

2.1 ENVIRONMENTAL SCIENCE

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RATIONALE

Any people must have knowledge of different types of pollution caused due to industries and constructional activities so that he may help in balancing the eco system and controlling pollution by pollution control measures. He should also be aware of environmental laws related to the control of pollution.

DETAILED CONTENTS

1. Basics of ecology, eco system and sustainable development (03 Period)
2. Conservation of land reforms, preservation of species, prevention of advancement of deserts and lowering of water table (03 Period)
3. Sources of pollution - natural and man made, their effects on living and non-living organisms, Pollution of water - causes, effects of domestic wastes and industrial effluent on living and non-living organisms, Pollution of air-causes and effects of man, animal, vegetation and non-living organisms, Sources of noise pollution and its effects (16 Period)
4. Solid waste management; classification of refuse material, types, sources and properties of solid wastes, abatement methods (06 Period)
5. Mining, blasting, deforestation and their effects (03 Period)
6. Legislation to control environment (04 Period)
7. Environmental Impact Assessment (EIA), Elements for preparing EIA statements (04 Period)
8. Current issues in environmental pollution and its control, role of non-conventional sources of energy in environmental protection (06 Period)

RECOMMENDED BOOKS

1. Environmental and Pollution Awareness by Sharma BR; Satya Prakashan, New Delhi.
2. Environmental Protection Law and Policy in India by Thakur Kailash; Deep and Deep Publications, New Delhi.
3. Environmental Engineering and Management by Suresh K Dhamija; SK Kataria and Sons, New Delhi.
4. Environmental Science by Deswal and Deswal; Dhanpat Rai and Co. (P) Ltd. Delhi.

SUGGESTED DISTRIBUTION OF MARKS

Topic No.	Time Allotted for Lecturers and Tutorials (Period)	Marks Allotted
1.	03	03
2.	03	05
3.	16	20
4.	06	06
5.	03	02
6.	04	04
7.	04	04
8.	06	06
TOTAL	45	50

2.2 BUILDING CONSTRUCTION

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RATIONALE

Diploma holders in Building Technology Engineering are supposed to supervise construction of buildings. To perform above task, it is essential that students should have knowledge of various sub components of buildings like foundations, walls, roofs, staircases, floors etc., and their constructional details. Therefore, the subject of Building Construction is very important for Building Technology Engineering diploma holders.

DETAILED CONTENTS

THEORY:

1. 1. Introduction: **(01 Period)**
 - 1.1 Definition of a building, classification of buildings based on occupancy
 - 1.2 Different parts of a building

2. Foundations: **(03 Period)**
 - 2.1 Concept of foundation and its purpose
 - 2.2 Types of foundation-shallow and deep
 - 2.2.1 Shallow foundation - constructional details of: Spread foundations for walls, thumb rules for depth and width of foundation and thickness of concrete block, stepped foundation, masonry pillars and concrete columns
 - 2.3 Earthwork
 - 2.3.1 Layout/setting out for surface excavation, cutting and filling
 - 2.3.2 Excavation of foundation, trenches, shoring, timbering and dewatering

3. Walls: **(04 Period)**
 - 3.1 Purpose of walls
 - 3.2 Classification of walls - load bearing, non-load bearing, dwarf wall, retaining, breast walls and partition walls
 - 3.3 Classification of walls as per materials of construction: brick, stone, reinforced brick, reinforced concrete, precast, hollow and solid concrete block and composite masonry walls
 - 3.4 Partition walls: Constructional details, suitability and uses of brick and wooden partition walls
 - 3.5 Mortars: types, selection of mortar and its preparation
 - 3.6 Scaffolding, construction details and suitability of mason's brick layers and tubular scaffolding, shoring, underpinning

4. Masonry **(04 Period)**
 - 4.1 Brick Masonry: Definition of terms, bond, facing, backing, hearting, column pillar, jambs, reveals soffit, plinth masonry, header, stretcher, bed of bricks bat, queen closer, king closer, frog and quoin, course
 - 4.1.1 Bond – meaning and necessity; English, flemish bond and other types of bonds

4.1.2 Construction of brick walls –methods of laying bricks in walls, precautions observed in the construction of walls, methods of bonding new brick work with old (toothing, raking, back and block bonding), Expansion and contraction joints

4.2 Stone Masonry

4.2.1 Glossary of terms – natural bed, bedding planes, string course, corbel, cornice, block in course grouting, moulding, templates throating, through stone, parapet, coping, plaster and buttress

4.2.2 Types of stone masonry, rubble masonry, random and coursed ashlar masonry, principles to be observed in construction of stone masonry walls

5. Arches and Lintels:

(04 Period)

5.1 Meaning and use of arches and lintels:

5.2 Glossary of terms used in arches and lintels - abutment, pier, arch ring, intrados, soffit, extrados, voussoiers, springer, springing line, crown, key stone, skew back, span, rise, depth of an arch, haunch, spandril, jambs, bearing, thickness of lintel, effective span

5.3 Arches:

5.3.1 Types of Arches - Semi circular, segmental, elliptical and parabolic, flat, inverted and relieving

5.3.2 Stone arches and their construction

5.3.3 Brick arches and their construction

5.4 Lintels

5.4.1 Purpose of lintel

5.4.2 Materials used for lintels

5.4.3 Cast-in-situ and pre-cast lintels

5.4.4 Lintel along with sun-shade or chhajja

6. Doors, Windows and Ventilators:

(03 Period)

6.1 Glossary of terms with neat sketches

6.2 Classification based on materials i.e. wood, metal and plastic and their suitability for different situations, different type of doors- panel door, flush door, rolling shutter, steel door, sliding door.

6.3 Window – Panel window, glazed windows casement window four light windows and ventilators, sky light window, Louvered shutters, plastic door and windows.

7. Damp Proofing and Water Proofing

(04 Period)

7.1 Dampness and its ill effects on bricks, plaster, wooden fixtures, metal fixtures and reinforcement, damage to aesthetic appearance, damage to heat insulating materials, damage to stored articles and health, sources and causes of dampness

7.2 Types of dampness - moisture penetrating the building from outside e.g. rainwater, surface water, ground moisture

7.3 Moisture entrapped during construction i.e. moisture in concrete, masonry construction and plastering work etc.

7.4 Moisture which originates in the building itself i.e. water in kitchen and bathrooms etc.

7.5 Damp proofing materials and their specifications: rich concrete and mortar, bitumen, bitumen mastic, polymer coating, use of chemicals

7.6 Damp proofing of : basement, ground floors, plinth and walls, special damp proofing arrangements in bathrooms, WC and kitchen, damp proofing for roofs and window sills

8. Floors **(03 Period)**

8.1 Glossary of terms-floor finish, topping, under layer, base course, rubble filling and their purpose

8.2 Types of floor finishes - cast-in-situ, concrete flooring (monolithic, bonded) Terrazzo tile flooring, stone (marble and kota) flooring, PCV flooring, Terrazzo flooring, Timber flooring, description with sketches. The methods of construction of concrete, terrazzo and timber floors and their BIS specifications

9. Roofs **(03 Period)**

9.1 Glossary of terms for pitched roofs - batten, eaves, fascia board, gable, hip, lap, purlin, rafter, rag bolt, valley, ridge

9.2 Types of roofs, concept of flat, pitched and arched roofs

9.3 False ceilings using gypsum, plaster boards, cellotex, fibre boards

10. Stairs **(04 Period)**

10.1 Glossary of terms: Staircase, winders, landing, stringer, newel, baluster, riser, tread, width of staircase, hand-rail, nosing

10.2 Classification of staircase on the basis of material – RCC, timber, steel, Aluminium

10.3 Planning and layout of staircase: Relations between rise and tread, determination of width of stair, landing etc

10.4 Various types of layout - straight flight, dog legged, open well, quarter turn, half turn (newel and geometrical stairs), bifurcated stair, spiral stair

11. Surface Finishes **(04 Period)**

11.1 Plastering - classification according to use and finishes like grit finish, rough cast, pebble dashed, concrete and stone cladding, plain plaster etc., dubbing, proportion of mortars used for different plasters, techniques of plastering and curing

11.2 Pointing - different types of pointing and their methods

11.3 Painting - preparation of surface, priming coat and application of paints on wooden, steel and plastered wall surfaces

11.4 White washing, colour washing and distempering, polishing, application of cement and plastic paints

11.5 Commonly used water repellent for exterior surfaces, their names and applications

12. Anti Termite Measures (As per IS 6313 –I – III) **(04 Period)**

12.1 Introduction, site preparation and chemicals used in anti-termite treatment

12.2 Treatment of masonry foundation

12.3 Treatment of RCC foundation

12.4 Treatment of top surface of earth filling

12.5 Treatment of junction of walls and floors

12.6 Treatment along external perimeter of building

12.7 Treatment and selection of timber

12.8 Treatment in existing buildings

13. Building Planning

(04 Period)

13.1 Site selection: Factors to be considered for selection of site for residential, commercial, industrial and public building

13.2 Basic principles of building planning, arrangement of doors, windows, cupboards etc for residential building

13.3 Orientation of building as per IS: 7662 in relation to sun and wind direction, rains, internal circulation and placement of rooms within the available area.

13.4 Planning of building services

13.5 Introduction to National Building code.

PRACTICAL EXERCISES

- i) Demonstration of tools and plants used in building construction
- ii) Layout of a building: two rooms building with front verandah
- iii) To construct brick bonds (English bond only) in one, one and half and two brick thick: (a) Walls for L, T and cross junction (b) Columns
- iv) Demonstration of following items of work at construction site:
 - a) Timbering of excavated trenching
 - b) Damp proof courses
 - c) Construction of masonry walls
 - d) Flooring: Laying of flooring on an already prepared lime concrete base
 - e) Plastering and pointing
 - f) Use of special type of shuttering/cranes/heavy machines in construction work
 - g) RCC work
 - h) Pre-construction and post construction termite treatment of building and woodwork

INSTRUCTIONAL STRATEGY

While imparting instructions in this subject, teachers are expected to take students to work site and explain constructional process and special details for various sub-components of a buildings. It is also important to make use of audio visual aids/video films (if available) to show specialised operations. The practical work should be given due importance and efforts should be made that each student should perform practical work independently. For carrying out practical works, polytechnics should have building yard where enough raw materials is made available for students to perform practical work.

RECOMMENDED BOOKS

1. Gupta, Sushil Kumar, Singla, DR, and Juneja BM; "A Text Book of Building Construction"; Ludhiana, Katson Publishing House.
2. Deshpande, RS and Vartak, GV; "A Text Book of Building Construction"; Poona, United Book Corporation.
3. Rangwala, SC: "Building Construction"; Anand, Charotar Book Stall
4. Kulkarni, GJ; "A Text Book of Building Construction"; Ahmedabad Book Depot

5. Arora, SP and Bindra, SP; "A Text Book of Building Construction"; New Delhi Dhanpt Rai and Sons.
6. Sharma,SK and Kaul, BK; "A Text Book of Building Construction"; Delhi, S Chand and Co.
7. Sushil Kumar; "Building Construction"; Standard Publishers Distributors, Delhi

SUGGESTED DISTRIBUTION OF MARKS

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1.	01	02
2.	03	03
3.	04	05
4.	04	05
5.	04	05
6.	03	02
7.	04	04
8.	03	02
9.	03	02
10.	04	05
11.	04	05
12.	04	05
13.	04	05
TOTAL	45	50

2.3 BUILDING DRAWING

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RATIONALE

Drawing is the language of engineers. Engineering is absolutely incomplete without a thorough knowledge of drawing. A Building Technology Engineering diploma holder must be capable of sketching detailed constructional drawing of various components of building for the purpose of communication with the craftsman. Planning of small buildings, developing a line plan, dimensioning, key plan, drainage plan should be a part of curriculum. The diploma engineer must be conversant with reading and interpretation of drawing for execution of work.

DETAILED CONTENTS

Drawing No. 1: (2 sheets)

Details of spread footing foundations, load bearing and non-load bearing wall for given thickness of walls with the help of given data or rule of the thumb, showing offsets, position of DPC; details of basement showing necessary damp proofing

Drawing No. 2: (one sheet)

Plans of 'T' and Corner junction of walls of 1 Brick, 1-1/2 Brick and 2 brick thick in English bond

Drawing No. 3: (4 sheets)

Elevation, sectional plan and sectional side elevation of flush door, panelled door with wire gauge shutter, steel and aluminum windows. Sketches of various joints of different members

Drawing No. 4: (2 sheet)

Drawing plan, elevation of a small building by measurement and foundation detail and sectional elevation.

Drawing No.5: (4 sheets)

Drawing detailed plan, elevation and section of a two room residential building from a given line plan, showing details of foundations, roof and parapet

Drawing No. 6 (one sheet)

Detailed plan and cross section of a domestic septic tank with soak pit for 5 to 10 users,

Drawing No. 7: (one sheet)

Drawing of Bathroom and W.C. connections. Practice of reading water supply and waste water drainage working drawing including hot water and cold water supply system.

Drawing No. 8 (one sheet)

Drawing details of damp proofing arrangement of roofs, floors, basement and walls as per BIS Code

NOTE:

- a) All drawings should be as per BIS code and specifications in SI Units
- b) Intensive practice of reading and interpreting building drawings should be given

RECOMMENDED BOOKS

1. Civil Engineering Drawing by RS Malik, Asia Publishing House
2. Civil Engineering Drawing by V.B.Sikka. Katson Publishing, Ludhiana
3. Civil Engineering Drawing by NS Kumar; IPH, New Delhi
4. Principles of Building Drawing by MG Shah and CM Kale, MacMillan, Delhi
5. Building Construction by Moorthy NRK
6. Civil Engg Drawing by Layal

2.4 CONCRETE TECHNOLOGY

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RATIONALE

Diploma holders in Building Technology Engineering are supposed to supervise concreting operations involving proportioning, mixing, transporting, placing, compacting, finishing and curing of concrete. To perform above functions, it is essential to impart knowledge and skills regarding ingredients of concrete and their properties; properties of concrete in plastic and hardened stage, water cement ratio and workability; proportioning for ordinary concrete; concreting operations and joints in concrete.

DETAILED CONTENTS

THEORY

1. Introduction: Definition of concrete, brief introduction to properties of concrete, uses of concrete in comparison to other building materials **(01 Period)**
2. Ingredients of Concrete: **(04 Period)**
 - 2.1 Cement: physical properties of cement; different types of cement:
 - 2.2 Aggregates:
 - 2.2.1 Classification of aggregates according to size and shape
 - 2.2.2 Characteristics of aggregates: Particle size and shape, surface texture, specific gravity of aggregate; bulk density, water absorption, surface moisture, bulking of sand, deleterious materials soundness
 - 2.2.3 Grading of aggregates: coarse aggregate, fine aggregate; All-in-aggregate; fineness modulus; interpretation of grading charts
 - 2.3 Water: Quality requirements as per IS:456-2000
3. Properties of Concrete: **(08 Period)**
 - 3.1 Properties in plastic state, Workability, Segregation, Bleeding and Harshness
 - 3.2 Properties in hardened state: Strength, Durability, Impermeability, Dimensional changes;
4. Water Cement Ratio: **(02 Period)**
 - 4.1 Principle of water-cement ratio law/Duff Abram's Water-cement ratio law: Limitations of water-cement ratio law and its effects on strength of concrete
5. Workability: **(04 Period)**
 - 5.1 Measurement of workability: slump test, compacting factor and vee bee consistometer; recommended slumps for placement in various conditions as per IS:456-2000 SP-
6. Proportioning for Nominal Concrete: **(04 Period)**
 - 6.1 Objectives of mix design, introduction to various grades as per IS:456- 2000; proportioning for nominal mix design as prescribed by IS 456-2000
 - 6.2 Adjustment on site for: Bulking of fine aggregate, water absorption of aggregate, workability
 - 6.3 Difference between nominal and controlled concrete

7. Admixtures (Introduction as per IS:456-2000) **(03 Period)**

7.1 Chemical admixtures

7.2 Mineral admixtures

7.2.1 Fly ash

7.2.2 Silica fumes

7.2.3 Rice husk ash

7.2.4 Meta Kaolin

8. Special Concretes **(06 Period)**

8.1 Concreting under special conditions, difficulties and precautions before, during and after concreting

8.1.1 Cold weather concreting

8.1.2 Under water concreting

8.1.3 Hot weather concreting

8.2 Ready mix concrete

8.3 Fibre reinforced concrete

8.4 Fly ash concrete

8.5 Self compacting concrete

9. Concreting Operations: **(04 Period)**

9.1 Storing of Cement:

9.1.1 Storing of cement in a warehouse

9.1.2 Storing of cement at site

9.1.3 Effect of storage on strength of cement

9.1.4 Determination of warehouse capacity for storage of Cement

9.2 Storing of Aggregate: Storing of aggregate on site

9.3 Batching:

9.3.1 Batching of Cement

9.3.2 Batching of aggregate by:

9.3.2.1 Volume, using gauge box (farma) selection of proper gauge box

9.3.2.2 Weight spring balances and by batching machines

9.3.3 Measurement of water

9.4 Mixing:

9.4.1 Hand mixing

9.4.2 Machine mixing - types of mixers, capacities of mixers, choosing appropriate size of mixers, operation of mixers

9.4.3 Maintenance and care of machines

9.5 Transportation of concrete: Transportation of concrete using pans, wheel barrows, transit mixers, chutes, belt conveyors, pumps, tower crane and hoists etc.

9.6 Placement of concrete: Checking of form work, shuttering and precautions to be taken during placement

9.7 Compaction:

9.7.1 Hand compaction

9.7.2 Machine compaction - types of vibrators, internal screed vibrators and form vibrators

9.7.3 Selection of suitable vibrators for different situations

9.8 Finishing concrete slabs - screeding, floating and trowelling

9.9 Curing:

9.9.1 Objective of curing, methods of curing like ponding, membrane curing, steam curing, chemical curing

9.9.2 Duration for curing and removal of form work

9.10 Jointing: Location of construction joints, treatment of construction joints expansion joints in buildings - their importance and location

9.11 Defects in concrete: Identification of and methods of repair

10. Importance and methods of non-destructive tests (introduction only)

(01 Period)

PRACTICAL EXERCISES:

- i) To determine the physical properties of cement as per BIS Codes
- ii) To determine flakiness and elongation index of coarse aggregates
- iii) Method to determine silt in fine aggregate
- iv) Determination of specific gravity and water absorption of aggregates
- v) Determination of bulk density and voids of aggregates
- vi) Determination of particle size distribution of fine, coarse and all in aggregate by sieve analysis (grading of aggregate)
- viii) To determine necessary adjustment for bulking of fine aggregate
- ix) To determine workability by slump test:
 - a) To verify the effect of water, fine aggregate/coarse aggregate ratio and aggregate/Cement ratio on slump
 - b) To test compressive strength of concrete cubes with varying water cement ratio
- x) Compaction factor test for workability
- xi) Non destructive test on concrete by:
 - a) Rebound Hammer Test
 - b) Ultrasonic Pulse Velocity Test
- xii) Tests for compressive strength of concrete cubes for M-20

RECOMMENDED BOOKS

- i) Kulkarni, PD; Ghosh, RK and Phull, YR; "Text Book of Concrete Technology"; New Delhi Oxford and IBH Publishing Co.
- ii) Krishnamurthy, KT; Rao, A Kasundra and Khandekar, AA; "Concrete Technology"; Delhi, Dhanpat Rai and Sons.
- iii) Gupta BL and Gupta Amit; "Text Book of Concrete Technology"; Standard Publishers Distributors, Delhi.
- iv) Varshney, RS; "Concrete Technology"; New Delhi, Oxford and IBH Publishing
- v) Neville, AM; "Properties of Concrete" London, Pitman (ELBS Edition available)
- vi) Orchard; "Concrete Technology"; Vol I, II, and III
- vii) Handoo, BL; and Puri, LD; "Concrete Technology"; New Delhi, Satya Prakashan
- viii) Sood, Hemant, Mittal LN and Kulkarni PD; "Laboratory Manual on Concrete Technology", CBS Publishers, New Delhi, 2002
- ix) Vazirani, VN; and Chandola, SP; "Concrete Technology"; Delhi, Khanna Publishers
- x) Gambhir, ML; "Concrete Technology"; New Delhi, MacMillan India Ltd.
- xi) Siddique, R., "Special Structural Concretes", New Delhi, Galgotia Publishers Pvt. Ltd. Delhi

SUGGESTED DISTRIBUTION OF MARKS

Topic No.	Time Allotted for Lecturers and Tutorials (Period)	Marks Allotted
1.	01	01
2.	04	05
3.	08	08
4.	02	03
5.	04	04
6.	04	04
7.	03	03
8.	06	06
9.	12	15
10.	01	01
TOTAL	45	50

2.5 BAR BENDING

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RATIONALE

This subject is an applied engineering subject. Diploma holders in Building Technology Engineering will be required to supervise RCC Construction and fabrication. He must be able to read and interpret structural drawings of different elements. This subject thus deals with elementary design principles as per BIS code of practice and their relevant drawings.

DETAILED CONTENTS

(A) Theory

1. Introduction **(10 Period)**
 - 1.1 Concept of Reinforced Cement Concrete (RCC)
 - 1.2 Reinforcement Materials:
 - Suitability of Steel as reinforcing material
 - Properties of mild steel and HYSD steel
 - 1.3 Shear and Bond
 - 1.4 Bond and Development Length
 - 1.5 Development Length for bars
 - 1.6 Anchorage value of standard bend and hook
 2. Reinforcement details (plan and sections) and bar bending schedule of: **(25 Period)**
 - 2.1 Singly Reinforced Beam
 - 2.1.1 BIS specifications regarding spacing of reinforcement,
 - 2.1.2 Cover to reinforcement, minimum reinforcement,
 - 2.1.3 Lapping & anchoring effective span for beams and slabs.
 - 2.2 Doubly Reinforced Beam
 - 2.3 T-Beam
 - 2.4 L-beams
 - 2.5 Simply Supported One Way Slab
 - 2.6 Continuous Slab
 - 2.7 Staircase
 - 2.8 Two-way simply supported slab
 - 2.9 Axially Loaded Column
 - 2.9.1 specifications for minimum reinforcement cover,
 - 2.9.2 Maximum reinforcement,
 - 2.9.3 Number of bars, main and lateral reinforcement for column.
 - 2.10 Square Footing of uniform thickness
 - 3 Prestressed Concrete: **(10 Period)**
 - 3.1 Concept of pre-stressed concrete,
 - 3.2 Methods of pre-stressing “ Pre tensioning and Post tensioning.
 - 3.3 Advantages and disadvantages of prestressed concrete.
 - 3.4 Losses in Pre-stress.
- Calculation of bending stressed in rectangular simply supported beam with straight and parabolic profile of tendons.

(B.) Practice of reading RCC Drawing

1. Reinforcement details from given data for the following with bar bending schedules:

- a) Slabs – one way slab, two way slab with torsional reinforcement and cantilever slab
- b) Rectangular beams – singly reinforcement, doubly reinforcement and cantilever beams with shear reinforcement
- c) Columns – square, rectangular and circular column with isolated footing of uniform depth and varying depth (sloped footings)

2. Details of reinforcement in a three bay two storeyed RCC portal frame with the details of reinforcement at the column – beam junctions from the given design data

INSTRUCTIONAL STRATEGY

Teachers are expected to give simple problems for designing various RCC structural members. For creating comprehension of the subject, teachers may prepare tutorial sheets, which may be given to the students for solving. It would be advantageous if students are taken at construction site to show form work for RCC as well as placement of reinforcement in various structural members, practice of reading structural drawings is another important feature of this course. Commentary on BIS:456 may be referred along with code for relevant clauses.

RECOMMENDED BOOKS

- 1. Sushil Kumar, "Treasurers of Reinforced Concrete Design", Delhi Standard Publishers Distributors
- 2. Verghese "Reinforced Concrete Design"
- 3. Limit State Design by Dr AK Jain
- 4. Ramamurtham, S; "Design and Testing of Reinforced Structures", Delhi Dhanpat Rai and Sons
- 5. Punmia, BC; "Reinforced Concrete Structure Vol I", Delhi Standard Publishers Distributors
- 6. Mallick, SK; and Gupta, AP; "Reinforced Concrete", New Delhi, Oxford and IBH Publishing Co
- 7. Dayaratnam, P; "Design of Reinforced Concrete Structures", New Delhi, Oxford and IBH Publishing Co.
- 8. Gambhir, M.L., "Reinforced Concrete Design", Macmillan India Limited
- 9. Structural Analysis and Design, STAAD – PRO; Research Engineers - USA

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Topic No.	Time Allotted for Lecturers and Tutorials (Period)	Marks Allotted
1.	10	10
2.	25	30
3.	10	10
TOTAL	45	50

2.6 WORKSHOP PRACTICAL WORKS

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RATIONALE

In order to have a balanced overall development of diploma engineers, it is necessary to integrate theory with practice. General workshop practices are included in the curriculum in order to provide hand on experience about use of different tools and basic manufacturing practices. This course aims at developing general manual and machining skills in the students. Besides above, the development of dignity of labour, precision, safety at work place, team working and development of right attitude are the other objectives.

DETAILED CONTENTS (PRACTICALS)

Note: The students are supposed to come in proper workshop dress prescribed by the institute. Wearing shoes in the workshop(s) is compulsory. Importance of safety and cleanliness, safety measures and upkeep of tools, equipment and environment in each of the following shops should be explained and practiced.

The students should prepare sketches of various tools/jobs in their practical Notebook. The following shops are included in the syllabus:

1. Plumbing shop
2. Painting Shop
3. Welding Shop
4. Electric Shop

1. Plumbing Shop

- 1.1 Technical terms, necessity, introduction and demonstration of plumbing tools,
- 1.2 Different connectors, and plumbing operations,
- 1.3 GI pipe marking, cutting, threading, Jointing of different types of elbow, T, unions, sockets, stopcock, tap etc.
- 1.4 Care and maintenance of measuring tools like calipers, steel rule, try square, vernier, micrometer etc.
- 1.5 Safety precautions in carpentry shop

2. Painting Shop

- 2.1 Technical terms, necessity, basics of white washing,
- 2.2 raw materials, preparation of surface, method of application,
- 2.3 care and maintenance of tools and safety measures.
- 2.4 Basics of color washing, snowcem, distemper, oil bond, raw materials,
- 2.5 preparation of surface, method of application,
- 2.6 care and maintenance of tools and safety measures.
- 2.7 Basics of painting/varnishing doors/windows etc., raw materials,
- 2.8 preparation of surface, method of application, c
- 2.9 are and maintenance of tools and safety measures.

3. Welding Shop

- 3.1 a) Introduction to welding and its importance in engineering practice; types of welding; common materials that can be welded, introduction to welding

equipment e.g. a.c. welding set, d.c. rectifier, electrode holder, electrodes and their specifications, welding screens and other welding related equipment, accessories and gloves.(b) Safety precautions during welding(c) Hazards of welding and its remedies

- 3.2** Electric arc welding, (a.c. and d.c.) precautions while using electric arc welding, Practice in setting current and voltage for striking proper arc. Earthing of welding machine. **Job I** Practice of striking arc bending and tacking while using electric arc welding set. **Job II** Welding practice on electric arc welding for making uniform and straight weld beads
- 3.3** Various types of joints and end preparation. Job III Preparation of butt joint by electric arc welding. Job IV Preparation of lap joint by electric arc welding. Job V Preparation of corner joint by using electric arc welding. Job VI Preparation of Tee joint by electric arc welding.

4. Electric Shop

- 4.1 Study, demonstration and identification of common electrical materials such as wires, cables, switches, fuses, ceiling roses, PVC Conduits, PVC Channels and allied items, tools along with electrical instruments such as voltmeter, ammeter and multimeter.
- 4.2 Study of electrical safety measures and demonstration about use of protective devices such as fuses, MCBs, ELCBs and relays including earthing. Job I Identification of phase, neutral and earth of domestic appliances and their connection to two pin/three pin plugs. Job II Preparation of a house wiring circuit on wooden board using fuse, switches, socket, holder, ceiling rose etc. in PVC conduit and PVC casing and capping wiring system.
- 4.3 Study of common electrical appliances such as electric iron, electric kettle, ceiling fan, table fan, electric mixer, electric Geyser, gas geyser, desert cooler, refrigerator, water purifier
- 4.4 Introduction to lead-acid battery, identification of parts and its working. Job III Installation of inverter with battery and to connect two or more batteries in series and in parallel (knowledge of a.c. and d.c.) Job IV Charging of a battery and testing it with the help of hydrometer and cell tester.

RECOMMENDED BOOKS

1. Workshop Technology I,II,III, by S K Hajra, Choudhary and A K Chaoudhary. Media Promoters and Publishers Pvt. Ltd., Bombay
2. Workshop Technology by Manchanda Vol. I,II,III India Publishing House, Jalandhar.
3. Manual on Workshop Practice by K Venkata Reddy, KL Narayana et al; MacMillan India Ltd. New Delhi
4. 4. Basic Workshop Practice Manual by T Jeyapooan; Vikas Publishing House (P) Ltd., New Delhi
5. Workshop Technology by B.S. Raghuvanshi, Dhanpat Rai and Co., New Delhi
6. Workshop Technology by HS Bawa, Tata McGraw Hill Publishers, New Delhi