledge regarding characteristics, uses and availability of various building materials and skills in conducting tests to determine suitability of materials for various construction purposes. In addition, specifications of various materials should also be known (PWD/BIS) for effective quality control.

COURSE OUTCOMES

After undergoing the subject, the students will be able to:

- CO1: Identify different types of rocks, bricks and tiles
- CO2: Perform laboratory tests of cement to determine properties of cement, bricks, tiles.
- CO3: Identify types of defects of timber
- CO4: Select paints/varnishes for various types of surfaces
- CO5: Identify and use different types of metals/alloys
- CO6: Select different materials used for wall paneling and false ceiling, such PVC, POP etc.

DETAILED CONTENTS

UNIT I

1. Building Stones

- 1.1 Sources of Stones
- 1.2 Quarrying of stones by blasting and its effect on environment
- 1.3 Dressing of stones
- 1.4 Requirements of good building stones
- 1.5 Various uses of stones in construction
- 1.6 Artificial Stones: Procedure of making an artificial stone, forms of artificial stones, advantages of artificial stones.

2. Bricks

2.1 Introduction to bricks

2.2 Raw materials for brick manufacturing and properties of good brick making earth

2.3 Manufacturing of bricks

2.3.1 Preparation of clay (Manual and Mechanically)

**2.3.2 Moulding: Hand moulding and machine moulding brick table; drying of bricks,

2.4 Burning of bricks: Bull's Trench Kiln, Hoffman's Kiln and Zig- Zag Kiln (only line diagram of kilns)

2.5 Sun dried bricks, Traditional bricks, Refractory bricks, Fly ash bricks, Hollow bricks,

2.6 Size and weight of standard brick

2.7 Classification and specifications of bricks as per BIS: 1077

2.8 Stacking of bricks and tiles at site

UNIT II

3. Tiles

3.1 Brick tiles and their uses

3.2 Ceramic tiles and their uses

3.3 Vitrified tiles and their uses

3.4 PVC Tiles and uses,

3.5 Paver blocks, interlocking tiles

4. Cement

**4.1 Introduction, raw materials, flow diagram of manufacturing of cement

4.2 Various types of cements, their uses and testing: Ordinary portland cement, rapid hardening cement, White cement, Portland pozzolana cement

4.3 Properties of cement

4.4 Storage of Cement at site

UNIT III

5. Timber and Wood Based Products

5.1 Identification and uses of different types of timber: Teak, Deodar, Shisham, Sal, Mango, Kail, Chir, Fir, Hollock, Champ

** 5.2 Seasoning of timber: Purpose, methods of seasoning as per BIS Code

5.3 Properties of timber and specifications of structural timber

5.4 Preservation of timber and methods of treatment as per BIS

5.5 Other wood based products, their brief description of manufacture and uses: Laminated Board, Block Board, Fibre Board, Hard board, Sunmica, Plywood, and Veneers

6. Paints, Varnishes and Distempers:**6.1 Paints****6.1.1 Purpose and use of paints****6.1.2 Characteristics of an ideal paint****6.1.3 Types of paints: Oil paints, Water paints, Cement paints and Enamel paint******6.1.4 Covering capacity of paints****6.2 Varnishes****6.2.1 Purpose and use of varnishes****6.2.2 Characteristics of an ideal varnish****6.2.3 Types of varnishes****6.3 Distemper****6.3.1 Properties of distemper and process of distempering.****UNIT IV****7. Metals and Non Metals**

7.1 Ferrous metals: Composition, properties and uses of cast iron, mild steel, HYSD steel, high tension steel as per BIS.

7.2 Commercial forms of ferrous, metals.

7.3 Properties and use of Aluminium

7.4 Properties and use of Stainless Steel.

8. Plastics

8.1 FRP: Introduction, Properties of FRP and Applications of FRP in Building Industry

8.2 PVC wall paneling

8.3 ACP and HPL Sheets

UNIT V**9. Miscellaneous Materials**

9.1 Asbestos: Introduction, properties and use of asbestos.

9.2 Types and uses of insulating materials for sound and thermal insulation

9.3 Construction chemicals like water proofing compound, epoxies, polymers

9.4 Water proofing and termite proofing materials – types and uses

9.5 Materials used in interior decoration works like POP, methods of doing POP

9.6 Eco friendly materials for construction of buildings.

NOTE: **A field visit may be planned to explain and show the relevant things

PRACTICAL EXERCISES

1. To identify the stones used in building works by visual examination
2. To determine the crushing strength of bricks
3. To determine the water absorption of bricks
4. To determine the efflorescence of bricks
5. To conduct a practical for dimensional tolerances of a brick.
6. To perform the following field tests on cement to judge the quality of cement:
7. Date of Packing, Colour, Hand Insertion, Float Test, Smell Test, and Presence of lumps.
8. To identify various types of timbers such as: Teak, Sal, Chir, Shisham, Deodar, Kail&Hollock by visual examination only
9. The students should submit a report work on the construction materials **(at least one per week)** as mentioned below. They will also show the competitive study based upon the **Cost, Brand Name and Sizes** available in the local market.
 - a) Plywood, Veneers, Sunmica
 - b) Paints, Varnishes and Distempers
 - c) Aluminium and Stainless steels
 - d) Water proofing material
 - e) PVC Panels and FRPs
 - f) POP and Asbestos sheets
 - g) Termites, Polymers and Epoxies

RECOMMENDED BOOKS

- 1) "Engineering Materials" by D Sharma, SK and Mathur GC; S. Chand and Co. Jalandhar
- 2) "Engineering Materials" by Surendra Singh; Vikas Publishing House Pvt. Ltd. New Delhi
- 3) "Engineering Materials" by Bahl, SK; , Rainbow Book Co., Delhi
- 4) "Civil Engineering Materials" by TTTI, Chandigarh; Tata McGraw Hill Publication, New Delhi.
- 5) "Engineering Materials" by Shahane; Allied Book Stall, Poona,
- 6) "Engineering materials" by Gurcharan Singh; Standard Publishers Distributors, Delhi..
- 7) "Construction Materials" by SC Rangawala; Charoter Publishers
- 8) "Construction Materials" by Alam Singh
- 9) "Lab Manual in Testing of Engineering Materials" by Dr. HemantSood; New Age International (P) Ltd., New Delhi
- 10) Handbook of Civil Engineering by PN Khanna.
- 11) e-books/e-tools/relevant software to be used as recommended by AICTE/HSBTE/NITTTR.

SUGGESTED WEBSITES

1. <http://swayam.gov.in>

INSTRUCTIONAL STRATEGY

Teachers are expected to physically show various materials while imparting instructions. Field-visits should also be organized to show manufacturing processes and use of various materials in Civil engineering works. Students should be encouraged to collect sample of various building materials so as to create a museum of materials in the polytechnic. This subject contains five units of equal weightage.