Rationale

Interpersonal communication is a natural and necessary part of organizational life. Yet, communicating effectively can be challenging because of our inherent nature to assume, overreact to and misperceive what actually is happening. Poor communication or lack of communication is often cited as the cause of conflict and poor teamwork. In today’s team-oriented workplace, managing communication and developing strategies for creating shared meaning are crucial to achieving results and creating successful organizations. The goal of the Communicating Effectively in English course is to produce civic-minded, competent communicators. To that end, students must demonstrate oral as well as written communication proficiency. These include organizational and interpersonal communication, public address and performance.

Objectives of Course in Communicating Effectively in English for the First Year (I & II Semesters) are:

* Understanding how communication works
* Gaining active listening and responding skills
* Understanding the importance of body language
* Acquiring different strategies of reading texts
* Increasing confidence by providing opportunities for oral and written expressions
DETAILED CONTENTS FOR FIRST SEMESTER

1. SEMESTER 48 HRS

1. COMMUNICATION SKILLS 6 hrs

1.1 Verbal and Non-verbal Communication
1.2 Process of Communication
1.3 Barriers to Communication; Overcoming Strategies
1.4 Listening and Speaking Skills and Sub-Skills

2. Spoken English-Introduction, Features of Spoken English

(Note: This module is only for practice. This should not be included in the final examination)

2. DEVELOPING ORAL COMMUNICATION SKILLS 8 hrs

2.1 Greeting, Starting a Conversation
2.3 Introducing Oneself
2.4 Introducing Others
2.5 Leave Taking
2.6 Thanking, Wishing Well
2.7 Talking about Oneself
2.8 Talking about Likes and Dislikes

3. GRAMMAR AND USAGE 12 hrs

3.1 Punctuation
3.2 Articles-a, an, the
3.3 Framing Questions
3.4 Verbs-Classification: Main Verb, Auxiliary Verb, Transitive & Intransitive Verbs, Phrasal Verbs
3.5 Word Formation

4. WRITING SKILLS 10 hrs

4.1 Writing Paragraphs
4.2 Picture Composition
### 5. READING SKILLS

**5.1 Vocabulary Enhancement**

**5.2 Techniques of Reading: Skimming, Scanning, Intensive and Extensive Reading**

**NOTE:** The Reading Skills of the learners (along with vocabulary enhancement) will be through reading thematic articles/essays and/or stories.

#### Section I

**Theoretical Concepts of Communication Skills**

<table>
<thead>
<tr>
<th>Unit</th>
<th>Topic</th>
<th>Duration</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Communication Skills</td>
<td></td>
</tr>
<tr>
<td>2</td>
<td>Listening and Speaking Skills and Sub-Skills</td>
<td>24</td>
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<tr>
<td>3</td>
<td>Pronunciation</td>
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#### Section II

**Oral Communication Skills**

<table>
<thead>
<tr>
<th>Unit</th>
<th>Topic</th>
<th>Duration</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Starting a Conversation</td>
<td>57</td>
</tr>
<tr>
<td>2</td>
<td>Introducing Oneself and Others</td>
<td>58</td>
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<td>3</td>
<td>Greeting and Taking Leave</td>
<td>62</td>
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<td>Wishing Well</td>
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<td>5</td>
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<td>7</td>
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#### Section III

**Reading Skills**

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<th>Unit</th>
<th>Topic</th>
<th>Duration</th>
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<tbody>
<tr>
<td>1</td>
<td>Who is the Dumbest Animal in the World?</td>
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<td>2</td>
<td>The Happy Guy Discovers the Cause of Memory Loss: Defective Glue</td>
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<tr>
<td>3</td>
<td>Himalaya: Tantric Phuchens Lamas</td>
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<tr>
<td>Unit 4</td>
<td>Samoa, Heart of Polynesia</td>
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<tr>
<td>Unit 5</td>
<td>A Guide to Gas Powered RC Cars</td>
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<tr>
<td>Unit 6</td>
<td>Life's a Beach: A Shore Theme in Your Outdoor Space</td>
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<tr>
<td>Unit 7</td>
<td>Spanish Tapas: The Small Plate with Big Flavour</td>
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<td>Unit 8</td>
<td>Himalaya: Cultural Experience—Spiti</td>
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<td>Unit 9</td>
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**Writing Skills**

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**Section V**

**Grammar and Usage**

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<td>Articles</td>
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<td>Unit 3</td>
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<td>Unit 4</td>
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1.2 APPLIED MATHEMATICS - I

RETIONALE
Applied Mathematics forms the backbone of engineering discipline. Basic elements of permutations and combinations, trigonometry, vector, complex number and statistics have been included in the curriculum as foundation course and to provide base for continuing education to the students.

DETAILED CONTENTS

1. Algebra (20 hrs)

   1.1 Permutations and Combinations, Value of \(^n_p\) and \(^n_c\), its properties and simple problems

   1.2 Binomial theorem (without proof) for positive integral index (expansion and general term); Binomial theorem for any index (expansion only) first and second binomial approximation with application to engineering problems

   1.3 Partial fractions (linear factors, repeated linear factors, non reducible quadratic factors)

   1.4 Determinants and Matrices – expansion of determinants (upto third order) using sarrus rule, expansion method and pivotal’s condensation method. Properties of determinants, solution of equations (upto 3 unknowns) by Cramer’s rule. Definition of matrix, addition, subtraction and multiplication of matrices (upto third order). Inverse of a matrix by adjoint method and elementary row transformations. Solution of
equations (up to 3 unknowns) by Matrix method

1.5 Logarithm: general properties of logarithms, calculations of engineering problems using log tables

2. Trigonometry (11 hrs)

2.1 Addition and subtraction formulae, product formulae and their application in engineering problems. Transformation from product to sum or difference of two angles or vice versa, multiple and sub-multiple angles

2.2 Conditional identities, solution of triangles (excluding ambiguous cases)

2.3 Graphs of \( \sin x, \cos x, \text{ and } \tan x, e^x \)

3. Vectors (11 hrs)


4. Complex Numbers (9 hrs) Definition, Real and Imaginary parts of a complex number, Polar and Cartesian representation of a complex number and conversion from one form to the other, conjugate of a complex number, modulus and argument of a complex number, addition, subtraction, multiplication and division of a complex number.

5. Statistics and Probability (13 hrs)

Evaluation of standard deviation and process capabilities. Rank, Rank correlation, probability: definition and laws on probability, concept of random variable, probability distribution (Binomial, Poisson and Normal) and their applications. Drawing control charts for average \( \bar{x} \) and range \( R \)
RECOMMENDED BOOKS

1. Applied Mathematics Vol. I by SS Sabharwal and Others by Eagle Prakashan, Jalandhar

2. Applied Mathematics Vol. II by SS Sabharwal and Others by Eagle Prakashan, Jalandhar


5. Applied Mathematics Vol. I by RD Sharma


1.3 APPLIED PHYSICS – I

RATIONALE

Applied physics includes the study of a large number of diverse topics all related to things that go in the world around us. It aims to give an understanding of this world both by observation and prediction of the way in which objects will behave. Concrete uses of physical principles and analysis in various fields of engineering and technology are given prominence in the course content.

DETAILED CONTENTS

1. Unit and Dimensions. (8 hrs)
   1.1 Physical quantities
   1.2 Fundamental and derived units
   1.3 Systems of unit (CGS, MKS and SI units)
   1.4 Dimensions and dimensional formulae of physical quantities (area, volume, velocity, acceleration, momentum, force, impulse, work, power, energy, surface tension, coefficient of viscosity and strain)
   1.5 Principle of homogeneity
   1.6 Dimensional equations and their uses with examples.
   1.7 Limitations of dimensional analysis.

2. Force and Motion (9 hrs + 6 hrs + 8 hrs)
   2.1 Scalar and vector quantities - examples, addition and multiplication of vectors, scalar product and vector product of vectors
   2.2 Force, resolution and composition of forces – resultant, parallelogram law of forces, friction, law of friction and type of friction.
2.3 Equilibrium of forces, Lamé’s theorem
2.4 Newton’s Laws of motion – concept of momentum, determination of force equation from Newton’s second law of motion, Newton’s third law of motion Conservation of momentum, impulse and impulsive forces, simple numerical problems.
2.5 Projectile, horizontal and oblique projections and equation of Trajectory (Derivation) Derivation of time of flight, maximum height and horizontal range
2.6 Circular motion (Definition)
   Relation between linear and angular velocity and linear acceleration and angular acceleration
2.7 Centripetal force (derivation) and centrifugal force Banking of roads.
2.8 Rotational Motion 6 hrs
   Definition of torque, moment of inertia, radius of gyration, Derivation of rotational kinetic energy and angular momentum, Conservation of angular momentum (qualitative) related problems.
2.9 Planetary Motion 8 hrs
   Newton’s law of gravitation, Kepler’s law of planetary motion, Escape velocity (derivation), Artificial satellites and related problems.

3. Work, Power and Energy (8 hrs)
3.1 Work: definition and its units.
3.2 Work done against friction in moving an object on horizontal and inclined plane (incorporating frictional forces)
3.3 Power: definitions and its units, calculation of power in simple cases.
3.4 Energy: Definitions and its units: Types: Kinetic energy and Potential energy, with examples and their derivation.
3.5 Principle of conservation of mechanical energy (for freely falling bodies), transformation of energy from one form to another and related problems.
4. Properties of Matter (9 hrs)
4.1 Elasticity, definition of stress and strain
4.2 Different types of modulus of elasticity
4.3 Pressure- its units, gauge pressure, absolute pressure, atmospheric pressure (Relation between them), Bourdon's pressure gauge, Fortin's barometer
4.4 Surface tension- its units, measurement of surface tension by capillary tube method, applications of surface tension, effect of temperature and impurity on surface tension.
4.5 Fluid motion, streamline and turbulent flow.
4.6 Viscosity and coefficient of viscosity, Effect of temperature on viscosity

5. Temperature and its measurement (8 hrs)
5.1 Difference between heat and temperature on the basis of K.E. of Molecules.
5.2 Principles of measurement of temperature and different scales of temperature.
5.3 Bimetallic and Platinum resistance thermometer: their merits and demerits
5.4 Pyrometers – Disappearing filament optical pyrometer

6. Transfer of Heat (8 hrs)
6.1 Modes of transfer of heat (conduction, convection and radiation with examples)
6.2 Coefficient of thermal conductivity
6.3 Properties of heat radiation. Prevost's theory of heat exchange
6.4 Laws of black body radiations: Stefan’s law, Kirchoff’s law, Wien’s law

LIST OF PRACTICALS
1. To find the thickness of wire using a screw gauge
2. To find volume of solid cylinder and hollow cylinder using a vernier caliper
3. To determine the thickness of glass strip and radius of curvature of a concave surface using a spherometer
4. To find the surface tension of a liquid by capillary rise method.
5. To determine the atmospheric pressure at a place using Fortin’s Barometer.
6. To determine the time period of simple pendulum and plot a graph between l & t
7. Verify parallelogram Law of forces.

RECOMMENDED BOOKS
1. Concept of Physics, Prof. H.C. Verma, Part-1 (Bharti Bhawan)
2. Concept of Physics, Prof. H.C. Verma, Part-2 (Bharti Bhawan)
3. A Text Book of Applied Physics : Egale Parkashan, Jullandhar
1.4 APPLIED CHEMISTRY-I

RATIONALE
The role of Chemistry and chemical products in every branch of engineering is expanding greatly. Now a days various products of chemical industries are playing important role in the field of engineering with increasing number of such products each successive years. The strength of materials, the chemical composition of substances, their behavior when subjected to different treatment and environment, and the laws of heat and dynamic energy have entered in almost every activity of modern life. Chemistry is considered as one of the core subjects for diploma students in engineering and technology for developing in them scientific temper and appreciation of chemical properties of materials, which they have to handle in their professional career. Effort should be made to teach this subject through demonstration and with the active involvement of students.

DETAILED CONTENTS
1. Language of Chemistry (6 hrs)
   1.1 Definition of symbol, formula, valency and chemical equation.
   1.2 Writing of the chemical formula of a simple chemical compound. Calculation of percentage composition of a chemical compound
   1.3 Essentials of a chemical equation, balancing of a chemical equation by Hit and Trial method

2. Atomic Structure (6 hrs)
Introduction to atom and its constituent particle, Dalton’s, Rutherford’s model.
Bohr’s model (postulates only), atomic number, mass number, isotopes, isobars, concept of atomic orbitals, shapes of S and P orbitals, quantum numbers, electronic configuration-Aufbau Principle, Hund’s rule and Pauli’s exclusion Principle, Hybridization (sp3, sp2 and sp).
3. Chemical Bonding (4 hrs)

3.1 Electronic concept of binding.

3.2 Elementary account of electrovalent, covalent and coordinate bond formation on the basis of the electronic concept of valency with the help of suitable examples to each.

3.3 Orbital concept of covalent bond, Sigma and Pi bond.

4. Water (10 hrs)

4.1 Hard and soft water, types of hardness and its causes, disadvantages of hardness of water (i) in industrial use (ii) in boilers for steam generation.

4.2 Methods to remove hardness of water (i) Soda Lime process (ii) Ion-Exchange process. Simple numerical problems related to soda lime process.

4.3 Definition of degree of hardness of water and the systems to express the degree of hardness of water, (Estimations method not included)

4.4 Qualities of water used for drinking purposes, treatment of river water to make it fit for town supply.

5. Solutions (8 hrs.)

5.1 Concept of homogeneous solution (i) Colloids (ii) Suspensions (iii) Brownian Movement (iv) Osmosis (v) Acidity (vi) Basicity (vii) Equivalent weight and gram equivalent weight with suitable examples (viii) Mole (ix) Avogadro number (x) pH (xi) Industrial application of pH

5.2 Strength of a solution (i) Normality (ii) Molarity (iii) Molality as applied in relation to a solution.

5.3 Simple numerical problems related to volumetric analysis.

6. Electrolysis (6 hrs)

6.1 Definition of the terms: Electrolytes, Non-electrolytes conductors and non-conductors with suitable examples

6.2 Faraday's Laws of Electrolysis

6.3 Simple numerical problems based upon the laws of electrolysis

6.4 Different industrial applications of 'Electrolysis'
6.5 Elementary account of (i) lead acid battery and (ii) Ni-Cd battery

**LIST OF PRACTICALS**
1. Volumetric analysis and study of apparatus used therein.
2. Preparation of standard solution of oxalic acid or potassium dichromate
3. Determine the strength of a given solution of sodium hydroxide with the help of a standard solution of oxalic acid
4. Determine the strength of solution of HCl with the help of a solution of NaOH and an intermediate solution of standard oxalic acid
5. Estimation of total alkalinity of water volumetrically
6. Determine, pH of water sample using pH meter

**RECOMMENDED BOOKS**
3. Engineering Chemistry by Dr. S. Rabin德拉 and Prof. B.K. Mishra; Kumar and Kumar Publishers (P) Ltd. Bangalore-40

**Other additional Books for Reading**
1. Engineering Chemistry by Jain PC and Jain M
2. Chemistry of Engineering by Aggarwal CV
3. Chemistry for Environmental Engineers by Swayer and McCarty, McGraw Hill, Delhi
4. Progressive Applied Chemistry –I and II by Dr. G.H. Hugar; Eagle Prakashan, Jalandhar
1.5 BASICS OF INFORMATION TECHNOLOGY

RATIONAL

Information technology has great influence on all aspects of life. Almost all workplaces and living environment are being computerized. In order to prepare diploma holders to work in these environments, it is essential that they are exposed to various aspects of information technology such as understanding the concept of information technology and its scope; operating a computer; use of various tools of MS office; using internet etc. form the broad competency profile of diploma holders. This exposure will enable the students to enter their professions with confidence, live in a harmonious way and contribute to the productivity.

Note:

1. Teaching of theory should be dovetailed with practical work
2. The following topics may be taught in the laboratory along with the practical exercises.

DETAILED CONTENTS

1. Information Technology – its concept and scope
2. Computers for information storage, information seeking, information processing and information transmission
3. Elements of computer system, computer hardware and software; data – numeric data, alpha numeric data; contents of a program, processing
4. Computer organization, block diagram of a computer, CPU, memory
5. Input devices; keyboard, mouse etc; output devices; VDU and Printer, Scanner, Plotter
6. Electrical requirements, inter-connections between units, connectors and cables
7. Secondary storage; magnetic disks – tracks and sectors, optical disk (CD and DVD Memory), primary and secondary memory: RAM, ROM, PROM etc., Capacity; device controllers, serial port, parallel port, system bus
8. Exercises on file opening and closing; memory management; device management and input – output (I/O) management with respect of windows
9. Installation concept and precautions to be observed while installing the system and software
10. Introduction about Operating Systems such as MS-DOS and Windows
11. Special features, various commands of MS word and MS-Excel
12. About the internet – server types, connectivity (TCP/IP, shell); applications of internet like: e-mail and browsing
13. Various Browsers like WWW (World wide web); hyperlinks; HTTP (Hyper Text Transfer Protocol); FTP (File Transfer Protocol)

LIST OF PRACTICALS
1. Given a PC, name its various components and list their functions
2. Identification of various parts of a computer and peripherals
3. Practice in installing a computer system by giving connection and loading the system software and application software
4. Installation of DOS and simple exercises on TYPE, REN, DEL, CD, MD, COPY, TREE, BACKUP commands
5. Exercises on entering text and data (Typing Practice)
6. Installation of Windows 98 or 2000 etc.
   (1) Features of Windows as an operating system
       - Start
- Shutdown and restore
- Creating and operating on the icons
- Opening closing and sizing the windows
- Using elementary job commands like – creating, saving, modifying, renaming, finding and deleting a file
- Creating and operating on a folder
- Changing setting like, date, time color (background and foreground)
- Using short cuts
- Using on line help

7. MS-WORD
- File Management:
  Opening, creating and saving a document, locating files, copying contents in some different file(s), protecting files, Giving password protection for a file
- Page Set up:
  Setting margins, tab setting, ruler, indenting
- Editing a document:
  Entering text, Cut, copy, paste using tool-bars
- Formatting a document:
  Using different fonts, changing font size and colour, changing the appearance through bold/italic/underlined, highlighting a text, changing case, using subscript and superscript, using different underline methods
- Aligning of text in a document, justification of document, inserting bullets and numbering
- Formatting paragraph, inserting page breaks and column breaks
- Use of headers, footers: Inserting footnote, end note, use of comments
- Inserting date, time, special symbols, importing graphic images, drawing tools
- Tables and Borders:
  Creating a table, formatting cells, use of different border styles, shading in tables, merging of cells, partition of cells, inserting and deleting a row in a table
- Print preview, zoom, page set up, printing options
- Using Find, Replace options
- Using Tools like:
  Spell checker, help, use of macros, mail merge, thesaurus word content and statistics, printing envelopes and tables
- Using shapes and drawing toolbar,
- Working with more than one window in MS Word,
- How to change the version of the document from one window OS to another
- Conversion between different text editors, software and MS word

8. MS-EXCEL
- Starting excel, open worksheet, enter, edit, data, formulas to calculate values, format data, create chart, printing chart, save worksheet, switching from another spreadsheet
- Menu commands:
  create, format charts, organise, manage data, solving problem by analyzing data, exchange with other applications. Programming with MS-Excel, getting information while working
- Workbooks:
  Managing workbooks (create, open, close, save), working in workbooks, selecting the cells, choosing commands, data entry techniques, formula creation and links, controlling calculations, working with arrays
- Editing a worksheet, copying, moving cells, pasting, inserting, deletion cells,
rows, columns, find and replace text, numbers of cells, formatting worksheet
- Creating a chart:
  Working with chart types, changing data in chart, formatting a chart, use chart to analyze data
- Using a list to organize data, sorting and filtering data in list
- Retrieve data with MS – query: Create a pivot table, customising a pivot table. Statistical analysis of data
- Customise MS-Excel:
  How to change view of worksheet, outlining a worksheet, customise workspace, using templates to create default workbooks, protecting work book
- Exchange data with other application: linking and embedding, embedding objects, linking to other applications, import, export document.

9. Internet and its Applications
   a) Log-in to internet
   b) Navigation for information seeking on internet
   c) Browsing and downloading of information from internet
   d) Sending and receiving e-mail
      - Creating a message
      - Creating an address book
      - Attaching a file with e-mail message
      - Receiving a message
      - Deleting a message
RECOMMENDED BOOKS

1. Fundamentals of Computer by V Rajaraman; Prentice Hall of India Pvt. Ltd., New Delhi
2. Computers Today by SK Basandara, Galgotia publication Pvt ltd. Daryaganj, New Delhi
4. Internet for Everyone by Alexis Leon and Mathews Leon; Vikas Publishing House Pvt. Ltd., Jungpura, New Delhi
5. A First Course in Computer by Sanjay Saxena; Vikas Publishing House Pvt. Ltd., Jungpura, New Delhi
7. Computer Fundamentals by PK Sinha; BPB Publication, New Delhi
1.6 ENGINEERING DRAWING – I

RATIONALE

Drawing is said to be the language of engineers and technicians. Reading and interpreting engineering drawing is their day-to-day responsibility. The course is aimed at developing basic graphic skills so as to enable them to use these skills in preparation of engineering drawings, their reading and interpretation.

Note: 1. First angle projection is to be followed
2. Minimum of 15 sheets to be prepared by each student
3. SP 46 – 1988 should be followed
4. Instruction relevant to various drawings may be given along appropriate demonstration, before assigning drawing practice

Students

DETAILED CONTENTS

1. Drawing Office Practice
   1.1 Drawing instruments
   1.2 Sizes and layout of standard drawing sheets
   1.3 Sizes of drawing boards
   1.4 Drafting table/board

2. Different types of Lines and Free Hand Sketching (1 sheet)
   2.1 Different types of lines in engineering drawing as per BIS specifications
   2.2 Practice in free hand sketching of vertical, horizontal and inclined lines, geometrical figures such as triangles, rectangles, small and large circles, parabolas, curves and ellipses

3. Lettering Techniques and Practice (2 sheets)
   3.1 Instrumental single stroke (capital and inclined) lettering of 35 mm height in the ratios of 7:4
3.2 Instrumental double stroke lettering of 35 mm height in the ratio of 7:4, vertical

3.3 Free hand lettering (alphabet and numerals) lower case and upper case, single stroke vertical and inclined at 75 degree in different standard series of 2.5, 3, 5, 7, 10, and 15 mm heights in the ratio of 7:4

4. Dimensioning (1 sheet)

4.1 Necessity of dimensioning, terms and notations – methods and principles, dimensioning small components as in 4.2 below (mainly theoretical instructions)

4.2 Dimensioning of overall sizes, circles, thread holes, chamfered surfaces, angles, tapered surface holes equally spaced on PCD, counter sunk hole counter bored holes, cylindrical parts, narrow space and gaps, radii, curves and arches – chain and parallel dimensioning

5. Scale (3 sheets)

5.1 Scales – their need and importance, Definition of representative fraction (RF); Find RF of a given scale

5.2 Types of scales

5.3 Construction of plain and diagonal scales

6. Principle of Projections (strictly in first angle projection) (8 sheets)

6.1 Principle of orthographic projection

6.2 Projection of points situated in different quadrants

6.3 Projection of lines, Lines inclined to one plane and parallel to the other and vice versa

6.4 Projection of Planes: Planes perpendicular and parallel to either of the planes; planes perpendicular to one plane and parallel to the other or vice versa

6.5 Projection of solids, such as Prism, Cube, Cylinder and Cones with axis perpendicular to horizontal plane or parallel to horizontal plane/vertical plane or both
6.6 Drawing 3 orthographic views of given objects (at least five objects)
6.7 Drawing 6 views of given objects (non-symmetrical one or two objects may be selected for this exercise)
6.8 Identification of surfaces on drawn orthographic views from isometric object drawn
6.9 Exercises on missing lines, surfaces and views
6.10 Sketching practice of pictorial views from isometric objects

7. Sectional Views (2 sheets)
   Need for sectional views – cutting planes methods of representing sections, conventional sections of various material, classification of sections, conventions in sectioning
   Drawing of full section, half section, partial broken out sections, off-set sections, revolved sections and removed sections. Exercises on sectional views of different isometric views
   Drawing of different conventions for materials in section, conventional breaks for shafts, pipes, rectangular, square, angle, channel, rolled sections

8. Isometric Views (2 sheets)
8.1 Fundamentals of isometric projections (theoretical instructions)
8.2 Isometric views from 2 or 3 given orthographic views

9. Introduction to Third angle projection (1 sheet)

Note: Minimum 15 drawing sheets will be prepared by the students

RECOMMENDED BOOKS
1. Elementary Engineering Drawing (in first angle projection) by ND Bhatt, Charotar Publishing House
2. A Text Book of Engineering Drawing by Surjit Singh published by Dhanpat Rai and Co., Delhi
3. Engineering Drawing by PS Gill published by SK Kataria and sons, Delhi
1.7 GENERAL WORKSHOP PRACTICE – I & II

RATIONAL

Manual abilities to handle engineering materials with hand tools need to be developed in the students. They will be using different types of tools/equipment in different shops for fabrication purposes. Besides developing the necessary skills, the students will appreciate the importance of quality and safety measures.

DETAILED CONTENTS

Note: 1. 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.

2. The shops to be offered in I and II semester may be decided at polytechnic level

3. The students should be taken to various shops (not included in the curriculum) in the polytechnic in batches and should be given knowledge of the various machines/equipment. Such as machine shop, foundry shop, sheet metal shop, etc.

4. Students of Diploma in Chemical Engineering will undergo Shops 1 to 6 only

Following seven shops are being proposed:

1. Carpentry shop
2. Fitting and plumbing shop
3. Welding shop
4. Paint shop
5. Forging and sheet metal shop
6. Electric shop
7. Electronics Shop

1. Carpentry Shop
1.1 Introduction to various types of wood, carpentry tools - their identification with sketches. Different types of wood joints.
1.2 Simple operations viz. hand sawing, marking, planning
1.3 Introduction and sharpening of wood working tools and practice of proper adjustment of tools
1.4 Demonstration and use of wood working machines i.e. band saw, circular saw, rip saw, bow saw and trammels. Universal wood working machine and wood turning lathe
1.5 Making of various joints (Also draw the sketches of various wooden joints in the Practical Note Book)
   a) Cross lap joint
   b) T-lap joint
   c) Corner lap joint
   d) Mortise and tenon joint
   e) Dovetail joint
   f) Prepare a file handle or any utility items by wood turning lathe

2. Fitting and Plumbing Shop
2.1. Introduction to fitting shop, common materials used in fitting shop, description and demonstration of various types of work-holding devices and surface plate, V-block
2.2. Demonstration and use of simple operation of hack-sawing, demonstration of various types of blades and their uses
2.3 Demonstrate and use of all important fitting shop tools with the help of neat sketches (files, punch, hammer, scraper, taps and dyes etc.)

2.4 Introduction of chipping, demonstration on chipping and its applications.
Demonstration and function of chipping tools.

2.5 Description, demonstration and practice of simple operation of hack saw, straight and angular cutting.

2.6 Demonstrations, description and use of various types of blades - their uses and method of fitting the blade.

2.7 Introduction and use of measuring tools used in fitting shop like: Try square, Steel rule, Measuring Tape, Outside micrometer, Vernier Caliper and Vernier Height Gauge

2.8 Description, demonstration and practice of thread cutting using taps and dies

2.9 Plumbing: Descriptions and drawing of various plumbing shop tools, Safety precautions. Introduction and demonstration of pipe dies, Pipe holding devices, Demonstration and practice of Pipe Fittings such as Sockets, Elbow, Tee, Reducer, Nipple, Union coupling, plug, Bend, Float valves and Taps

Job: Cutting and filing practice on a square of 45 X 45 mm² from MS flat
Job: Angular cutting practice of 45° (on the above job)
Job: Preparation of stud (to cut external threads) with the help of dies (mm or BSW)
Job: Drilling, counter drilling and internal thread cutting with Taps
Job: H-Fitting in Mild steel [ms] square
Job: Pipe cutting practice and thread cutting on GI Pipe with pipe dies

3. **Welding Shop**

3.1 Introduction to welding, type of welding, common materials that can be welded, introduction to gas welding equipment, types of flame, adjustment of flame, applications of gas welding, Welding tools and safety precautions
3.2 Introduction to electric arc welding (AC and DC), practice in setting current and voltage for striking proper arc, precautions while using electric arc welding.
Applications of arc welding. Introduction to polarity and their use.

3.3 Introduction to brazing process, filler material and fluxes; applications of brazing. Use of solder. Introduction of soldering materials.

3.4 Demonstrate and use of the different tools used in the welding shop with sketches. Hand shield, helmet, clipping hammer, gloves, welding lead, connectors, apron, goggles etc.

3.5 Demonstration of welding defects and Various types of joints and end preparation.

Job: Preparation of cap joint by arc welding
Job: Preparation of Tee joint by arc welding
Job: Preparation of single V or double V butt joint by using Electric arc welding
Job: Brazing Practice. Use of Speltor (on MS sheet pieces)
Job: Gas welding practice on worn-out and broken parts

4. Paint Shop
Introduction of painting shop and necessity. Different types of paints. Introduction of powder coating plant and their uses.

Job: Preparation of surface before painting such as cleaning, sanding, putty, procedure and application of primer coat, and painting steel item.
Job: Painting practice by brush on MS sheet
Job: Practice of dip painting
Job: Practice of lettering: Name plates / Sign board
Job: Polishing and painting on wooden and metallic surfaces
Job: Practical demonstration of powder coating
5. **Forging and sheet metal shop**

Introduction to forging, forging tools, tongs, blowers/pressure blowers, hammers, chisels, punch, anvil, swag-block etc. Forging operations.

5.1 Forge a L hook or Ring from MS rod 6 mm φ

5.2 Forge a chisel and give an idea of hardening and tempering

5.3 Lap joint with forge welding

5.4 High Strength Steel (HSS) tools – forging of Lathe shaper tools like side-tools and V-shape tools

5.5 Making sheet metal joints

5.6 Making sheet metal trey or a funnel or a computer chassis

5.7 Preparation of sheet metal jobs involving rolling, shearing, creasing, bending and cornering

5.8 Prepare a lap riveting joint of sheet metal pieces

6. **Electric Shop**

6.1 Demonstration of tools commonly used in Electric Shop

6.2 Safety precautions, electric shock treatment

6.3 Demonstration of Common Electric material like: wires, fuses, ceiling roses, battens, cleats and allied items

6.4 Demonstration of Voltmeter, Ammeter, Multimeter and Energy meter

Job: Wiring practice in batten wiring, plastic casing-capping and conduit

Job: Control of one lamp by one switch

Job: Control of one lamp by two switches Job: Control of one bell by one switch

Job: Assemble a Tube light

Job: Dismantle, study, find out fault, repair the fault, assemble and test domestic appliances like electric iron, electric mixer, ceiling and table fan, tube-light, water heater (geyser) and desert cooler

Job: Laying out of complete wiring of a house (Single-phase and Three-phase)

7. **Electronics Shop**
7.1 Identification, familiarization, demonstration and use of the following electronic instruments:
   a) Multi-meter digital
   b) Single beam simple CRO, function of every knob on the front panel
   c) Power supply, fixed voltage and variable voltage, single output as well as dual output.

7.2 Identification, familiarization and uses of commonly used tools; active and passive components; colour code and types of resistor and potentiometers

7.3 Cut, strip, join and insulate two lengths of wires/cables (repeat with different types of cables/wires)

7.4 Demonstrate and practice the skill to remove components/wires by unsoldering

7.5 Cut, bend, tin component, leads, inserts. Solder components e.g. resistor, capacitor, diodes, transistors on a PCB

7.6 Wiring of a small circuit on a PCB/tag strip involving laying, sleeving and use of identifier tags

7.7 Demonstrate the joining (or connecting) methods/mounting and dismantling method, as well as uses of the items mentioned below:
   a) Various types of plugs, sockets, connectors suitable for general-purpose audio video use. Some of such connectors e.g. 2 and 3 pin mains plug and sockets, Banana plugs, sockets and similar male and female connectors and terminal strips.
   b) Various types of switches such as: normal/miniature toggle, slide, push button piano key, rotary, SPST, SPDT, DPST, DPDT, band selector, multi-way Master Mains Switch

7.8 Exposure to modern soldering and de-soldering processes (Field visits)

7.9 De-solder pump, remove and clean all the components and wires from a given equipment, a PCB or a tag strip.
2.1 COMMUNICATING EFFECTIVELY IN ENGLISH
II SEMESTER SYLLABUS

RATIONALE

Interpersonal communication is a natural and necessary part of organizational life. Yet communicating effectively can be challenging because of our inherent nature to assume, overreact to and misperceive what actually is happening. Poor or lack of communication is often cited as the cause of conflict and poor teamwork. In today’s team-oriented workplace, managing communication and developing strategies for creating shared meaning are crucial to achieving results and creating successful organizations. The goal of the Communicating Effectively in English course is to produce civic-minded, competent communicators. To that end, students must demonstrate oral as well as written communication proficiency. These include organizational and interpersonal communication, public address and performance.

II SEMESTER   48 hrs

1. LISTENING COMPREHENSION 4hrs
1.1 Locating Main Ideas in a Listening Excerpt
1.2 Note-taking

2. ORAL COMMUNICATION SKILLS  14 hrs
2.1 Offering-Responding to Offers
2.2 Requesting-Responding to Requests
2.3 Congratulating
2.4 Expressing Sympathy and Condolences
2.5 Expressing Disappointments
2.6 Asking Questions-Polite Responses
2.7 Apologizing, forgiving
2.8 Complaining
2.9 Persuading
2.10 Warning
2.11 Asking For and Giving Information
2.12 Giving Instructions
2.13 Getting and Giving Permission
2.14 Asking For and Giving Opinions
3. GRAMMAR AND USAGE

3.1 Prepositions
3.2 Pronouns
3.3 Determiners
3.4 Conjunctions
3.5 Question and Question Tag
3.6 Tenses (Simple Present, Simple Past)

*One chapter revising the topics discussed during the first semester. (Punctuation, Articles, Framing questions, Verbs, Word formation)

4. WRITING SKILLS

4.1 Writing Notice
4.2 Writing Circular
4.3 Writing a Memo
4.4 Agenda for a Meeting
4.5 Minutes of the Meeting
4.6 Telephonic Messages

*Writing a paragraph will be a continuous exercise throughout the session. (Writing will be based on verbal stimuli, tables and graphs.)

5. READING SKILLS

5.1 Vocabulary Enhancement
5.2 Techniques of reading: Skimming, Scanning, Intensive and Extensive Reading

NOTE: The Reading Skills of the learners (along with vocabulary enhancement) will be through reading thematic articles/essays and/or stories.
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2.2 APPLIED MATHEMATICS-II

RATIONALE

Applied Mathematics forms the backbone of engineering discipline. Basic elements of differential calculus, integral calculus, differential equations and coordinate geometry have been included in the curriculum as foundation course and to provide base for continuing education to the students.

DETAILED CONTENTS

1. Co-ordinate Geometry (18 hrs)
   1.1 Area of a triangle, centroid and incentre of a triangle (given the vertices of a triangle), Simple problems on locus
   1.2 Equation of straight line in various standard forms (without proof) with their transformation from one form to another, Angle between two lines and perpendicular distance formula (without proof)
   1.3 Circle: General equation and its characteristics given:
      ¾ The center and radius
      ¾ Three points on it
      ¾ The co-ordinates of the end’s of the diameter
   1.4 Conics (parabola, ellipse and hyperbola), standard equation of conics (without proof), given the equation of conic to calculate foci, directrix, eccentricity, latus rectum, vertices and axis related to different conics

2. Differential Calculus (22 hrs)
   2.1 Concept of function, four standard limits
      \[
      \lim_{x \to a} \frac{x^n - a^n}{x - a}, \lim_{x \to 0} \frac{\sin x}{x}, \lim_{x \to 0} \frac{(a^x - 1)}{x}, \lim_{x \to 0} (1+x)^{1/x}
      \]
   2.2 Concepts of differentiation and its physical interpretation
      ¾ Differentiation by first principle of \(x^n\), \((ax + b)^n\), \(\sin x\), \(\cos x\), \(\tan x\), \(\sec x\), \(\cosec x\) and \(\cot x\), \(e^x\), \(a^x\), \(\log x\). Differentiation of a function of a function and explicit and implicit functions
      ¾ Differentiation of sum, product and quotient of different functions
      ¾ Logarithmic differentiation. Successive differentiation excluding \(n^{th}\) order
   2.3 Application of derivatives for (a) rate measure (b) errors (c) real root by Newton’s method (d) equation of tangent and normal (c)
finding the maxima and minima of a function (simple engineering problems)

3. Integral Calculus (16 hrs)

3.1 Integration as inverse operation of differentiation

3.2 Simple integration by substitution, by parts and by partial fractions

3.3 Evaluation of definite integrals (simple problems) by explaining the general properties of definite integrals

3.4 Applications of integration for
   ¾ Simple problem on evaluation of area under a curve where limits are prescribed
   ¾ Calculation of volume of a solid formed by revolution of an area about axis (simple problems) where limits are prescribed
   ¾ To calculate average and root mean square value of a function
   ¾ Area by Trapezoidal Rule and Simpson’s Rule

4. Differential Equations (8 hrs)

Solution of first order and first degree differential equation by
   ¾ Variable separation
   ¾ Homogeneous differential equation and reducible Homogeneous differential equations
   ¾ Linear differential equations and reducible linear differential equations

RECOMMENDED BOOKS

1. Higher Engineering Mathematics by BS Grewal
2. Engineering Mathematics by BS Grewal
4. Engineering Mathematics by Ishan Publication
5. Applied Mathematics Vol. II by SS Sabharwal and Others; Eagle Parkashan, Jalandhar
6. Engineering Mathematics by IB Prasad
7. Applied Mathematics Vol. II by Dr RD Sharma
2.3 APPLIED PHYSICS

RATIONALE

Applied physics includes the study of a large number of diverse topics related to things that go in the world around us. It aims to give an understanding of this world both by observation and prediction of the way in which objects behave. Concrete use of physical principles and analysis in various fields of engineering and technology are given prominence in the course content.

DETAILED CONTENTS

1. Waves and vibrations

1.1 Waves, Generation of waves by vibrating particles.
1.2 Types of wave motion, transverse and longitudinal wave motion with examples
1.3 Relation between velocity of wave, frequency and wave length of a wave \((v = \frac{\eta}{\lambda})\)
1.4 Simple harmonic motion: definition, expression for displacement, velocity, acceleration, time period, frequency in S.H.M.
1.5 Vibration of spring mass system, cantilever and determination of their time period.
1.6 Free, forced and resonant vibrations with examples

2. Applications of sound waves

2.1 Acoustics of buildings-reverberation, reverberation time, echo, noise, coefficient of absorption of sound, methods to control reverberation
2.2 Ultrasonics-Methods of production (magnetostriction and piezoelectric) and their engineering applications to cold welding, drilling, cleaning, flaw detection and SONAR

3. Principles of optics

3.1 Review of concept of mirrors, lenses, reflection & refraction of light, refractive index, lens formula (no derivation), real and virtual image, magnification.
3.2 Power of lens
3.3 Simple and compound microscope, astronomical telescope, magnifying power and its calculation (in each case)
3.4 Total internal reflection, critical angle and conditions for total internal reflection.

4. Electrostatics (10 hrs)

4.1 Coulomb’s law, unit charge
4.2 Gauss’s Law
4.3 Electric field intensity and electric potential
4.4 Electric field of point charge, charged sphere, straight charged conductor,
plane charged sheet
4.5 Capacitance, types of capacitors, capacitance of parallel plate capacitor, series and parallel combination of capacitors
4.6 Dielectric and its effect on capacitors, dielectric constant and dielectric

5. **Current Electricity** *(8 hrs)*
5.1 Ohm’s law
5.2 Resistance of a conductor, specific resistance, series and parallel combination of resistors, effect of temperature on resistance
5.3 Kirchhoff’s laws, Wheatstone bridge principle and its applications
5.4 Heating effect of current and concept of electric power

6. **Semi-conductor physics** *(8 hrs)*
6.1 Energy bands, intrinsic and extrinsic semi-conductor, p-n junction diode and its characteristics
6.2 Diode as rectifier-half wave and full wave rectifier, semi conductor transistor pnp and npn (concept only)

7. **Modern Physics** *(9 hrs)*
7.1 Lasers: concept of energy levels, ionizations and excitation potentials; spontaneous and stimulated emission; lasers and its characteristics, population inversion, types of lasers, ruby laser and applications
7.3 Fiber optics: Introduction and applications
7.4 Super conductivity: Phenomenon of super conductivity, Type I and Type II super conductor and its applications

**LIST OF PRACTICALS**
1. To determine and verify the time period of cantilever by drawing graph between load and depression
2. To determine the magnifying power of a compound microscope
3. To determine the magnifying power of an astronomical telescope
4. To verify Ohm’s law
5. To verify law of resistances in series
6. To verify law of resistances in parallel
7. To convert a galvanometer into an ammeter of given range
8. To convert a galvanometer into a voltmeter of given range

**RECOMMENDED BOOKS**
1. Concept of Physics Prof. H.C. Verma, Part-1 (Bharti Bhawan)
2. Concept of Physics, Prof. H.C. Verma, Part-2 (Bharti Bhawan)
3. A Text Book of Applied Physics: Egale Parkashan, Jullandhar
2.4 APPLIED CHEMISTRY – II

RATIONALE

The role of Chemistry and chemical products in every branch of engineering is expanding greatly. Now a day's various products of chemical industries are playing important role in the field of engineering with increasing number of such products each successive years. The strength of materials, the chemical composition of substances, their behavior when subjected to different treatment and environment, and the laws of heat and dynamic energy have entered in almost every activity of modern life. Chemistry is considered as one of the core subjects for diploma students in engineering and technology for developing in them scientific temper appreciation of chemical properties of materials, which they have to handle in their professional career. Effort should be made to teach this subject through demonstration and with the active involvement of students.

DETAILED CONTENTS

1. Metallurgy (10 hrs)
   1.1 A brief introduction of the terms: Metallurgy (types), mineral, ore, gangue or matrix, flux, slag, concentration (methods of concentrating the ores), roasting calcination and refining as applied in relation to various metallurgical operations.
   1.2 Metallurgy of (i) Aluminium (ii) Iron (iii) copper with their physical and chemical Properties.
   1.3 Definition of an alloy, purposes of alloying, composition, properties and uses of alloys-brass, bronze, monel metal, magnalium, duralumin.

2. Fuels (10 hrs)
   2.1 Definition of a 'Fuel', characteristics of a good fuel and classification of fuels with suitable examples
   2.2 Definition of Calorific value of a fuel and determination of calorific value of a liquid fuel with the help of Bomb calorimeter. Simple numerical problems based upon Bomb-calorimeter method of finding the Calorific values
   2.3 Brief description of 'Proximate' and 'Ultimate' analysis of a fuel. Importance of conducting the proximate and ultimate analysis of a fuel
   2.4 Qualities of a good fuel and merits of gaseous fuels over those of other varieties of fuels
   2.5 Manufacture, composition, properties and uses of (i) Water gas (ii) Oil gas (iii) Biogas (iv) LPG (V) CNG
3 Corrosion (3 hrs)
3.1 Meaning of the term ‘corrosion’ and its definition
3.2 Theories of corrosion i.e.
   (i) direct chemical action theory and
   (ii) electro chemical theory
3.3 Prevention of corrosion by
   1. (a) Alloying
   (b) Providing metallic coatings
   2. Cathodic protections: (a) Sacrificial
   (b) Impressed voltage method

4 Lubricants (4 hrs)
4.1 Definition of (i) lubricant (ii) lubrication
4.2 Classification of lubricants
4.3 Principles of lubrication
   (i) fluid film lubrication
   (ii) boundary lubrication
   (iii) extreme pressure lubrication
4.4 Characteristics of a lubricant such as viscosity, viscosity index, volatility oiliness, acidity, emulsification, flash point and fire point and pour point.

5. Classification and Nomenclature of Organic Compounds (7 hrs)
5.1 Homologous series
5.2 IUPAC Nomenclature of Hydrocarbons, Alcohols, Aldehydes and Ketones & Carboxylic acids
5.3 Hydrocarbons (Alkanes, Alkenes and Alkynes)-general preparation, Chemical properties and uses.
5.4 Alcohols (Diols and Triols not included)-general preparation, Chemical properties and uses.
5.5 Aldehydes and Ketones preparation properties and uses.
5.6 Monocarboxlic acids-general preparation, chemical properties and uses

6 Rubber and Polymers (2 hrs)
6.1 Definition of Rubber and Polymers
6.2 Types of Rubber
6.3 Classification of Polymers
6.4 Composition and uses of Polythene, PVC, Teflon, Bakelite.
LIST OF PRACTICALS

1. Gravimetric analysis and study of apparatus used there in
2. To determine the percentage composition of a mixture consisting of a volatile and a non-volatile substances
3. Determine the viscosity of a given oil with the help of “Redwood viscometer”
4. Estimate the amount of ash in the given sample of coal
5. Determination of copper in the given brass solution, or sample of blue vitriol volumetrically
6. Electroplate the given strip of Cu with Ni
7. Detection of organic compounds (Aldehydes, Ketones, Carboxylic acid, and Amines)

RECOMMENDED BOOKS

1. “A Text Book of Applied Chemistry-1” by SS Kumar; Tata McGraw Hill, Delhi
3. Engineering Chemistry by Dr. S. Rabindra and Prof. B.K. Mishra; Kumar and Kumar Publishers (P) Ltd. Bangalore-40

Other additional books for reading

1. Engineering Chemistry by Jain PC and Jain M
2. Chemistry of Engineering by Aggarwal CV
3. Chemistry for Environmental Engineers by Swayer and McCarty, McGraw Hill, Delhi
4. Progressive Applied Chemistry –I and II by Dr. G.H. Hugar; Eagle Prakashan, Jalandhar
2.5 APPLIED MECHANICS

RATIONALE

The subject Applied Mechanics deals with basic concepts of mechanics like laws of forces, moments, friction, centre of gravity, laws of motion and simple machines which are required by the students for further understanding of other allied subjects. The subject enhances the analytical ability of the students.

DETAILED CONTENTS

1. Introduction (6 hrs)
   1.1 Concept of engineering mechanics, definition of mechanics, statics, dynamics, application of engineering mechanics in practical fields
   1.2 Concept of rigid body

2. Laws of forces (6 hrs)
   2.1 Different force systems (coplanar and non-coplanar), principle of transmissibility of forces
   2.2 Parallelogram law of forces, triangle law of forces, polygon law of forces (graphically and analytically) resolution of forces, resolving a force into two rectangular components
   2.3 Free body diagram
   2.4 Equilibrium force and its determination
   2.5 Lami’s theorem

3. Moment (6 hrs)
   3.1 Concept of moment
   3.2 Moment of a force and units of moment
   3.3 Varignon’s theorem (definition only)
   3.4 Principle of moment and its applications
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<td>4.1</td>
<td>Definition and concept of friction, types of friction</td>
</tr>
<tr>
<td>4.2</td>
<td>Laws of static friction, coefficient of friction, angle of friction, angle of repose, cone of friction</td>
</tr>
<tr>
<td>4.3</td>
<td>Equilibrium of a body lying on a horizontal plane, equilibrium of a body lying on a rough inclined plane, friction in simple screw jack</td>
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<tr>
<td>4.4</td>
<td>Calculation of least force required to maintain equilibrium of a body on a rough inclined plane subjected to a force:</td>
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<tr>
<td></td>
<td>a) acting along the inclined plane</td>
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<td></td>
<td>b) horizontally</td>
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<td></td>
<td>c) at some angle with the inclined plane</td>
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<tr>
<td>5.</td>
<td>Centre of Gravity (6 hrs)</td>
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<tr>
<td>5.1</td>
<td>Concept, definition of center of gravity and centroid of plain figure and symmetrical solid body</td>
</tr>
<tr>
<td>5.2</td>
<td>Determination of centroid of plain and composite lamina using moment method, centroid of bodies with removed portion</td>
</tr>
<tr>
<td>5.3</td>
<td>Determination of center of gravity of solid bodies - cone, cylinder, hemisphere and sphere; composite bodies and bodies with portion removed</td>
</tr>
<tr>
<td>6.</td>
<td>Application of the laws of motion (10 hrs)</td>
</tr>
<tr>
<td></td>
<td>Simple problems on second law of motion, piles, lift, bodies tied with strings</td>
</tr>
<tr>
<td>7.</td>
<td>Simple machines (8 hrs)</td>
</tr>
<tr>
<td>7.1</td>
<td>Definition of effort, velocity ratio, mechanical advantage and efficiency of a machine and their relationship, law of machine</td>
</tr>
</tbody>
</table>
7.2 Simple and compound machine
7.3 Definition of ideal machine, reversible and self locking machine
7.4 Effort lost in friction, determination of maximum mechanical advantage and maximum efficiency
7.5 System of pulley (first, second, third system of pulleys), determination of velocity ratio, mechanical advantage and efficiency
7.6 Working principle and application of wheel and axle, different pulley blocks, simple screw jack, worm and worm wheel, single and double purchase winch crab, expression for their velocity ratio and field of their application

Note: Simple problem/numericals may be included in all the above topics wherever feasible

LIST OF PRACTICALS

1. Verification of the following laws:
   a) Parallelogram law of forces
   b) Triangle law of forces
   c) Polygon law of forces

2. To verify the forces in different members of a jib crane

3. To verify the reaction at the supports of a simply supported beam

4. To find the mechanical advantage, velocity ratio and efficiency in case of an inclined plane

5. To find the mechanical advantage, velocity ratio and efficiency of a screw jack

6. To find the mechanical advantage, velocity ratio and efficiency of worm and worm wheel

7. To find mechanical advantage, velocity ratio and efficiency of single purchase winch crab

8. To find center of gravity of regular lamina

9. To find center of gravity of irregular lamina

10. To determine coefficient of friction between different surfaces on horizontal plane
RECOMMENDED BOOKS


2. Text Book in Applied Mechanics by MM Malhotra, R Subramanian, PS Gahlot and BS Rathore; Wiley Eastern Ltd., New Delhi


7. Elements of Strength of Materials by SP Timoshenko, DH Young; East West Press Pvt Ltd.


9. A Text Book of Applied Mechanics by NL Arora and RK Dhawan; India Publishing House, Delhi

10. A Text Book of Applied Mechanics by RK Rajput; Laxmi Publications, New Delhi

2.6 ENGINEERING DRAWING – II

RATIONAL

Drawing is said to be the language of engineers and technicians. Reading and interpreting engineering drawing is their day-to-day responsibility. The course is aimed at developing basic graphic skills so as to enable them to use these skills in preparation of engineering drawings, their reading and interpretation.

Note: 1. First angle projection is to be followed
2. Minimum of 15 sheets to be prepared by each student
3. SP 46 – 1988 should be followed
4. Instructions relevant to various drawings may be given along with Students

DETAILED CONTENTS

1. Detail and Assembly Drawing (2 sheets)
   1.1 Principle and utility of detail and assembly drawings
   1.2 Wooden joints i.e. corner mortice and tenon joint, Tee halving joint, Mitre faced corner joint, Tee bridle joint, Crossed wooden joint, Cogged joint, Dovetail joint, Through Mortice and Tenen joint, Corner and Through halving joint, Closed Mortise and Tenon joint

2. Threads (3 sheets)
   2.1 Nomenclature of threads, types of threads (metric), single and multiple start threads
   2.2 Forms of various external thread sections such as V, square and acme threads, BA, BSW and Knuckle, Metric, Seller Thread, Buttress Threads
   2.3 Simplified conventions of left hand and right hand threads, both external and internal threads

3. Locking Devices (1 sheet)
   Lock nuts, castle nuts, split pin nuts, sawn nuts, slotted nut

4. Nuts and Bolts (3 sheets)
   Different views of hexagonal and square nuts; Different views of hexagonal and square nuts; Assembly of hexagonal headed, square headed, square headed with square neck bolts with hexagonal and square nuts and washers. Foundations bolts
   - Rag bolt and Lewis bolt
5. Screws, Studs and Washers (1 sheet)
   5.1 Drawing various types of machine screws
   5.2 Drawing various types of studs and set screws

6. Keys and Cotters (3 sheets)
   6.1 Various types of keys and cotters and their practical application and preparation of drawing of various keys and cotters showing keys and cotters in position
   6.2 Cotter joints (i) sleeve and cotter joint (ii) gib and cotter joint (iii) knuckle joint (iv) Spigot and socket joint

7. Rivets and Riveted Joints (2 sheets)
   7.1 Types of structural and general purpose rivet heads
   7.2 Caulking and fullering of riveted joints
   7.3 Types of riveted joints – lap, butt (single riveted, double riveted lap joint, single cover plate and double cover plate), chain and zig – zag riveting

8. Welded Joints (1 sheet)
   8.1 Various conventions and symbols of welded joints (IS 696)
   8.2 Practical applications of welded joints say joints on steel frames, windows, doors and furniture

9. Couplings (2 sheets)
   9.1 Muff or Box coupling, half lap muff coupling
   9.2 Flange coupling (Protected and non-protected)
   9.3 Flexible coupling
10. Symbols and Conventions (2 sheets)
   10.1 Civil engineering sanitary fitting symbols
   10.2 Electrical fitting symbols for domestic interior installations
   10.3 Building plan drawing with electrical and civil engineering symbols

11. Development of Surfaces (3 sheets)
   11.1 Construction of geometrical figures such as square, pentagon, hexagon
   11.2 Development of surfaces of cylinder, square, pentagonal and hexagonal, Prism, Conc and Pyramid, Sequence pentagonal and hexa pyramid

12. Interpenetration of (2 sheets)
   12.1 Cylinder to cylinder
   12.2 Cylinder to cone

13. AUTO CAD
   13.1 Concept of AutoCAD, Tool bars in AutoCAD, coordinate system, snap, grid, and ortho mode
   13.2 Drawing commands – point, line, arc, circle, ellipse
   13.3 Editing commands – scale, erase, copy, stretch, lengthen and explode
   13.4 Dimensioning and placing text in drawing area
   13.5 Sectioning and hatching
   13.6 Inquiry for different parameters of drawing entity

Note: A minimum of 15 sheets should be prepared by each student

RECOMMENDED BOOKS

1. Elementary Engineering Drawing (in first angle projection) by ND Bhatt, Charotar Publishing House
2. A Text Book of Engineering Drawing by Surjit Singh Published by Dhanpat Rai and Co. Delhi
3. Engineering Drawing by PS Gill; published by SK kataria and Sons, New Delhi
2.7 GENERAL WORKSHOP PRACTICE – I & II

RATIONAL

Manual abilities to handle engineering materials with hand tools need to be developed in the students. They will be using different types of tools/equipment in different shops for fabrication purposes. Besides developing the necessary skills, the students will appreciate the importance of quality and safety measures.

DETAILED CONTENTS

Note: 1. 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.

2. The shops to be offered in I and II semester may be decided at polytechnic level

3. The students should be taken to various shops (not included in the curriculum) in the polytechnic in batches and should be given knowledge of the various machines/equipment. Such as machine shop, foundry shop, sheet metal shop, etc.

4. Students of Diploma in Chemical Engineering will undergo Shops 1 to 6 only

Following seven shops are being proposed:

1. Carpentry shop
2. Fitting and plumbing shop
3. Welding shop
4. Paint shop
5. Forging and sheet metal shop
6. Electric shop
7. Electronics Shop

1. Carpentry Shop

1.1 Introduction to various types of wood, carpentry tools - their identification with sketches. Different types of wood joints.

1.2 Simple operations viz. hand sawing, marking, planning

1.3 Introduction and sharpening of wood working tools and practice of proper adjustment of tools
1.4 Demonstration and use of wood working machines i.e. band saw, circular saw, rip saw, bow saw and trammels. Universal wood working machine and wood turning lathe

1.5 Making of various joints (Also draw the sketches of various wooden joints in the Practical Note Book)
   a) Cross lap joint
   b) T-lap joint
   c) Corner lap joint
   d) Mortise and tenon joint
   e) Dovetail joint
   f) Prepare a file handle or any utility items by wood turning lathe

2. **Fitting and Plumbing Shop**

2.1 Introduction to fitting shop, common materials used in fitting shop, description and demonstration of various types of work-holding devices and surface plate, V-block

2.2 Demonstration and use of simple operation of hack-sawing, demonstration of various types of blades and their uses

2.3 Demonstrate and use of all important fitting shop tools with the help of neat sketches (files, punch, hammer, scraper, taps and dyes etc.)

2.4 Introduction of chipping, demonstration on chipping and its applications.
   Demonstration and function of chipping tools.

2.5 Description, demonstration and practice of simple operation of hack saw, straight and angular cutting.

2.6 Demonstrations, description and use of various types of blades - their uses and method of fitting the blade.

2.7 Introduction and use of measuring tools used in fitting shop like: Try square, Steel rule, Measuring Tape, Outside micrometer, Vernier Caliper and Vernier Height Gauge

2.8 Description, demonstration and practice of thread cutting using taps and dies
2.9 Plumbing: Descriptions and drawing of various plumbing shop tools, Safety precautions. Introduction and demonstration of pipe dies, Pipe holding devices, Demonstration and practice of Pipe Fittings such as Sockets, Elbow, Tee, Reducer, Nipple, Union coupling, plug, Bend, Float valves and Taps

Job: Cutting and filing practice on a square of 45 X 45 mm² from MS flat
Job: Angular cutting practice of 45° (on the above job)
Job: Preparation of stud (to cut external threads) with the help of dies (mm or BSW)
Job: Drilling, counter drilling and internal thread cutting with Taps
Job: H-Fitting in Mild steel (ms) square
Job: Pipe cutting practice and thread cutting on GI Pipe with pipe dies

3. **Welding Shop**

3.1 Introduction to welding, type of welding, common materials that can be welded, introduction to gas welding equipment, types of flame, adjustment of flame, applications of gas welding. Welding tools and safety precautions

3.2 Introduction to electric arc welding (AC and DC), practice in setting current and voltage for striking proper arc, precautions while using electric arc welding. Applications of arc welding. Introduction to polarity and their use

3.3 Introduction to brazing process, filler material and fluxes; applications of brazing. Use of solder. Introduction of soldering materials

3.4 Demonstrate and use of the different tools used in the welding shop with sketches. Hand shield, helmet, clipping hammer, gloves, welding lead, connectors, apron, goggles etc.

3.5 Demonstration of welding defects and Various types of joints and end preparation

Job: Preparation of cap joint by arc welding
Job: Preparation of Tee joint by arc welding
Job: Preparation of single V or double V butt joint by using Electric arc welding
Job: Brazing Practice. Use of Speltor (on MS sheet pieces) Job: Gas welding practice on worn-out and broken parts
4. **Paint Shop**  
Introduction of painting shop and necessity. Different types of paints. Introduction of powder coating plant and their uses.

Job: Preparation of surface before painting such as cleaning, sanding, putty, procedure and application of primer coat, and painting steel item.  
Job: Painting practice by brush on MS sheet  
Job: Practice of dip painting  
Job: Practice of lettering: Name plates / Sign board  
Job: Polishing and painting on wooden and metallic surfaces  
Job: Practical demonstration of powder coating

5. **Forging and sheet metal shop**

Introduction to forging, forging tools, tongs, blowers/pressure blowers, hammers, chisels, punch, anvil, swag-block etc. Forging operations.

5.1 Forge a L hook or Ring from MS rod 6 mm φ

5.2 Forge a chisel and give an idea of hardening and tempering

5.3 Lap joint with forge welding

5.4 High Strength Steel (HSS) tools – forging of Lathe shaper tools like side-tools and V-shape tools

5.5 Making sheet metal joints

5.6 Making sheet metal trey or a funnel or a computer chassis

5.7 Preparation of sheet metal jobs involving rolling, shearing, creasing, bending and cornering

5.8 Prepare a lap riveting joint of sheet metal pieces

6. **Electric Shop**

6.1 Demonstration of tools commonly used in Electric Shop

6.2 Safety precautions, electric shock treatment

6.3 Demonstration of Common Electric material like: wires, fuses, ceiling roses, battens, cleats and allied items
6.4 Demonstration of Voltmeter, Ammeter, Multimeter and Energy meter

Job: Wiring practice in batten wiring, plastic casing-capping and conduit Job: Control of one lamp by one switch Job: Control of one lamp by two switches Job: Control of one bell by one switch Job: Assemble a Tube light

Job: Dismantle, study, find out fault, repair the fault, assemble and test domestic appliances like electric iron, electric mixer, ceiling and table fan, tube-light, water heater (geyser) and desert cooler

Job: Laying out of complete wiring of a house (Single-phase and Three-phase)

7. **Electronics Shop**

7.1 Identification, familiarization, demonstration and use of the following electronic instruments:

   a) Multi-meter digital
   b) Single beam simple CRO, function of every knob on the front panel
   c) Power supply, fixed voltage and variable voltage, single output as well as dual output.

7.2 Identification, familiarization and uses of commonly used tools; active and passive components; colour code and types of resistor and potentiometers

7.3 Cut, strip, join and insulate two lengths of wires/cables (repeat with different types of cables/wires)

7.4 Demonstrate and practice the skill to remove components/wires by unsoldering

7.5 Cut, bend, tin component, leads, inserts. Solder components e.g. resistor, capacitor, diodes, transistors on a PCB

7.6 Wiring of a small circuit on a PCB/tag strip involving laying, sleeving and use of identifier tags

7.7 Demonstrate the joining (or connecting) methods/mounting and dismantling method, as well as uses of the items mentioned below:

   a) Various types of plugs, sockets, connectors suitable for general-purpose audio video use. Some of such connectors e.g. 2 and 3 pin mains plug and sockets, Banana plugs, sockets and
similar male and female connectors and terminal strips.

b) Various types of switches such as: normal/miniature toggle, slide, push button piano key, rotary, SPST, SPDT, DPST, DPDT, band selector, multi-way Master Mains Switch.

7.8 Exposure to modern soldering and de-soldering processes (Field visits)

7.9 De-solder pump, remove and clean all the components and wires from a given equipment, a PCB or a tag strip.
3.1 FLUID MECHANICS

RATIONALE

Subject of Fluid Mechanics is a science subject and helps in solving problems in the field of Aeronautical, Electronics, Electrical, Mechanical, Metallurgical Engineering subject.

The subject deals with basic concepts and principles in hydrostatics, hydrokinematics and hydrodynamics and their application in solving fluid flow problems.

DETAILED CONTENTS

THEORY

1. Introduction: (4 hrs)
   1.1 Fluids: Real and ideal fluids
   1.2 Fluid Mechanics, Hydrostatics, Hydrodynamics, Hydraulics

2. Properties of Fluids: (6 hrs)
   2.1 Mass density, specific weight, specific gravity, viscosity, surface tension - cohesion, adhesion and capillarity, vapour pressure and compressibility.
   2.2 Units of measurement

3. Hydrostatic Pressure: (8 hrs)
   3.1 Pressure, intensity of pressure, pressure head, Pascal's law and its applications.
   3.2 Total pressure, resultant pressure, and centre of pressure.
   3.3 Total pressure and centre of pressure on vertical and inclined plane surfaces: Rectangular, triangular, trapezoidal

4. Measurement of Pressure: (8 hrs)
   4.1 Atmospheric pressure, gauge pressure, vacuum pressure and absolute pressure.
   4.2 Piezometer, simple manometer, differential manometer and Bourden gauge
5. Fundamentals of Fluid Flow: (8 hrs)

5.1 Types of Flow: Steady and unsteady flow, laminar and turbulent flow, uniform and non-uniform flow

5.2 Discharge and continuity equation (flow equation)

5.3 Types of hydraulic energy: Potential energy, kinetic energy, pressure energy

5.4 Bernoulli's theorem; statement and description (without proof of theorem)

5.5 Venturimeter (horizontal and inclined)

6. Flow Measurements (6 hrs)

Measurement of velocity of fluid by:

6.1 Venturimeter

6.2 Orificemeter

6.3 Plot tube

6.4 Mouthpiece

6.5 Notches and wears

6.6 Current meters

7. Flow through Pipes: (8 hrs)

7.1 Definition of pipe flow; , laminar and turbulent flow - explained through Reynolds's experiment

7.2 Reynolds number, critical velocity and velocity distributions in a pipe for laminar and turbulent flows

7.3 Head loss in pipe lines due to friction, sudden expansion and sudden contraction, entrance, exit, obstruction and change of direction (No derivation of formula)

7.4 Hydraulic gradient line and total energy line

7.5 Flow from one reservoir to another through a long pipe of uniform cross section (simple problems)
7.6 Pipes in series and parallel

7.7 Water hammer phenomenon and its effects (only definition and description)

8. Flow through open channels: (10 hrs)

8.1 Definition of an open channel, uniform flow and non-uniform flow

8.2 Discharge through channels using
i) Chezy's formula (no derivation)
ii) Manning's formula (no derivation)

8.3 Most economical channel sections
i) Rectangular
ii) Trapezoidal

8.4 Head loss in open channel into friction, transition losses due to graded expansion and contraction, obstruction and change of direction (no derivation)

PRACTICAL EXERCISES

i) To verify Bernoulli's Theorem

ii) To find out venturimeter coefficient

iii) To determine coefficient of velocity ($C_v$), Coefficient of discharge ($C_d$), Coefficient of contraction ($C_c$) of an orifice and verify the relation between them

iv) To perform Reynold's experiment

v) To verify loss of head in pipe flow due to
   a) Sudden enlargement
   b) Sudden Contraction

vi) To determine velocity of flow of an open channel by using a current meter

vii) To determine coefficient of discharge of a rectangular notch/triangular notch.
INSTRUCTIONAL STRATEGY

Hydraulics being a fundamental subject, teachers are expected to lay considerable stress on understanding the basic concepts, principles and their applications. For this purpose, teachers are expected to give simple problems in the class room and provide tutorial exercises so as to develop necessary knowledge for comprehending the basic concepts and principles. As far as possible, the teaching of the subject be supplemented by demonstrations and practical work in the laboratory.

RECOMMENDED BOOKS

4. Likhi SK., Laboratory Manual in Hydraulics, Delhi Wiley Eastern
3.2 GENERAL ENGINEERING

RATIONALE

A diploma holder has to assist in activities of installation, operation and maintenance etc of different machines and equipment. These activities are not branch specific and instead require him to know basics of civil, electrical and mechanical engineering. The subject of General Engineering has been included to impart basic knowledge of civil, electrical and mechanical engineering to the students.

Note:
1. The students of Civil Engineering, Chemical Engineering, Chemical Engineering (pulp and paper) will be studying only Part A (Mechanical Engineering) and Part B (Electrical Engineering)
2. The students of Electrical engineering, Electronics and Communication Engineering, Instrumentation and Control Engineering, Computer Engineering and Information Technology will be studying only Part A (Mechanical Engineering) and Part C (Civil Engineering)
3. The students of Mechanical Engineering will be studying only Part B (Electrical Engineering) and Part C (Civil Engineering)
4. The students of other branches of engineering and technology will be studying all the three Parts A (Mechanical Engineering), Part B (Electrical Engineering) and Part C (Civil Engineering), unless specified otherwise
5. A time of 2 hours per week has been allotted to Mechanical Engineering, 2 hours per week to Electrical Engineering and 1 hour per week to Civil Engineering in the lecture hours, for teaching theory and a lump-sum time of 2 hours week has been allotted for the Practicals.

DETAILED CONTENTS

PART-A

MECHANICAL ENGINEERING

Theory

1. Transmission of Power (8 hrs)
   1.1 Transmission of power through belt, rope drives and pulleys, gears and chains
   1.2 Different type of pulleys and their application
   1.3 Chain drives and its comparison with belt drive
   1.4 Gear drives, types of gears, simple gear trains and velocity ratio
2. **Internal combustion Engines** (14 hrs)

2.1 Classification and application of IC Engines commonly used: spark ignition and compression ignition engines.

2.2 Working principles of two stroke and four stroke petrol and diesel engines

2.3 Ignition system in petrol engines i.e. spark ignition, magneto ignition

2.4 Spark plug

2.5 Carburetor

2.6 Cooling system of IC Engines: Lubrication of IC Engines

2.7 General maintenance of engines

3. **Air Conditioning System** (8 hrs)

3.1 Basic principle of refrigeration and air conditioning

3.2 Working of centralized air conditioner

3.3 Concept of split air conditioner and its applications

4. **Pumps**: Types and their uses (2 hrs)

**PRACTICAL EXERCISES IN MECHANICAL ENGINEERING**

1. Study of main parts of 4 stroke petrol and diesel engines by actually dismantling them (The idea is to acquaint the students with the most common troubles occurring in the engines)

2. Study of main parts of 2 stroke petrol engine by actually dismantling it. (The idea is to acquaint the students with the most common trouble occurring in the engines)

3. Study of ignition system of petrol engines

4. Study of fuel and air circuit of a petrol engine

5. Study of fuel injection system and air circuit of a diesel engine

6. Study of cooling system and lubricating (including greasing) of an IC Engine

7. Study of friction clutch

8. Study of hydraulic brake

9. Study of various drives for transmission of powers. Models of belts, pulleys, gears, chains and clutches

10. Study of air conditioning system in a building

**NOTE:** Study will include dismantling and reassembling of actual parts
PART B

ELECTRICAL ENGINEERING

Theory

5. Application and Advantages of Electricity: (3 hrs)

5.1 Difference between AC and DC
5.2 Various applications of electricity
5.3 Advantages of electrical energy over other types of energy

6. Basic Quantities of Electricity: (4 hrs)

6.1 Definition of voltage, current, power and energy with their units
6.2 Name of the instruments used for measurement of quantities given in 5.1
6.2 Connection of the instruments in 5.2 in electric circuit

7. Various Types of Power Plants: (3 hrs)

7.1 Elementary block diagram of thermal, hydro and nuclear power stations
7.2 Brief explanation of the principle of power generation in above power stations

8. Elements of Transmission Line: (4 hrs)

8.1 Pictorial diagram of a three-phase transmission and distribution system showing transformers, supports, conductors, insulators and earth wire etc.
8.2 Brief function of accessories of transmission lines
8.3 Earthing of lines, substation and power station - need and practices adopted

9. Distribution System (4 hrs)

9.1 Distinction between high and low voltage distribution system
9.2 Identification of three phase wires, neutral wires and the earth wire on a low voltage distribution system
9.3 Identification of the voltage between phases and between one phase and neutral
9.4 Distinction between three phase and single phase supply

10. Supply from the Poles to the Distribution Board: (3 hrs)

10.1 Arrangement of supply system from pole to the distribution board
10.2 Function of service line, energy meter, main switch, distribution board
11. Domestic Installation: (4 hrs)

11.1 Distinction between light and fan circuits and single phase power circuit, sub circuits
11.2 Various accessories and parts of installation, identification of wiring systems
11.3 Common safety measures and earthing
11.4 Introduction to BIS code of safety and wiring installation

12. Electric Motors and Pumps: (5 hrs)

12.1 Definition and various application of single phase and three phase motors
12.2 Connection and starting of three phase motors by star delta starter
12.3 Conversion of horse power in watts or kilowatts
12.4 Type of pumps and their applications

PRACTICAL EXERCISES IN ELECTRICAL ENGINEERING:

1. Use of Megger:
   **Objective:** To make the students familiar with different uses of megger

2. Connection of a three phase motor and starter including fuses and reversing of direction of rotation.
   **Objective:** Students may be made familiar with the equipment needed to control a three-phase motor
   The students must experience that by changing any two phases, the direction of rotation is reversed.

3. Connection of a lamp, ceiling fan, socket outlet, geyser, floor grinder, voltage stabiliser etc.
   **Objective:** Students may be made familiar with the different types of equipment and circuits used in the domestic installations

4. Trouble shooting in a three-phase motor
   **Note:** The teacher may create anyone of the following faults
   (a) Loose connections
   (b) Blown fuse
   (c) Tripped overload protection
   (d) Incorrect direction of rotation
   (e) Single phasing
   (f) Burnt winding to be simulated by a loose connection behind a terminal box.
   **Objective:** The students must be able to detect the most common faults, which may occur in a three-phase motor, using meggar wherever necessary
5. Trouble shooting in a domestic wiring system.
   **Note:** The teacher may introduce a fault in the existing wiring system of a classroom or workshop like
   (a) blown fuse
   (b) loose connection
   (c) faulty components/accessories etc.
   **Objective:** Students must be able to detect common faults which may occur in a domestic wiring system

6. Treatment of electric shock
   **Note:** The teacher may give a demonstration how an electric shock must be treated.
   **Objective:** Students must be trained to treat the persons suffering from an electric shock

7. Study of a distribution Board
   **Note:** Students may be asked to study the distribution board in the institution and note down all accessories.
   **Objective:** Students must be made familiar with the distribution board

8. Connections and reading down an energy meter
   **Objective:** Students may be asked to connect an energy meter to a load and calibrate reading

9. Demonstration in electrical machine laboratory
   **Objective:** Students may be shown different types of electrical machines and their starters and should be told that the three phase induction motors are most commonly used.

10. Study of submersible motor pump set:
    **Objective:** To tell use of the set in water supply and irrigation works.

**PART C**

**CIVIL ENGINEERING**

**Theory**

13. Construction Materials (10 hrs)
    Basics of various construction materials such as stones, bricks, lime, cement and timber along with their properties, physical/field testing and uses, elements of brick masonry.

14. Foundations (8 hrs)
    i) Bearing capacity of soil and its importance
ii) Types of various foundations and their salient features, suitability of various foundations for heavy, light and vibrating machines

15. Concrete (8 hrs)
Various ingredients of concrete, different grades of concrete, water cement ratio, workability, physical/field testing of concrete, mixing of concrete

16. RCC (4 hrs)
Basics of reinforced cement concrete and its use (elementary knowledge), introduction to various structural elements of a building

PRACTICAL EXERCISES IN CIVIL ENGINEERING

Testing of bricks
a) Shape and size
b) Soundness test
c) Water absorption
d) Crushing strength

Testing of concrete
a) Slump test
b) Compressive Strength of concrete cube

3. The students should be taken to different construction sites to show them various construction materials, concreting process and construction of RCC structural elements, foundations and other civil works

Note: While imparting instructions, teachers are expected to lay more emphasis on concepts and principles. It will be better if the classes for general engineering are conducted in the laboratories and organized demonstrations for explaining various concepts and principles.

RECOMMENDED BOOKS

Mechanical Engineering

1. General Mechanical Engineering by M. Adithan; TTTI, Chandigarh
2. Basic Civil and Mechanical Engineering by Jayagopal; Vikas Publications, New Delhi
3. IC Engines and Automobile Engineering by Dr.MP Poonia, Standard Publishers, New Delhi
4. Refrigeration and Air Conditioning by RK Rajput; SK Kataria and sons; Ludhiana
5. Theory of Machines by RS Khurmi and JK Gupta; S. Chand and Company Ltd., New Delhi

**Electrical Engineering**

1. Electrical Technology Part 1: Basic Electrical Engineering by Theraja, BL; S Chand and Company, New Delhi
3. Basic Electrical Engineering by Mehta VK; S Chand and Company, New Delhi
5. Basic Electrical and Electronics Engineering by SK Sahdev; Dhanpat Rai and sons, New Delhi
7. Basic Electricity by BR Sharma; Satya Parkashan, New Delhi

**Civil Engineering**

5. Building Construction by J Jha and Sinha; Khanna Publishers, Delhi
7. Civil Engineering Materials by SV Deodhar and Singhai; Khanna Publishers, Delhi
8. Soil Mechanics and foundation Engineering by SK Garg; Khanna Publishers, Delhi
3.3 SURVEYING - I

RATIONAL

The important functions of a diploma civil engineer includes the jobs of detailed surveying, plotting of survey data, preparation of survey maps and setting out works.

While framing the curriculum for the subject of surveying, stress has been given to the development of the skill in each type of survey like chain surveying, compass surveying and levelling that the Civil Engineering diploma holder will normally be called upon to perform. Plane table surveying, contouring, theodolite surveying, curves and use of minor instruments have been also included in this subject.

Field work should be a selected one so that student can check his work and have an idea of the results the extent of error in the work done by him. As far as possible, the surveys done should be got plotted, as this will also reveal errors in the work and develop skill in plotting.

DETAILED CONTENTS

THEORY

1. Introduction: (3 hrs)
   1.1 Basic principles of surveying
   1.2 Concept and purpose of surveying, measurements-linear and angular, units of measurements
   1.3 Instruments used for taking these measurements, classification of survey-based on instruments

2. Chain surveying: (3 hrs)
   2.1 Purpose of chain surveying, principles of chain surveying
   2.2 Obstacles in chain surveying
       2.5.1 Errors in chain surveying
       2.5.2 Correction for measurements by erroneous length of chain, simple problems on this.
3. Compass surveying: (8 hrs)

3.1 Purpose of compass surveying. Construction and working of prismatic compass, use of prismatic compass: Setting and taking observations

3.2 Concept of:
   a) Meridian - Magnetic and true
   b) Bearing - Magnetic, True and Arbitrary
   c) Whole circle bearing and reduced bearing
   d) Fore and back bearing
   e) Magnetic dip and declination

3.3 Local attraction - causes, detection, errors and corrections, problems on local attraction, magnetic declination and calculation of included angles in a compass traverse

3.4 Concept of a traverse - Open and closed. Traversing with a compass. Checks for an open and closed traverse, plotting a traverse - By included end deflection angles, concept of closing error, adjustment of traverse graphically by proportionate method,

4. Levelling: (10 hrs)

4.1 Purpose of levelling, concept of a level surface, horizontal surface, vertical surface, datum, reduced level and bench marks

4.2 Principle and construction of Dumpy level

4.3 Concepts of line of collimation, axis of the bubble tube, axis of the telescope and vertical axis

4.4 Levelling staff: single piece, folding, invar precision staff, telescopic

4.5 Temporary adjustment: setting up and leveling, adjusting for parallax of Dumpy

4.6 Concept of back sight, foresight, intermediate sight, station change point, to determine reduce levels

4.7 Level book and reduction of levels by
   4.7.1 Height of collimation method and
   4.7.2 Rise and fall method

4.8 Arithmetic checks, problem on reduction of levels, fly levelling, check leveling and profile levelling (L-section and X-section), errors in levelling,
and precautions to minimize them and permissible limits, reciprocal levelling, testing and adjustment of IOP level. Numerical Problems.

4.9 Computations of Areas of regular figure and irregular figure. Simpson rule: prismoidal formula and graphical method, use of planimeter

5. Plane Table Surveying: (8 hrs)

5.1 Purpose of plane table surveying, equipment used in plane table survey:
(a) Plane table
(b) Alidade (Plain and Telescopic)
(c) Accessories

5.2 Setting of a plane table:
(a) Centering
(b) Levelling
(c) Orientation

5.3 Methods of plane table surveying
(a) Radiation,
(b) Intersection
(c) Traversing
(d) Resection

5.4 Two point problem

5.5 Three point problem by
a) Mechanical Method (Tracing paper)
b) Bessel’s Graphical Method
c) Trial and error method and Lehman’s Rules

Errors in plane table survey and precautions to control them. Testing and adjustment of plane table and alidade

PRACTICAL EXERCISES

1. Chain surveying:

i) a) Ranging a line
b) Chaining a line and recording in the field work
c) Testing and adjustment of chain
d) Taking offsets - perpendicular and oblique (with a tape only)
e) Setting out right angle with a tape

ii) a) Chaining of a line involving reciprocal ranging
b) Taking off sets and setting out right angles, with cross staff and Indian optical square
iii) Chain survey of a small area (field work and plotting)
iv) Chaining a line involving obstacles to ranging

II. Compass Surveying:

i) a) Study of prismatic compass  
b) Setting the compass and taking observations  
c) Measuring angles between the lines meeting at a point

ii) Traversing with the prismatic compass and chain (Recording and plotting by included angles)

III. Levelling:

i) a) Study of dumpy level and levelling staff  
b) Temporary adjustments of a Dumpy level  
c) Taking staff readings on different stations from the single setting and finding differences of level between them

ii) a) Study of IOP level  
b) Its temporary adjustments  
c) Taking staff readings on different stations from the single setting and finding differences of level between them

iii) Longitudinal and cross sectioning of a road/railway/canal
iv) Setting a gradient by dumpy and IOP level

IV. Plane Table Surveying:

i) a) Study of the plane table survey equipment  
b) Setting the plane table  
c) Marking the North direction  
d) Plotting a few points by radiation method

ii) a) Orientation by  
- Trough compass  
- Back sighting  
b) Plotting few points by intersection method

iii) Traversing an area with a plane table (at least five lines)

iv) a) Two point problem  
b) Three point problem by
- Tracing paper method
- Bessel's graphical method
- Trial and Error method

v) Setting and checking grades with abney level. Setting and checking grades with Ceylon Ghat Tracer

vi) Finding heights by Indian Pattern Clinometer (Tangent Clinometer)
Enlargement/reduction of a plan by the use of pentagraph

vii) Use of planimeter for computing areas

INSTRUCTIONAL STRATEGY

This is highly practice-oriented course. While imparting theoretical instructions, teachers are expected to demonstrate the use of various instruments in surveying, stress should be laid on correct use of various instruments so as to avoid/minimize errors during surveying. It is further recommended that more emphasis should be laid in conducting practical work by individual students

RECOMMENDED BOOKS


ii) Hussain, SK and Nagraj, MS; "Text Book of Surveying"; New Delhi, S Chand and Co Ltd.

iii) Deshpande, RS; "A Text Book Surveying and Levelling"; Poona, United Book Corporation

iv) Kocher, CL; "A Text Book of Surveying"; Ludhiana, Katson Publishing House

v) Kanetkar, TP and Kulkarni, SV., "Surveying and Leveling", Poona, AVG Parkashan

vi) Kanetkar, TP; and Kulkarni, SV; "Surveying and Leveling-Vol.2" Poona, AVG Prakashan


3.4 CONSTRUCTION MATERIALS

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.

DETAILED CONTENTS

THEORY

1. Building Stones: (4 hrs)
   1.1 Classification of Rocks: (General Review)
      1.1.1 Geological classification: Igneous, sedimentary and metamorphic rocks
      1.1.2 Chemical classification; Calcareous, argillaceous and siliceous rocks
      1.1.3 Physical classification: Unstratified, stratified and foliated rocks
   1.2 General characteristics of stones – Marble, Granite, Sand stone, Lime stone and Slate
   1.3 Requirements of good building stones
   **1.4 Identification of common building stones
   1.5 Various uses of stones in construction
   1.6 Kota stone, marble

2. Bricks and Tiles: (10 hrs)
   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/mechanically)
   **2.3.2 Moulding: hand moulding and machine moulding, hand moulding brick table; drying of bricks, burning of bricks, types of kilns (Bull's Trench Kiln and Hoffman's Kiln), process of burning, size and weight of standard brick; traditional brick, refractory brick, clay-flyash bricks, sun dried bricks, only line diagram of kilns
2.4 Classification and specifications of bricks as per BIS: 1077
2.5 Testing of common building bricks as per BIS: 3495
   Compressive strength, water absorption – hot and cold water test, efflorescence, Dimensional tolerance
2.6 Tiles
   2.6.1 Building tiles; Types of tiles-wall, ceiling, roofing and flooring tiles
   2.6.2 Ceramic, linoleum, terrazo and PVC tiles, their properties and uses
2.7 Stacking of bricks and tiles at site

3. Cement: (7 hrs)
   **3.1 Introduction, raw materials, flow diagram of manufacturing of cement, by wet process
   3.2 Various types of Cements and their uses: Ordinary portland cement, rapid hardening cement, low heat cement, high alumina cement, blast furnace slag cement, white and coloured cement, portland pozzolana cement, super sulphated cement
   3.3 Properties of cement
   3.4 Storage of Cement

4. Lime: (4 hrs)
   4.1 Introduction: Lime as one of the cementing materials
4.2 Definition of terms; quick lime, fat lime, hydraulic lime, hydrated lime, lump lime
4.3 Calcination and slaking of lime
4.4 IS classification of lime

5. Timber and Wood Based Products: (7 hrs)

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

**5.2 Market forms of converted timber as per BIS

5.3 Seasoning of timber: Purpose, methods of seasoning, kiln seasoning as per BIS

5.4 Defects in timber, decay in timber

5.5 Preservation of timber and methods of treatment as per BIS

5.6 Properties of timber and specifications of structural timber

**5.7 Common timbers in India, their uses - Teak, Deodar, Chir, Kail, Shisham, Sal and Mango, Plywood; Veneers and veneering, manufacturing of plywood (brief description only), uses of plywood.

5.8 Other wood based products, their brief description of manufacture and uses: laminated board, black board, fibre board, hard board

6. Paints and Varnishes: (6 hrs)

6.1 Purpose and use of paints

6.2 Different types of paints: oil paints, water paints and cement paints
   6.2.1 Cement paints - commonly available cement paints, their properties and uses. Application of Cement paints
   6.2.2 Varnishes and polish-types, properties and their uses.
   6.2.3 Lacquers and enamels - their properties and uses.
   6.2.4 Oil paints: their properties and uses

7. Metals: (4 hrs)

7.1 Ferrous metals: Composition, properties and uses of cast iron, steel (mild and high tension steel), requirements of mild steel as per BIS.
7.2 Non Ferrous metals: properties and uses of the following non ferrous metals in Civil Engineering works - copper, lead, zinc, tin and aluminium

7.3 Commercial forms of ferrous and non ferrous metals.

8. Miscellaneous Materials: (6 hrs)

8.1 Plastics: Important commercial products of plastics used in Civil Engineering construction.

8.2 Asbestos based products: Commercial forms and their uses (Asbestos tiles, fibre boarded, cellotex)

8.3 Insulating materials for Sound and Thermal Insulation

8.4 Construction chemicals like: water proofing components, epoxies, sulphides, polymers.

8.5 Glass: Types of glasses, their properties, Commercial forms and uses: plate glass, wired glass, bullet resisting glass, coloured glass, fibre glass, foamed glass, glass wool, Float glass, glass reinforced plastic.

8.6 Water proofing materials; Bitumen sheets and felts, chemical admixtures

**8.7 Finishings Materials: Homogenous laminated fibres, panel boards, wall boards, wall papers etc

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

**PRACTICAL EXERCISES**:

i) To identify different types of stones

ii) To determine the crushing strength of bricks

iii) To determine the water absorption of bricks

iv) To identify various types of timbers such as: Teak, Sal, Chir, Sissoo, Deodar, Kail & Hollock

v) To determine fineness (by sieve method) of cement

vi) To determine normal consistency of cement

vii) To determine initial and final setting times of cement
viii) To determine soundness of cement
ix) To determine compressive strength of cement

**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.

**RECOMMENDED BOOKS**

1) TTTI, Chandigarh "Civil Engineering Materials:" Tata McGraw Hill Publication
4) Bahl, SK; "Engineering Materials;" Delhi, Rainbow Book Co.
5) Sharma, SK; and Mathur, GC; "Engineering Materials;" Delhi-Jalandhar, R. Chand and Co.
7) Shahane; Engineering Materials; Poona, Allied Book Stall.
8) Gurcharan Singh; Engineering materials, Standard Publishers Distributors
3.5 **BUILDING CONSTRUCTION**

### RATIONALE

Diploma holders in Civil 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, stair cases, floors etc., and their constructional details. Therefore, the subject of Building Construction is very important for Civil Engineering diploma holders.

### DETAILED CONTENTS

**THEORY:**

1. **Introduction:**
   1.1 Definition of a building, classification of buildings based on occupancy
   1.2 Different parts of a building

2. **Foundations:**
   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, raft foundation,
      2.2.2 Deep foundations; Pile foundations - their suitability
         (This topic may be demonstrated with the help of transparencies)
   2.3 Earthwork
      2.3.1 Surface excavation, definition, setting out, cutting, filling and blasting
      2.3.2 Excavation of foundation, trenches, shoring, timbering and de-watering

3. **Walls:**
   3.1 Purpose of walls
   3.2 Classification of walls - load bearing, non-load bearing, dwarf, retaining, breast walls and dhaji 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 (8 hrs)

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

4.1.1 Bond – meaning and necessity; English and flemish bond
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, racking, 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, thorough 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: (4 hrs)

5.1 Meaning and use of arches and lintels:

5.2 Glossary of terms used in arches and lintels - abutment, peir, 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: RCC, RBC, stone, steel and timber
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:** (2 hrs)

6.1 Glossary of terms

6.2 Classification and their suitability for different situations

*7. Damp Proofing and Water Proofing* (6 hrs)

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** (6 hrs)

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) Terrazo tile flooring, stone (marble and kota) flooring, PCV
flooring, Terrazo flooring, Timber flooring, description with sketches of the methods of construction of the floors and their specifications

9. Roofs (6 hrs)

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

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

9.3 Ceilings – Gypsum, plaster boards, cellotex, fibre boards

10. Stairs (4 hrs)

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 (6 hrs)

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 method

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) (4 hrs)

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 (4 hrs)

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

14. Repair and Maintenance of Buildings (4 hrs)

14.1 Introduction
14.2 Importance of repair and maintenance of buildings
14.3 Common repair problems and their solutions
14.4 Cracks in buildings
14.5 Repair of DPC against rising dampness
14.6 Repair and maintenance of public health services
14.7 Types of materials for building repairs

Note
* An expert may be invited from field/industry for extension lecture
** A field visit may be planned to explain and show the relevant things
Demonstration and site visits should be done for following:

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 pre-construction and post-construction termite treatment of building and woodwork

v) 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) White and colour washing
   g) Use of special type of shuttering/cranes/heavy machines in construction work
   h) RCC work

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


5. Arora, SP and Bindra, SP; "A Text Book of Building Construction"; New Delhi Dhanpt Rai and Sons.


7. Sushil Kumar; "Building Construction"; Standard Publishers Distributors, Delhi


9. SP – 62 Hand Book of BIS


11. B.I.S. – 6313 Part 1, 2, 3
3.6 BUILDING DRAWING

L T P
- - 6

RATIONALE

Drawing is the language of engineers. Engineering is absolutely incomplete without a thorough knowledge of drawing. A Civil 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

Section-I

Drawing No. 1:
Details of spread footing foundations for 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. (3 x 3 = 9)

Drawing No. 2:
Plans of ‘T’ and Corner junction of walls 1 Brick, 1-1/2 Brick and 2 brick thick in English bond (2 x 4 = 8)

Drawing No. 3:
Elevation, sectional plan and sectional side elevation of flush door, panelled door, panelled and glazed door, edged, battened and braced-door, steel windows and aluninium windows (2 x 4 = 8)

Section-II

Drawing No. 4:
Steel roof truss (king post, queen post) showing details of joints, fixation of roof coverings, eaves and gutters. (2 x 4 = 8)

Drawing No. 5:
Drawing plan, elevation of a small building by measurement. (2 x 4 = 8)
**Drawing No. 6:**

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

\[(3 \times 4 = 12)\]

**Drawing No. 7:**

Drawings of following floors

a) Cement concrete floors on ground and at first floor
   
i) Conglomerate
   
ii) Bonded cement concrete flooring
   
iii) Terrazo flooring

b) Wooden floors
   
i) Single wooden floors
   
ii) Double wooden floors on ground and first floor  
\[(3 \times 4 = 12)\]

**Section-III**

**Drawing No. 8:**

Drawing plan and section of a dog legged stair (RCC), quarter turn stair in a given room  
\[(2 \times 4 = 8)\]

**Drawing No. 9:**

Drawing a small double storey building with a RCC slab roof, sloping roof showing position of sanitary fittings house drainage and electrical fittings  
\[(4 \times 4 = 16)\]

**Drawing No. 10:**

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
2. Civil Engineering Drawing by NS Kumar; IPH, New Delhi
3. Principles of Building Drawing by MG Shah and CM Kale, MacMillan, Delhi
4. Building Construction by Moorthy NRK
5. Building Construction by Mitchell
6. Building Construction by Meckay and Meckay
8. S.P. : 20
A diploma holder 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.

This is to be organized at a stretch for 3 to 4 days. Lectures will be delivered on following broad topics. There will be no examination for this subject.

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

RATIONALE

Diploma holders in Civil 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, advantages of concrete, uses of concrete in comparison to other building materials (2 hrs)

2. Ingredients of Concrete: (7 hrs)
   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: (7 hrs)
   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: (2 hrs)

4.1 Principle of water-cement ration law/Duff Abram’s Water-cement ratio law: Limitations of water-cement law

4.2 Definition of strength of concrete, relation between water cement ratio and strength of concrete

5. Workability: (3 hrs)

5.1 Definition, phenomenon of workability, concept of internal friction, segregation and harshness; factors affecting workability

5.2 Measurement of workability: slump test, compacting factor and vee bee consistometer; recommended slumps for placement in various conditions as per IS:456-2000 and SPECIFICATIONS-23-1982

6. Proportioning for Normal Concrete: (4 hrs)

6.1 Objectives of mix design, introduction to various grades as per IS:456-2000; proportioning for normal mix 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 normal and controlled concrete

7. Admixtures (Introduction as per IS:456-2000) (3 hrs)

7.1 Chemical admixtures (Plasticizers, Accelerators and Retarders, Water-reducing admixtures, Air-entraining admixtures)

7.2 Mineral admixtures

7.3 Fly ash

7.4 Silica fumes

7.5 Rice husk ash

7.6 Meta Kaolin

8. Special Concretes (6 hrs)

8.1 Concreting under special conditions

8.1.1 Cold weather concreting
8.1.2 Under water concreting
8.1.3 Hot weather concreting

8.2 Fibre reinforced concrete
8.3 Fly ash concrete
8.4 Silica fume concrete
8.5 Polymer concrete

9. Conducting Operations: (12 hrs)

**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 etc.

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

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

** 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
   c) Profometer/covesometer

xii) Tests for compressive strength of concrete cubes for M-15 or M-20

**INSTRUCTIONAL STRATEGY**

This subject is of practical nature. While imparting instructions, teachers are expected to organize demonstrations and field visits to show various stages of concreting operations. While working in the laboratory, efforts should be made to provide extensive practical training to students so as to make them confident in the preparation and testing of concrete. Teachers should also organize viva examination so as to develop understanding about concepts and principles involved.

**RECOMMENDED BOOKS**

i) Sood, Hemant, Mittal LN and Kulkarni PD; "Laboratory Manual on Concrete Technology", CBS Publishers, New Delhi, 2002


iii) Krishnamurthy, KT; Rao, A Kasundra and Khandekar, AA; "Concrete Technology"; Delhi, Dhanpat Rai and Sons.

iv) Gupta BL; "Text Book of Concrete Technology"; Standard Publishers Distributors

v) Varshney, RS;"Concrete Technology";New Delhi, Oxford and IBH Publishing

vi) Neville, AM; "Properties of Concrete" London, Pitman (ELBS Edition available)

vii) Orchard; "Concrete Technology"; Vol I, II, and III

viii) Handoo, BL; and Puri, LD;"Concrete Technology"; New Delhi, Satya Prakashan
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
4.2 WATER SUPPLY AND WASTE WATER ENGINEERING

**RATIONALE**

One of the basic necessities of life is potable water, which is not easily available to most of the people. Providing potable water, collection and disposal of waste water are important activities in the field of civil engineering. This subject imparts basic knowledge and skills in the field of water supply and waste water disposal engineering. Classroom instructions should be supplemented by field visits to show functional details of water supply and waste water disposal systems. It is also recommended to invite professionals from field to deliver extension lectures on specialized operations.

**DETAILED CONTENTS**

**THEORY**

**PART-A: WATER SUPPLY**

1. Introduction (1 hr)
   
   Water as a natural resource importance of hydrological cycle, significance of water quality and various components of public water supply scheme

2. Quantity of Water (5 hrs)
   
   2.1 Water demand for domestic, commercial, industrial and public utility purposes as per BIS standards
   
   2.2 Per capita demand
   
   2.3 Variations in rate of demand – hourly, daily, weekly and seasonal
   
   2.4 Methods of population forecasting and related numericals
   
   2.5 Design period and estimation of water requirement for public water supply scheme

3. Sources of Water Supply (3 hrs)
   
   3.1 Various sources of water (surface and underground sources)
   
   3.2 Quantity and quality of water from various sources, selection of a suitable source
3.3 Development of springs, infiltration galleries and various types of wells, rain water harvesting and recharge of ground water

4. Intakes and Conveyance of Water (3 hrs)

4.1 Various types of intakes and their locations

4.2 Materials for conveyance of water: cast iron, GI, Steel, PVC, asbestos, cement, concrete timber etc. Suitability of various materials as per BIS specifications

4.3 Joints in various types of pipes

4.4 Numerical on conveyance of water

5. Quality of Water (3 hrs)

5.1 Impurities in water

5.2 BIS standards of potable water

5.3 Necessity for the analysis of water

5.4 Sampling techniques, physical, chemical and bacteriological tests and their significance

6. Treatment of Water (5 hrs)

6.1 Objectives of water treatment and various types of treatment processes

6.2 Purpose and types of screening, aeration, straining and sedimentation

6.3 Coagulation and flocculation: common coagulants, optimum dose and feeding devices

6.4 Filtration: significance and theory of filtration; types, working, suitability and operational problems of filters

6.5 Disinfection: necessity, types of disinfectants, and requirements of a good disinfectant, chlorination: practices of chlorination, break point chlorination, residual chlorine and chlorine demand, application of chlorine

6.6 Flow diagram of various treatment processes
7. Storage and Distribution of Water (5 hrs)

7.1 Clear water reservoir site selection and determination of its capacity by mass-curve method
7.2 Adequate pressure in distribution pipes, layouts of distribution systems along with their merits and demerits
7.3 Systems of water supply: continuous and intermittent, their advantages and disadvantages
7.4 Appurtenances sluice, reflux and air relief valves, bib cock, stopcocks, fire hydrants, water meters and their working
7.5 Pumps and pumping of water, estimation of HP of pumps for water supply
7.6 Detection and prevention of leakage of water, maintenance of distribution network

8. Laying of Pipes: (3 hrs)

8.1 Setting out alignment of pipes
8.2 Excavation for laying of pipes and precautions to be observed
8.3 Handling, lowering, laying and jointing of pipes
8.4 Testing of pipe lines
8.5 Back filling and restoration to original surface

9. Plumbing and Water Supply Installations (3 hrs)

9.1 General principles as per BIS standards
9.2 Service connections
9.3 Water supply fixtures and installations
9.4 Hot and cold water supply
9.5 Estimation of pipe sizes
PART-B: WASTE WATER ENGINEERING

10. Introduction (2 hrs)
   10.1 Purpose of sanitation, necessity of systematic collection and disposal of waste water
   10.2 Definition of terms in waste water engineering
   10.3 Systems of sanitation: conservancy and water carriage systems, their advantages and disadvantages
   10.4 Systems of sewerage: advantages, disadvantages and their suitability

11. Design of Sewers (5 hrs)
   11.1 Quantity of sanitary and storm sewage, variation in flow and their importance, dry weather flow
   11.2 Form and materials of sewers and BIS specifications
   11.3 Conditions of flow, self-cleansing and limiting velocities, hydraulic formulae for flow of sewage in sewers
   11.4 Numerical on design of sewers by use of nomograms
   11.5 Sewer appurtenances: location, function and construction features, manholes, drop manholes, catch basin inverted siphon, flushing tanks, grease and oil trap, storm water regulators and ventilating shafts

12. Construction and Laying of Sewers (3 hrs)
   12.1 Setting out alignment of sewers
   12.2 Excavation, setting the gradient with boning rod, preparation of bed, handling and jointing, testing, back filling and restoration to original surface

13. Characteristics and Testing of Waste Water (3 hrs)
   13.1 Composition and decomposition of waste water
   13.2 Sampling; physical, chemical and bacteriological analysis of waste water
14. Natural Methods of waste water Disposal (3 hrs)

14.1 Decomposition of waste water

14.2 Waste water disposal methods: disposal by dilution and self-purification of stream, disposal by land treatment

14.3 Nuisance due to disposal

15. Waste Water Treatment (4 hrs)

15.1 Meaning and principles of primary and secondary treatment

15.2 Constructional details of screens, grit chambers, skimming tanks and primary clarifiers

15.3 Trickling filters, activated sludge process and their merits and demerits. Secondary clarifiers and oxidation ditch

16. Treatment and Disposal of Sludge (2 hrs)

16.1 Disposal of wet sludge

16.2 Sludge digestion, sludge drying and its disposal

17. Building Drainage (6 hrs)

17.1 Aims of building drainage and its principles

17.2 General layout of house drainage as per BIS specifications

17.3 Different sanitary fittings

17.4 Traps, seals, causes and prevention of breaking of water seals

17.5 Testing of house drainage

18. Rural Sanitation (4 hrs)

18.1 Drainage, topography, alignments of lanes and by-lanes, storm water, natural drainage, development of drains, size and gradient of drains

18.2 Disposal of night soil, collection and disposal of garbage and refuse, septic tanks, cess pools, pit privies, bore hole latrines and soak pits

18.3 Biogas plant: construction details, use and maintenance
PRACTICAL EXERCISES

1. To determining pH value, conductivity and turbidity of water sample along with their field applications of water sample and their field applications

2. To determine optimum alum dose for coagulation of raw water

3. To determine residual chlorine and chloride demand of water

4. Threading/Joining of GI, CI, and plastic pipes

5. Installation of the following
   a) Service connection: water supply to the building
   b) Water meter
   c) Valves and fittings

6. Water supply connection to bathrooms, bath tubs, showers and geysers

7. To determine total, dissolved and suspended solids in a given waste water sample

8. To determine chemical oxygen demand (COD)

9. To determine Biochemical oxygen demand (BOD)

10. Installation of sanitary fittings: wash basin, water closets (Indian and European), flushing cisterns and their connections to anti-syphonage pipe

11. Installation and testing of house drainage

12. Construction of inspection chamber

13. Laying and testing of sewers

14. Assembling parts of a septic tank

15. Assembling parts of a Biogas plant

INSTRUCTIONAL STRATEGY

As the subject is of practical nature, classroom instructions be supplemented by field visits. Visits to water and waste water treatment plants will motivate the students for learning in the classroom. Collection of information, pamphlets and catalogues from the manufacturers of water supply and sanitary fittings will be very helpful for the students.
RECOMMENDED BOOKS

2. Kshirsagar, SR; “waste water and waste water Treatment”, Roorkee Publishing House, Roorkee
3. Garg, SK; “Water Supply Engineering”, Khanna Publisher, Delhi
10. BIS Code related to Water Supply & Waste Water
4.3 SOIL AND FOUNDATION ENGINEERING

RATIONAL

Civil Engineering diploma engineers are required to supervise the construction of roads and pavements, dams, embankments, and other Civil Engineering structures. As such the knowledge of basic soil engineering is the pre-requisite for these engineers for effective discharge of their duties. This necessitates the introduction of Soil Engineering subject in the curriculum for Diploma Course in Civil Engineering.

The subject covers only such topics as will enable the diploma engineers to identify and classify the different types of soils, their selection and proper use in the field for various types of engineering structures.

The emphasis will be more on teaching practical aspect rather than theory.

DETAILED CONTENTS

THEORY

1. Introduction: (3 hrs)
   1.1 Importance of soil studies in Civil Engineering
   1.2 Geological origin of soils with special reference to soil profiles in India: Residual and transported soil, Alluvial deposits, lake deposits, dunes and loess, glacial deposits, conditions in which above deposits are formed and their engineering characteristics.
   1.3 Names of organizations dealing with soil engineering work in India, soil map of India

2. Physical Properties of Soils: (4 hrs)
   2.1 Constituents of soil and representation by a phase diagram
   2.2 Definitions and meaning of void ratio, porosity, degree of saturation, water content, specific gravity, unit weight, dry unit weight of soil grains
   2.3 Simple numerical problems with the help of phase diagrams

3. Soils Classification and Identification: (4 hrs)
   3.1 Particle size, shape and their effect on engineering properties of soil
3.2 Gradation and its influence on engineering properties

3.3 Relative density and its use in describing cohesionless soils

3.4 Behaviour of cohesive soils with change in water content, Atterberg limits-definitions, use and practical significance

3.5 Field identification tests for soils

3.6 BIS soil classification system as per IS 1498; basis, symbols, major divisions and sub divisions, groups, plasticity chart; procedure to be followed in classifying a given soil into a group

3.7 Black cotton soils: Properties and their effect on construction of buildings and other structures

4. Flow of Water Through Soils: (4 hrs)

4.1 Concept of permeability and its importance

4.2 Darcy's law, coefficient of permeability, seepage velocity and factors affecting permeability

4.3 Comparison of permeability of different soils as per BIS

4.4 Measurement of permeability in the laboratory

5. Effective Stress: (Concept only) (4 hrs)

5.1 Stresses in subsoil

5.2 Definition and meaning of total stress, effective stress and neutral stress

5.3 Principle of effective stress

5.4 Importance of effective stress in engineering problems

6. Deformation of Soils (4 hrs)

6.1 Meaning, conditions/situations of occurrence with emphasis on practical significance of:
   a) Consolidation and consolidation settlement
   b) Creep
   c) Plastic flow
   d) Heaving
   e) Lateral movement
6.2 Definition and practical significance of compression index, coefficient of consolidation, degree of consolidation.

6.3 Meaning of total settlement, uniform settlement, differential settlement and rate of settlement and their importance

6.4 Settlement due to construction operations and lowering of water table

6.5 Tolerable settlement for different structures as per BIS

7. Strength Characteristics of Soils: (5 hrs)

7.1 Examples of shear failure in soils

7.2 Factors contributing to shear strength of soils, Coulomb's law

7.3 Determination of shearing strength, vane shear test, direct shear test and unconfined compression test. Brief idea about triaxial shear test.

7.4 Drainage conditions of test and their significance

7.5 Stress and strain curve, peak strength and ultimate strength, their significance

7.6 Numerical problems

8. Soil Compaction: (4 hrs)

8.1 Various terms used to discuss degree of compaction and necessity of compaction

8.2 Laboratory compaction test (standard and modified as per BIS) definition and importance of optimum water content, maximum dry density; moisture dry density relations for typical soils with different compactive efforts

8.3 Field compaction; methods and equipment, choice of equipment

8.4 Compaction control; Density control, field density test, (sand replacement), moisture control, Proctor's needle and its use, thickness control, jobs of an embankment supervisor in relation to compaction

9. Bearing Capacity (6 hrs)

9.1 Concept of bearing capacity
9.2 Definition and significance of ultimate bearing capacity, net safe bearing capacity and allowable bearing pressure
9.3 Bearing capacity from building BIS codes (IS 6403)
9.4 Factors affecting bearing capacity
9.5 Concept of vertical stress distribution in soils due to foundation loads, pressure bulb
9.6 Plate load test (no procedure details) and interpretation of its results, limitations of plate load test
9.7 Application of SPT and unconfined compression test and direct shear test in estimation of bearing capacity
9.8 Soil properties governing choice of foundation type
9.9 Improvement of bearing capacity (elementary), sand drain method compaction, use of geotextiles, grouting.

10. Soil Exploration: (4 hrs)
10.1 Purpose and scope of soil exploration, economical aspects
10.2 Undertaking planning of subsurface investigations
10.3 Influence of soil conditions on exploratory programme
10.4 Possibility of misjudgment of subsoil conditions
10.5 Location, depth and spacing of exploration
10.6 Influence of size of project and type of structure on exploratory programme
10.7 Methods of soil exploration; Reconnaissance, Trial pits, borings, (Auger, wash, rotary, percussion to be briefly dealt), SPT (Brief description and information collected)
10.8 Groundwater level measurement
10.9 Sampling; undisturbed, disturbed and representative samples; selection of type of sample; thin wall and piston samples; area ratio, recovery ratio of samples and their significance, number and quantity of samples, resetting, sealing and preservation of samples.
10.10 Presentation of soil investigation results
11. Foundation Engineering: (8 hrs)

Concept of shallow and deep foundation; types of shallow foundations and their suitability. Factors affecting the depth of shallow foundations, deep foundations, type of piles and their suitability; constructional features of pile foundations, pile classification on the basis of material, method of load transmission, method of installation.

PRACTICAL EXERCISES

i) Auger Boring and Standard Penetration Test

   a) Identifying the equipment and accessories
   b) Conducting boring and SPT at a given location
   c) Collecting soil samples and their identification
   d) Preparation of boring log and SPT graphs
   e) Interpretation of test results

ii) Extraction of Disturbed and Undisturbed Samples

   a) Extracting a block sample
   b) Extracting a tube sample
   c) Extracting a disturbed samples for mechanical analysis, Compaction and limit test
   d) Field identification of samples

iii) Determination of water content by oven drying method and rapid moisture meter

iv) Field Density Measurement (Sand replacement and core cutter method)

   a) Calibration of sand
   b) Conducting field density test at a given location
   c) Determination of water content
   d) Computation and interpretation of results

v) Liquid Limit and Plastic Limit Determination:

   a) Identifying various grooving tools:
   b) Preparation of sample
   c) Conducting the test
   d) Observing soil behaviour during tests
   e) Computation, plotting and interpretation of results
vi) Specific gravity of soil solids by pycnometer

vii) Mechanical Analysis
   a) Preparation of sample
   b) Conducting sieve analysis
   c) Computation of results
   d) Plotting the grain size distribution curve
   e) Interpretation of the curve

viii) Laboratory Compaction Tests
   a) Preparation of sample
   b) Conducting the test
   c) Observing soil behaviour during test
   d) Computation of results and plotting
   e) Determination of Optimum Moisture Content and maximum dry density

ix) Determination of permeability of soil samples by constant head and falling head methods
   a) Preparation of sample
   b) Preparing set up
   c) Conduct the test
   d) Determination of permeability
   e) Interpretation of results

x) Unconfined Compression Test
   a) Specimen preparation
   b) Conducting the test
   c) Plotting the graph
   d) Interpretation of results and finding bearing capacity

xi) Direct shear test on sandy soil samples

xii) Conduct of standard penetration test

xiii) Vane shear test on cohesive soils

INSTRUCTIONAL STRATEGY

The teacher while imparting instructions are expected to lay greater emphasis on the practical aspects rather than theory and mathematical treatment. To bring clarity regarding concepts and principles involved, teachers should organize demonstrations in
the laboratories and fields. It is necessary to create understanding that soils fail either under shear or settlement due to heavy loads. This can be shown by making use of photographs on working models of such failures. Efforts should be made in the practical classes that students perform practical exercises individually. Conduct of viva examination at the end of each practical work will develop clear understanding about the concepts and principles related to this subject.

RECOMMENDED BOOKS


iii) Sehgal, SB; "A Text Book of Soil Mechanics"; Delhi, CBS Publishers and Distributors


v) Gulati, SK; "Engineering Properties of Soils", Tata McGraw Hill


vii) Khan, Iqbal H, “A Text Book of Geotechnical Engineering”, Delhi, Prentice Hall of India


x) BIS Codes IS 6403 (latest edition) and IS 1498 (latest edition)
4.4 SURVEYING – II

L T P
2 - 6

RATIONALE

The important functions of a civil technician includes the jobs of detailed surveying, plotting of survey data, preparation of survey maps and setting out works.

While framing the curriculum for the subject of surveying, stress has been given to the development of the skill in each type of survey like chain surveying, compass surveying and levelling that the Civil Engineering diploma holder will normally be called upon to perform. Plane table surveying, contouring, theodolite surveying, curves and use of minor instruments have been also included in this subject.

Field work should be a selected one so that student can check his work and have an idea of the results the extent of error in the work done by him. As far as possible, the surveys done should be got plotted, as this will also reveal errors in the work and develop skill in plotting.

DETAILED CONTENTS

1. Contouring: (6 hrs)

   Concept of contours, purpose of contouring, contour interval and horizontal equivalent, factors effecting contour interval, characteristics of contours, methods of contouring: Direct and indirect, use of stadia measurements in contour survey, interpolation of contours; use of contour map, Drawing cross section from a contour map; marking alignment of a road, railway and a canal on a contour map, computation of earth work and reservoir capacity from a contour map

2. Theodolite Surveying: (8 hrs)

   Working of a transit vernier theodolite, axes of a theodolite and their relation; temporary adjustments of a transit theodolite; concept of transiting, swinging, face left, face right and changing face; measurement of horizontal and vertical angles. Prolonging a line (forward and backward) measurement of bearing of a line; traversing by included angles and deflection angle method; traversing by stadia measurement, theodolite triangulation, plotting a traverse; concept of coordinate and solution of omitted measurements (one side affected), errors in theodolite survey and precautions taken to minimize them; limits of precision in theodolite traversing.

3. Tacho-metric surveying (4 hrs)

   Tachometry, Instruments to be used in tachometry, methods of tachometry, stadia system of tachometry, general principles of stadia tachometry, examples of stadia tachometry
4. Curves: (6 hrs)

Simple Circular Curve:

4.1 Need and definition of a simple circular curve; Elements of simple circular curve - Degree of the curve, radius of the curve, tangent length, point of intersection (Apex point), tangent point, length of curve, long chord deflection angle, Apex distance and Mid-ordinate. Setting out of simple circular curve:
   a) By linear measurements only:
      - Offsets from the tangent
      - Successive bisection of arcs
      - Offsets from the chord produced
   b) By tangential angles using a theodolite

4.2 Transition Curve:

Need (centrifugal force and super elevation) and definition of transition curve; requirements of transition curve; length of transition curve for roads; by cubic parabola; calculation of offsets for a transition curve; setting out of a transition curve by tangential offsets only

4.3 Vertical curve

Setting out of a vertical curve

5. Minor Instruments: (4 hrs)

Study and use of the instruments given below to be explained in addition to providing practice:

   a) Abney level
   b) Tangent clinometer
   c) Ceylon Ghat Tracer
   d) Pentagraph
   f) Planimeter

6. Study and Use of Modern Surveying equipment such as: (4 hrs)

   a) Auto level
   b) Digital planimeter
   c) Micro-optic theodolite
   d) Digital theodolite
   e) EDM
   f) Total station
   g) Introduction to GIS

NOTE:

a) For various surveying equipment relevant Indian Standards should be followed
b) No sketch of the instruments may be asked in the examination
PRACTICAL EXERCISES

I. Contouring:

  i) Preparing a contour plan by radial line method by the use of a Tangent Clinometer/Tachometer

  ii) Preparing a contour plan by method of squares

  iii) Preparing a contour plan of a Road/Railway track/Canal by taking cross sections.

II. Theodolite:

  i) Taking out the Theodolite, mounting on the tripod and placing it back in the box

  ii) Study of a transit vernier theodolite; temporary adjustments of theodolite

  iii) Reading the vernier and working out the least count, measurement of horizontal angles by repetition and reiteration methods

  iv) Measurement of vertical angles and use of tachometric tables

  v) Measurement of magnetic bearing of a line

  vi) Running a closed traverse with a theodolite (at least five sides) and its plotting

III. Curves

  i) Setting out of a simple circular curve with given data by the following methods

     a) Offsets from the chords produced
     b) One theodolite method

  ii) Setting out a circular curve with transition length by linear measurements

IV. Demonstration of digital instruments like Autolevel, digital Planimeter, microoptic theodolite, digital theodolite

INSTRUCTIONAL STRATEGY

This is highly practice-oriented course. While imparting theoretical instructions, teachers are expected to demonstrate the use of various instruments in surveying, stress should be
laid on correct use of various instruments so as to avoid/minimize errors during surveying. It is further recommended that more emphasis should be laid in conducting practical work by individual students

**RECOMMENDED BOOKS**


ii) Hussain, SK and Nagraj, MS; "Text Book of Surveying"; New Delhi, S Chand and Co Ltd.

iii) Deshpande, RS; "A Text Book Surveying and Levelling"; Poona, United Book Corporation

iv) Kocher, CL; "A Text Book of Surveying"; Ludhiana, Katson Publishing House

v) Kanetkar, TP and Kulkarni, SV., "Surveying and Leveling", Poona, AVG Parkashan

vi) Kanetkar, TP; and Kulkarni, SV; "Surveying and Leveling-Vol.2" Poona, AVG Parkashan


4.5 STRUCTURAL MECHANICS

RATIONAL

This is a basic engineering subject. The purpose of the subject is to impart basic knowledge and skill regarding properties of materials, concept of stresses and strains, bending moment and shear force diagrams, second moment of area, bending and shear stresses, slope and deflection and analysis of trusses. The above knowledge will be useful for designing simple structural components. This subject is very important to develop basic concepts and principles related to structural mechanics. This subject will also enable the students to continue their further education.

DETAILED CONTENTS

THEORY:

1. Properties of Materials (2 hrs)
   1.1 Classification of materials, elastic materials, plastic materials, ductile materials, brittle materials.
   1.2 Tensile test, compressive test, impact test, fatigue test, torsion test.

2. Simple Stresses and Strains: (8 hrs)
   2.1 Concept of stress, normal and shear stresses, stresses due to torsion.
   2.2 Concept of strain and deformation, longitudinal and transverse strain, poisson's ratio, volumetric strain
   2.3 Hooke's law, modulii of elasticity and rigidity, Bulk modulus of elasticity, relationship between the elastic constants.
   2.4 Stresses and strains in bars subjected to tension and compression. Extension of uniform bar under its own weight, stress produced in compound bars (two or three) due to axial load.
   2.5 Stress-strain diagram for mild steel, mechanical properties, factor of safety.
   2.6 Temperature stresses and strains
   2.7 Concept of principal plains, principal stresses and strains
3. Bending Moment and Shear Force: (12 hrs)

3.1 Concept of a beam and supports (Hinges, Roller and Fixed), types of beams: simply supported, cantilever, propped cantilever, fixed and continuous beams.

3.2 Types of loads (dead load, live load, snow load, wind load etc) and types of loading (point, uniformly distributed and uniformly varying loads)

3.3 Concept of bending moment and shear force, sign conventions

3.4 Bending Moment and shear force diagrams for cantilever, simply supported and overhanging beams subjected to concentrated, uniformly distributed and uniformly varying loads

3.5 Relationship between load, shear force and bending moment, point of maximum bending moment and contraflexure.

4. Second Moment of Area: (3 hrs)

4.1 Concept of second moment of area, radius of gyration

4.2 Theorems of parallel and perpendicular axes

4.3 Second moment of area for sections of: Rectangle, Triangle, Circle, Trapezium, Angle, Tee, I, Channel and, Compound. (No Derivation)

5. Bending and Shear Stresses: (6 hrs)

5.1 Theory of simple bending

5.2 Assumptions and Application of the equation \( M/I = F/Y = E/R \) (no derivation)

5.3 Moment of resistance, sectional modulus and maximum/permissible bending stresses in circular, rectangular, I,T and L sections; Comparison of strengths of the above sections.

5.4 Concept of shear stresses in beams, shear stress distribution in rectangular, I and T section (Formula to be stated, no derivation)

6. Slope and Deflection: (6 hrs)

6.1 Necessity for determination of slope and deflection

6.2 Moment area theorems (no derivation)
6.3 Computation of slopes and deflections using moment area theorems for:

(a) Simply supported beam with UDL over entire span and concentrated load at any point
(b) Cantilever with UDL over entire span and concentrated load at free end

7. Columns and Struts (4 hrs)

Theory of columns, Euler's critical load, empirical design formulae, Rankine’s, secant and parabolic formulae, I.S. formulae (Rankin’s - Merchant formulae)

8. Combined Direct and Bending Stresses: (3 hrs)

8.1 Concentric and eccentric loads, eccentricity

8.2 Effect of eccentric load on the section, stresses due to eccentric loads, examples in the case of short columns.

9. Analysis of Trusses: (4 hrs)

9.1 Concept of a frame, perfect, redundant and deficient frame, end supports, ideal and practical trusses.

9.2 Analysis of trusses by:

(a) Method of joints
(b) Method of sections and
(c) Graphical method

PRACTICAL EXERCISES

i) Determination of yield stress, ultimate stress, percentage elongation and plot the stress strain diagram and compute the value of young's modulus on mild steel

ii) Determination of Young's modulus of elasticity for steel wire with searl's apparatus

iii) Determination of modulus of rupture of a timber beam

iv) Determination of maximum deflection and young's modulus of elasticity in simply supported beam with load at middle third

v) Verification of forces in a framed structure
INSTRUCTIONAL STRATEGY

Teachers are expected to give simple exercises involving the applications of various concepts and principles being taught in the subject. Efforts should be made to prepare tutorial sheets on various topics and students should be encouraged/guided to solve tutorial sheets independently. In the practical works, individual students should be given opportunities to do practical work, make observations and draw conclusions. Teachers should also conduct viva examination in which stress should be given on the understanding of basic concepts and principles.

RECOMMENDED BOOKS


vi) VS prasad “Structural mechanics; Galgotia publications Pvt ltd.

vii) Chakarborty, ‘Strength of Materials; SK Kataria and Sons

viii) RK Dhawan, ‘A Text Book on Strength of Materials”, Jalandhar IPH


4.6 PUBLIC HEALTH ENGINEERING DRAWING

RATIONALE

Diploma holders in Civil Engineering are expected to supervise construction of water supply and waste water treatment works. They are also responsible for waste disposal activities. This subject aims at imparting skills for preparing water supply and waste water engineering drawings to develop competencies for reading the drawings, and their execution in their field.

DETAILED CONTENTS

1. Drains and Sewers
   1.1 Cross section of standard types of open drains (circular, v-shaped and µ-shaped) with their foundations
   1.2 Cross section of earthen ware and RCC sewer pipes
   1.3 Cross sections of masonry sewers (circular and egg shaped)

2. Traps, manholes and inspection chamber
   2.1 Detailed section of floor trap and gully trap
   2.2 Detailed plan and section of an inspection chamber
   2.3 Detailed plan and section of a manhole

3. Septic Tank and Soak Pit
   Detailed plan and cross sections of a domestic septic tank and soak pit for 5-10 users with details of open jointed pipes as per BIS Code

4. Bath room and W.C connections:
   4.1 Cross-section through the external wall of lavatories at ground and first floor showing the single and double pipe system and the connections of the lavatory to inspection chamber
   4.2 Plan of a bathroom showing positions of lavatory, bath tub, wash-basin, taps and showers

5. Draw the plan and section of a two bed roomed single and double storeyed residential building showing details of water supply and waste water installation and drainage systems. Show the drainage and water supply up to the municipal systems on the site plan also.
6. Practice of reading water supply and sanitary engineering drawings (PWD/urban Development agencies) including hot water and cold water supply system

INSTRUCTIONAL STRATEGY

Teachers are expected to develop skills in preparation of water supply and waste water engineering drawings as per BIS codes of practice. Attention must be paid towards line work, specifications writing, dimensioning, proportioning and accuracy at different intervals of time. Reading and interpreting actual field drawings should also be practiced so as to develop necessary competency in the students.

RECOMMENDED BOOKS

1. Civil Engineering Drawings by RP Chandel

2. Civil Engineering Drawing by NS Kumar; IPH, New Delhi

3. Civil Engineering Drawing by RS Malik and GA Meo; Asian Publishing House, New Delhi
5.1 RCC DESIGN AND DRAWING

RATIONALE

This subject is an applied engineering subject. Diploma holders in Civil Engineering will be required to supervise RCC construction. He may also be required to design simple structural elements, make changes in design depending upon availability of materials (bars of different diameters). 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 BIS: 456 – 2000 and their relevant drawings.

DETAILED CONTENTS

A. RCC THEORY & DESIGN

1. Introduction: Concept of Reinforced Cement Concrete (3 hrs)

2. Reinforcement Materials: (2 hrs)
   2.1 Various types of reinforcing materials
   2.2 Suitability of steel as reinforcing material
   2.3 Properties of different types of steel (mild steel, medium tensile steel, and deformed bars)

3. Theory of R.C.C. Beams: (12 hrs)
   3.1 Assumption in the theory of simple bending for RCC beam
   3.2 Flexural strength of a singly reinforced RCC beam
      Position of the Neutral axis, concept of balanced, under reinforced and over reinforced sections moment of the section
   3.3 Shear strength of singly reinforced RCC beam, Assumptions made, permissible shear stresses as per IS code of practice, actual average shear stresses in singly reinforced concrete beam, concept of diagonal stirrups and inclined bars, shear strength of RCC beam section
   3.4 Bond in RCC beams:
      3.4.1 Concept of bond
      3.4.2 Permissible bond stresses for plain and deformed bars as per BIS code of practice, minimum length, standard hook
4. Singly Reinforced Concrete Beam (8 hrs)
   4.1 Loads and loading standards as per IS:875 (Part I-V)
   4.2 Design of singly reinforced concrete beam as per BIS-456 code of practice
       from the given data such as span, load and properties of materials used.
   4.3 Design of lintel with and without chajja
   4.4 Design of a main/secondary beam for RCC roof and floor
   4.5 Design of a cantilever beam/slab

5. Doubly Reinforced Concrete Beams: (6 hrs)
   5.1 Doubly reinforced concrete beam and its necessity
   5.2 Design of a doubly reinforced concrete beam

6. T-Beams: (8 hrs)
   6.1 Structural behaviour of beam and slab floor laid monolithically
   6.2 Rules for the design of T-beams
   6.3 Economical depth of T-beams
   6.4 Design of simply supported T-beams using IS code of practice

7. RCC Slabs: (8 hrs)
   7.1 Structural behaviour of slabs under UDL
   7.2 Type of Boundary conditions
   7.3 Design of one way slab
   7.4 Design of two way slab with the help of tables of IS:456

8. RCC Stairs (6 hrs)
   8.1 Generator principles for design of RCC stairs
   8.2 Design of horizontally spanning stairs
8.3 Design of dog legged RCC stairs

9. Columns and Isolated Footings (10 hrs)
   9.1 Concept of long and short columns
   9.2 IS specifications for main and lateral reinforcement including spiral reinforcement
   9.3 Behaviour of RCC columns under axial load
   9.4 Design of Axially loaded short and long columns with different end condition
   9.5 Design of isolated footings to determine depth and width of foundation

10. Basic concept of limit state design method and prestressed concrete – introduction to pre and post tensioning methods (4 hrs)

B. RCC DRAWING

1. Details of reinforcement in a simply supported RCC beam (singly reinforced and doubly reinforced) with the given design data regarding the size and number of bars, stirrups their size and spacing.

2. Details of reinforcement for a RCC square and circular column with isolated square footing

3. Details of reinforcement for a cantilever beam with given data regarding the size of the beam and the reinforcement

NOTE: Exercises on bar bending schedules for each of the three above items will be prepared

4. Details of reinforcement in plan and section for a simply supported RCC one way slab with intermediate support and two-way slabs from the given data. Bar bending schedule should be prepared

5. Details of reinforcement in a two storeyed RCC internal and corner column. In this, the details of reinforcement at the junction with beams must be shown from the given design data

6. Details of reinforcement of the junction of a secondary beam with the main beam with the given 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.

RECOMMENDED BOOKS

1. Jai Krishna and Jain, OP; "Plain and Reinforced Concrete", Vol. I, Roorkee, Nem Chand and Bros

2. Handoo, BL; Mahajan, VM and Singla, DR; "Elementary of RCC Design", New Delhi, Satya Prakashan

3. Mallick, SK; and Gupta, AP; "Reinforced Concrete", New Delhi, Oxford and IBH Publishing Co


5. Sushil Kumar, "Treasures of Reinforced Concrete Design", Delhi Standard Publishers Distributors

6. Ramamurtham, S; "Design and Testing of Reinforced Structures", Delhi Dhanpat Rai and Sons


8. Gambhir, M.L., "Reinforced Concrete Design", Macmillan India Limited

9. Structural Analysis and Design, STAAD – PRO; Research Engineers - USA

10. STRUDC – Softtech – Pune

11. Verghese “Reinforced Concrete Design”

12. Ram Chandra “Reinforced Concrete Design”
5.2 HIGHWAY ENGINEERING

RATIONALE

Construction of roads is one of the area in which diploma holders in Civil Engineering get employment. These diploma holders are responsible for construction and maintenance of highways. Basic concepts of road geo-metrics, surveys and plans, elements of traffic engineering, road materials, construction of rigid and flexible pavements, special features of hill roads, road drainage system and various aspects of maintenance find place in above course.

DETAILED CONTENTS

THEORY

1. Introduction (2 hrs)
   1.1 Importance of Highway transportation;
   1.2 Functions of IRC, CRRI, MOST&H
   1.3 IRC classification of roads
   1.4 Organization of a state highway department

2. Road Geometrics (8 hrs)
   2.1 Glossary of terms used in geo-metrics and their importance: Right of way, formation width, road margin, road shoulder, carriage way, side slopes, kerbs, formation levels, camber and gradient
   2.2 Design and average running speed, stopping and passing sight distance
   2.3 Curve necessity, horizontal and vertical curves including transition curves and super elevation. Methods of providing super elevation
   2.4 Sketch of typical cross-sections in cutting and filling on straight alignment and at a curve
   (Note: No design/numerical problem to be taken)

3. Highway Surveys and Plan (6 hrs)
   3.1 Designation of a topographic map, reading the data given on a topographic map
   3.2 Basic considerations governing alignment for a road in plain and hilly area
3.3 Highway location; marking of alignment; importance of various stages viz
   a) Reconnaissance survey: Conduct reconnaissance and prepare reconnaissance report
   b) Preliminary survey: Object, organizing, conducting and information to be collected
   c) Location survey
   d) Standards for preparing the highway plans as per Ministry of Surface Transport (MOST)

4. Road Materials (6 hrs)
   4.1 Different types of road materials in use; soil, aggregate, binders
   4.2 Function of soil as highway subgrade
   4.3 California Bearing Ratio; method of finding CBR value and its significance
   4.4 Testing aggregates: Los Angeles Abrasion test, impact test, crushing strength test, water absorption test and soundness test
   4.5 Aggregates: Availability of road aggregates in India, requirements of road aggregates as per IRC specifications
   4.6 Binders: Common binders; cement, bitumen and tar, properties as per IS specifications, penetration and viscosity test of bitumen, procedures and significance, cut back and emulsion and their uses, Bitumen modifiers

5. Road Pavements (8 hrs)
   5.1 Road pavement: Flexible and rigid pavement, their merits and demerits, typical cross-sections, functions of various components
   5.2 Sub-grade preparation:
      Setting out alignment of road, setting out bench marks, control pegs for embankment and cutting, borrow pits, making profiles of embankment, construction of embankment, compaction, stabilization, preparation of subgrade, methods of checking camber, gradient and alignment as per recommendations of IRC, equipment used for subgrade preparation
5.3 Flexible pavements: sub base necessity and purpose, stabilized sub base; purpose of stabilization. Types of stabilization:

a) Mechanical stabilization
b) Lime stabilization
c) Cement stabilization
d) Fly ash stabilization

5.4 Base Course:

* Preparation of base course: Prime coat, Tack coat
  (a) Water bound macadam
  (b) Wet mix macadam
  (c) Bituminous macadam

*Methods of construction as per Ministry of Surface Transport (MOST)

5.5 Surfacing:

*Types of surfacing

a) surface dressing
b) open graded premix carpet
c) semi dense bituminous concrete
d) mix seal surfacing
e) seal coat
f) bituminous Penetration Macadam

*Methods of constructions as per Ministry of Surface, Transport, specifications and quality control; equipment used for above.

5.6 Rigid Pavements:

Construction of concrete roads as per IRC specifications: Form laying, mixing and placing the concrete, compacting and finishing, curing, joints in concrete pavement, equipment used

6. Hill Roads: (6 hrs)

6.1 Introduction: Typical cross-sections showing all details of a typical hill road in cut, partly in cutting and partly in filling

6.2 Special problems of hill areas
  6.2.1 Landslides: Causes, prevention and control measures
  6.2.2 Drainage
  6.2.3 Soil erosion
6.2.4 Snow: Snow clearance, snow avalanches, frost
6.2.5 Maintenance of plant and machinery

7. Road Drainage: (4 hrs)

7.1 Necessity of road drainage work, cross drainage works

7.2 Surface and subsurface drains and storm water drains. Location, spacing and typical details of side drains, side ditches for surface drainage. Intercepting drains, pipe drains in hill roads, details of drains in cutting embankment, typical cross sections

8. Road Maintenance: (4 hrs)

8.1 Common types of road failures of flexible pavements: Pot hole, cracks, rutting, corrugation, fatty surface upheaval - their causes and remedies

8.2 Maintenance of bituminous road such as seal-coat, patch-work and resurfacing.

8.3 Maintenance of concrete roads-filling cracks, repairing joints, maintenance of shoulders (berms), maintenance of traffic control devices

9. Construction Equipment: (4 hrs)

Output and use of the following plant and equipment

9.1 Hot mix plant

9.2 Tipper, tractors (wheel and crawler) scraper, bulldozer, dumpers, shovels, grader, roller, dragline

9.3 Asphalt mixer and tar boilers

9.4 Road pavers

PRACTICAL EXERCISES

i) Determination of the california bearing ratio (CBR) for the sub-grade soil (demonstration only)

ii) Determination of penetration value of bitumen

iii) Determination of softening point of bitumen

iv) Determination of impact value and crushing value of the road aggregate
v) Determination of abrasion value (Los Angeles’) of road aggregate

vi) Determination of ductility of bitumen

vii) Determination of viscosity of tar/bitumen

INSTRUCTIONAL STRATEGY

While imparting instructions, it is recommended that emphasis should be laid on constructional details and quality control aspects. Students should be asked to prepare sketches and drawings, clearly indicating specifications and constructional details for various sub components of a highway. It will be also advantageous to organize field visits to show the actual construction of roads at site.

RECOMMENDED BOOKS

i) Khanna, SK and Justo, CEG, "Highway Engineering" Roorkee Nem Chand and Bros.


iii) Priyani, VB, "Highway and Airport Engineering" Anand, Charotar Book Stall

iv) Sehgal, SB; and Bhanot, KL; "A Text Book on Highway Engineering and Airport" Delhi, S Chand and Co

v) Bindra, SP; "A Course on Highway Engineering" New Delhi, Dhanpat Rai and Sons

vi) Sharma, RC; and Sharma, SK; "Principles and Practice of Highway Engineering", New Delhi, Asia Publishing House

viii) Duggal AK, Puri VP., "Laboratory Manual in Highway Engineering", Delhi, New Age Publishers (P) Ltd

ix) Rao, GV’ Transportation Engineering

x) Duggal AK, “Maintenance of Highway – a Reader”, TTTI, Sector 26, Chandigarh

IRC Publications

i) MOST Specifications for Road and Bridge Works Latest Edition

ii) MOST Pocket book for Highway Engineers, 2001

iii) MOST Manual for Maintenance of Roads, 1983
5.3 SURVEY CAMP

Purpose

a. To impart intensive training in the use of surveying instruments
b. To train the students to appreciate practical difficulties in surveying on the field
c. Making the students conversant with the camp life
d. Training the students to communicate with the local population
e. Providing an opportunity for the students to develop team spirit
f. To train the students for self management

Task:

Preparation of topographical plan of a given area

Sub Tasks:

1. Reconnaissance of the area and fixing control stations
2. Traversing for the establishment of the control stations
3. Adjusting and plotting the traverse (office work)
4. Carrying the BM from any available reference BM to the site of work
5. Planimetric detailing and contouring
6. Fair plotting of the contours and other details (office work)
7. Finalisation of the group sheet (office work)
5.4 COMPUTER APPLICATIONS IN CIVIL ENGINEERING - I

RATIONAL

Computers play a very vital role in present day life, more so, in all the professional life of engineering. In order to enable the students use the computers effectively in problem solving, this course offers various engineering applications of computers in civil engineering.

DETAILED CONTENTS

PRACTICAL EXERCISES

1. Introduction and use of AutoCAD
2. Development of various drawing elements e.g. line, rectangle, circle, surfaces etc.
3. Develop plan, elevation, section of single storey building by using AutoCAD
4. Development of 3D view of building
5. Development of various layouts like electrical, sanitary, water filling using layers concept
5.5 RAILWAYS, BRIDGES AND TUNNELS

RATIONALE

The subject will cater to the needs of those technicians who would like to find employment in the construction of railway tracks, bridges and tunnels. The subject aims at providing broad based knowledge regarding various components and construction of railway track, bridges and tunnels.

DETAILED CONTENTS

PART – A: RAILWAY (28 hrs)

1. Introduction – brief history of railways, advantages of railways, Indian railways and its salient features

2. Railway surveys: Factors influencing the railways route, brief description of various types of railway survey

3. Rail Gauge: Definition, types, practice in various countries and India, Uniformity of gauge, unigauge project of Indian Railways

4. Rails – permanent way and its requirements, types of rails, steel for rails, corrugation, corrosion of rails, welding of rails, wear, methods to reduce wear, failure, coning of wheels, hoggged rails, buckling, their cause and remedies creep: definition, causes, effects and remedies

5. Rail Fastenings: Rail joints, types of rail joints, requirements of an ideal fastening, fastenings for rails, fish plates, brief idea of spikes, fang bolts, hook bolts, chairs and keys; bearing plates

6. Sleepers: Functions of sleepers, types of sleepers, requirements of an ideal material for sleepers. Brief idea of timber and steel sleepers, concrete and prestress type sleepers: their salient features and advantages

7. Ballast: Function of ballast, requirements of an ideal material for ballast, various methods used, size and quantity of ballast

8. Plate laying: meanings of the terms, methods of plate laying, tram line method, telescopic method, American method, material required per unit length of track, ballast train, relaying a track

9. Maintenance of track: necessity, maintenance of track, inspection of soil, track and fixtures; maintenance and boxing of ballast maintenance gauges, tools
10. Earth work and Drainage: Forms of cross-section, features of rail road, bed level, width of formation, side slopes, drains, methods of construction, requirement of drainage system.

**PART-B: BRIDGES**

(28 hrs)

11. Introduction

Bridge – its function and component parts, difference between a bridge and a culvert

12. Classification of Bridges

Their structural elements and suitability:

12.1 According to life-permanent and temporary

12.2 According to road way level – Deck, through and semi-through

12.3 According to material – wooden, steel, RCC, pre-stressed and masonry

12.4 According to structural form;

- Beam type – RCC, T-Beam, steel girder bridges, plate girder and box girder, balanced cantilever. Trussed bridges, N and warren
- Arch type – open spandrel and filled spandrel barrel and rib type
- Suspension type – unstiffened sling type, its description with sketches
- According to the position of highest flood level submersible and non submersible

13. Site Selection and Collection of Data

Factors affecting the selection of site for a bridge, data to be collected

14. Foundations

14.1 Depth of foundation, types of foundations, well foundation and caisson (open type only), their details of construction with sketches

14.2 Laying of foundations (i) dry soil (ii) soil charged with water (iii) under water, coffer dams their types and construction
15. Piers, Abutments and Wingwalls

15.1 Piers—definition, parts; types—solid (masonry and RCC), open; cylindrical and abutment piers. Definition of the terms: height of pier, water way (natural and artificial); afflux and clearance

15.2 Abutments and wing walls—definition, types of abutments (straight and tee), abutment with wing walls (straight splayed, return and curved)

16. Bridge bearings

Purpose of bearings; types of bearings—fixed plate, sliding plate, deep cast base, rocker, rocker and roller, thier functions with sketches

17. Temporary bridges

Necessity, description with sketches of pontoon and boat bridges

18. Maintenance of Bridges

19.1 Inspection of bridges

19.2 Routine maintenance

PART - C: TUNNELS (8 hrs)

19. Definition and necessity of tunnels

20. Typical section of tunnels for a national highway and single and double broad gauge railway track

21. Transfer of centre line of tunnel by shaft method

22. Method of construction of tunnels in soft rock by needle beam method

23. Method of construction of tunnels in hard rock with full face method and safety precaution to be taken, other methods of tunneling (names only)

24. Lining of tunnels with concrete

25. Ventilation—necessity and methods of ventilation, by combination of blowing and exhaust

26. Drainage method of draining water in tunnels

27. Lighting of tunnels

28. Shafts, mucking, hauling

Notes: Field visits may be organized to Bridge construction site or a bridge/Tunnel construction site/Railways tracks to explain the various components
INSTRUCTIONAL STRATEGY

This subject is of practical nature. While imparting instructions, teachers are expected to organize demonstrations and field visits to show various components and their construction of railway track, bridges and tunnel.

RECOMMENDED BOOKS

1. Vaswani, NK; “Railway Engineering”, Roorkee Publishing House
2. Rangwala, SC; ‘Railway Engineering”, Anand, Charotar Book Stall
7. IRC Bridge Codes
8. MOST drawings for various types of bridges
9. MOST pocket books for bridge Engineers, 2000 (First Revision)
5.6 IRRIGATION ENGINEERING AND DRAWING

Rationale

Diploma holders in civil engineering have to supervise the construction, repair and maintenance of canals, head works, river training works, cross drainage works, regulatory and other works. Some of diploma holders are also engaged for preventing water logging and irrigation by tubewells. This subject imparts knowledge regarding hydrology, flow irrigation – storage and distribution system, constructional features of head works, river training works, cross drainage works, causes and prevention of water logging and construction of tube wells.

Detailed Contents

Theory

1. Introduction: (2 hrs)
   1.1 Definition of irrigation
   1.2 Necessity of irrigation
   1.3 History of development of irrigation in India
   1.4 Major, medium and minor irrigation projects
   1.5 Planning of irrigation project

2. Water Requirement of Crops (3 hrs)
   2.1 Principal crops in India and their water requirements
   2.2 Crop seasons – Kharif and Rabi
   2.3 Soil water, soil crop and crop water relationships, Duty, Delta and Base Period, their relationship
   2.4 Gross command area, culturable command area, Intensity of Irrigation, Irrigable area

3. Rainfall and Run-off (3 hrs)
   Rainfall, definition rain-gauges – automatic and non-automatic, methods of estimating average rainfall (Arithmetic system); catchment area runoff, factors
affecting rain off, rain off formulae - Dicken's, Ryve's and Rational formulae
hydrograph, basic concept of unit hydrograph.

4. Methods of Irrigation
   (6 hrs)
   4.1 Surface methods and their advantages and limitations
   4.2 Sprinkler irrigation conditions favourable and essential requirements for
   sprinkler irrigation, sprinkler system – classification and component parts,
   design consideration
   4.3 Drip irrigation, suitability of drip irrigation, layout, Component parts,
   advantages

5. Design of Irrigation Canals
   (4 hrs)
   5.1 Classification, apurtenances of a canal and their functions, sketches of
different canal cross-sections
   5.2 Design of irrigation canals – Chezy’s formula, Manning’s, Kennedy’s and
Lacey’s silt theories and equations, comparison of above two silt theories
   5.3 Use of Garrets charts
   5.4 Various types of canal lining - Advantages and disadvantages, sketches of
different lined canal, x-section with drainage behind lining

6. Tube Well Irrigation
   (4 hrs)
   6.1 Introduction, occurrence of ground water, location and command,
advantages and disadvantages, comparison with canal irrigation
   6.2 Tube wells, explanation of terms: water table, radius of influence,
depression head, cone of depression, confined and unconfined aquifers.
Yield of a well-simple problems
   6.3 Types of tube wells and their choice-cavity, strainer and slotted type;
   6.4 Method of construction boring, installation of well assembly, development
of well, pump selection and installation and maintenance Testing of tube-
well and rehabilitation of a tube-well

7. Dams
   ( hrs)
   7.1 Classification, earth dams - types, causes of failure; cross-section of zoned
earth dam, gravity dams – types, labeled cross-sections of a dam
7.2 Spillways and energy dissipators

7.3 Concept of small and micro dams

8. Canal Head Works and Regulatory Works (4 hrs)
Definition, object, general layout, functions of different parts of head works. Difference between weir and barrage

9. Cross Drainage Works (5 hrs)
9.1 Functions and necessity of the following types: aqueduct, siphon, super passage, level crossing, inlet and outlet
9.2 Constructional details of the above

10. Design of Hydraulic Structures (4 hrs)
10.1 Falls
10.2 Gross and head regulators
10.3 Outlets
10.4 Energy dissipators and canal excepes

11. River Training Works (3 hrs)
Methods of river training, guide banks and their design, approach embankments, afflux embankments, groynes and spurs

12. Water Logging and Drainage and Ground Water Re-charge (3 hrs)
12.1 Definition, causes and effects, detection, prevention and remedies
12.2 Surface and sub-surface drains and their layout
12.3 Concept and various techniques used for ground water re-charge
IRRIGATION ENGINEERING DRAWING

1. Typical cross-section of a channel
   - L-section of a channel for given data
   - Typical cross section of an unlined and lined channel in cutting, partly cutting and partly filling and fully in filling with given design data

2. Plan and cross-section of an aqueduct

3. Details of guide banks

4. Distributory falls: Plan, cross section and L-section of a typical fall with details of wing wall, pitching, flooring and toe wall

5. Details of canal head works

6. Details of an outlet

INSTRUCTIONAL STRATEGY

The teaching of the subject should be supplemented by field visits at regular intervals of time to expose the students to irrigation works. Students should be asked to prepare drawings of various irrigation works.

RECOMMENDED BOOKS

1. Singhal, RP; ‘A Text Book on Irrigation Engineering', Singhal publications


3. Garg, Santosh Kumar, 'Irrigation Engineering and Hydraulics Structures', Delhi, Khanna Publishers

4. Punmia, BC; and Pande Brij Bansi Lal, 'Irrigation and Water Power Engineering', Delhi, Standard Publishers Distributors

5. Sharma, RK; 'Text Book of Irrigation Engineering and Hydraulics Structures', New Delhi, Oxford and IBH Publishing Company

6. Sharma, SK; 'Principles and Practice of Irrigation Engineering', New Delhi, Prentice Hall of India Pvt. Ltd.

7. Asawa, CL, “Irrigation Engineering”


11. BIS Codes

5.7 QUANTITY SURVEYING

L T P
3 1 -

RATIONALE

Diploma holders in Civil Engineering are supposed to prepare material estimates for various Civil Engineering works namely; buildings, irrigation works, public health works and roads etc. In addition, they must have basic knowledge regarding analysis of rates, contracting principles of valuation. Therefore, this subject has great importance for diploma holders in Civil Engineering.

DETAILED CONTENTS

1. Introduction to quantity surveying and its importance. Duties of quantity surveyor (2 hrs)

2. Types of estimates (4 hrs)
   2.1 Preliminary estimates
      - Plinth area estimate
      - Cubic rate estimate
      - Estimate per unit base
   2.2 Detailed estimates
      - Definition
      - Stages of preparation – details of measurement and calculation of quantities and abstract

3. Measurement (4 hrs)
   3.1 Units of measurement for various items of work as per BIS:1200
   3.2 Rules for measurements
   3.3 Different methods of taking out quantities – centre line method and long wall and short wall method

4. Preparation of Detailed and Abstract Estimates from Drawings (20 hrs)
   4.1 A small residential building with a flat roof
   4.2 Pitched roof with steel truss
   4.3 Timber structures
4.4 Earthwork for unlined channel
4.5 Water supply lines
4.6 Sanitary and water supply fittings i.e. septic tank for a domestic building
4.7 WBM road and pre-mix carpeting
4.8 Single span RCC slab culvert
4.9 Earthwork for plain and hill roads
4.10 RCC work in beams, slab, column and lintel
4.11 Stone masonry in retaining walls
4.12 Arches

5. Calculation of quantities of materials for (12 hrs)
5.1 Cement mortars of different proportion
5.2 Portland cement concrete of different proportion
5.3 Brick masonry in cement mortar
5.4 Plastering and pointing
5.5 White washing
5.6 Cement concrete flooring
5.7 Terrazo flooring
5.8 Stone masonry – random rubble and Ashlar

6. Analysis of Rates (14 hrs)
6.1 Steps involved in the analysis of rates. Requirement of material, labour, sundaries, contractor’s profit and overheads
6.2 Analysis of rates for finished items when data regarding labour, rates of material and labour is given:
- Earthwork in excavation hard/ordinary soil and filling with a concept of lead and lift
- Cement concrete in foundation
- RCC in roof slab
- Brick masonry in cement mortar
- Cement Plaster
- White washing

6.3 Running and maintenance cost of construction equipment

INSTRUCTIONAL STRATEGY

This is an applied engineering subject. Teachers are expected to provide working drawings for various Civil Engineering works and students be asked to calculate the quantities of materials required for execution of such works. Teachers should conceptualise making analysis of rates for different items of works. It will be advantageous if students are given valuation reports for reading.

RECOMMENDED BOOKS

1. Pasrija, HD; Arora, CL and S. Inderjit Singh, “Estimating, Costing and Valuation (Civil)”, Delhi, New Asian Publishers

2. Rangwala, BS; Estimating and Costing”. Anand, Charotar Book Stall


5. Dutta, BN; “Estimating and Costing

6. STAAD – Research Engineers - USA
6.1 STEEL STRUCTURES DESIGN AND DRAWING

L T P
3 1 3

RATIONALE

This subject is an applied engineering subject. Diploma holders in Civil Engineering will be required to supervise steel construction and fabrication. He may also be required to design simple structural elements, make changes in design depending upon availability of materials. 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 BIS: 800 and their relevant drawings.

DETAILED CONTENTS

a) Theory

1. Structural Steel and Sections: (2 hrs)
   1.1 Properties of structural steel as per BIS Codes
   1.2 Designation of structural steel sections as per BIS handbook and BIS:800

2. Structural Steel and Connections: (12 hrs)
   2.1 Riveted connections, types of rivets, permissible stresses in rivets as per BIS:800, types of riveted joints, specifications as per BIS 800 for riveted joints, design of riveted joints for axially loaded members, testing and inspection of riveted joints as per BIS:800
   2.2 Welded connections: Types of welds, permissible stresses in welds, types of welded connections, design of butt and fillet welded connections subjected to axial loads, testing and inspection of welded joints as per BIS:800

3. Tension Members: (6 hrs)

   Permissible stresses in tension for steel, design of tension members as per BIS:800 (flats, angles and tee sections only).

4. Compression Members: (10 hrs)
   4.1 Concept of buckling of columns, effective length and slenderness ratio, permissible stresses in compression as per IS:800, strength of columns of single and built up sections with the help of table of permissible compressive stresses.
4.2 IS specifications for design of compression members, design of angle, struts and axially loaded columns (no built up columns); use of tacking rivets

4.3 Beam and column, frame and seated connections (no design)

5. Beams (8 hrs)

BIS specifications for the design of simply supported steel beams including design of base plate at the ends (laterally restrained beams only), structural behaviour, deflected shapes and function of various elements of a plate girder and freehand sketching of a plate girder and its elements.

6. Roof Truss (10 hrs)

Form of trusses, pitch of roof truss, spacing of trusses, spacing of purlins, connection between purlin and roof covering, joint details of roof trusses, loading for roof truss, weight of roof truss, wind loads, snow loads, combination of loads, design of various elements of truss.

b) Steel Structures Drawing

1. Preparation of a working drawing (elevation, plan, details of joints as ridge, eaves and other connections) for a riveted steel roof truss resting on a masonry wall with the given span, shape of the truss and the design data regarding the size of the members and the connections. Also calculate the quantity of steel for the truss.

2. Steel connections (a,b,c,d) rivetted and (e) welded all unstiffened
   - Beam to beam connections (Seated and framed)
   - Beam to column (Seated and framed)
   - Column base connections (Slab base, grillage base and gusseted base)
   - Details of column splices
   - Connections of a steel bracket with flange of a column

3. Detailed drawing showing plan and elevation for a riveted plate girder with the given design data regarding the sizes of its parts, with details at the supports and connections of stiffeners, flange angles and cover plates with the web

INSTRUCTIONAL STRATEGY

Teachers are expected to give simple problems for designing various steel 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 fabrication and erection of steel structures. Practice of reading structural drawings is another important feature of this course.

**RECOMMENDED BOOKS**

1. Arya, AS and Ajmani, JL; "Design of Steel Structures", Roorkee, Nem Chand and Bros.

2. Ram Chandra, "Design of Steel Structures", Delhi, Standard Publishers Distributors.


4. Kazimi and Jindal, “Design of Steel Structures”, Prentice Hall of India, New Delhi

6.2 EARTHQUAKE RESISTANT BUILDING CONSTRUCTION

RATIONAL

Diploma holders in civil engineering have to supervise construction of various earthquake resistant buildings. Therefore, the students should have requisite knowledge regarding terminology of earthquake and the precautions to be taken while constructing earthquake resistant buildings.

DETAILED CONTENTS

1. Introduction to Seismic Design Parameters (10 hrs)
   1.1 Introduction to Earthquakes
   1.2 Causes of earthquakes
   1.3 Epicenter, Hypocenter
   1.4 Earthquake waves: Primary waves, secondary waves, long waves
   1.5 Seismic Region: Seismic zones in India
   1.6 Intensity and isoseismal of an earthquake
   1.7 Magnitude and energy of earthquake

2. Performance of buildings under past earthquakes (2 hrs)

3. Introduction to provisions of IS: 1893:2002 (4 hrs)

4. Introduction to ductile detailing provisions of IS:13920 for Reinforced Concrete Buildings (6 hrs)

5. Introduction to IS:4326 for construction of earthquake resistant masonry buildings (6 hrs)

6. Special construction methodologies, tips and precautions to be observed while planning, designing and construction of earthquake resistant buildings (8 hrs)

7. Disaster Management (6 hrs)

Disaster rescue, psychology of rescue, rescue workers, rescue plan, rescue by steps, rescue equipment, safety in rescue operations, debris clearance and casualty management
INSTRUCTIONAL STRATEGY

The student may be taken for visit to various building construction sites where precautions related to earthquake resistant construction are being taken so that the students may appreciate the importance of the subject.

RECOMMENDED BOOKS

1. Elements of Earthquake Engineering by Jai Krishana and AR Chandersekaran; Sarita Parkashan, Meerut.
2. Building Construction by BL Gupta and NL Arora, Satya Prakashan, New Delhi
3. Manual Published by Earthquake Engineering department, IIT Roorkee
4. IS 1893-2002
5. IS 13920
6. IS 4326
6.3 COMPUTER APPLICATIONS IN CIVIL ENGINEERING - II

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RATIONALE

Computers play a very vital role in present day life, more so, in all the professional life of engineering. In order to enable the students use the computers effectively in problem solving, this course offers various engineering applications of computers in civil engineering.

DETAILED CONTENTS

1. Estimate and costing by the use of software Civil-Pro

2. Networking techniques of the project using Primavera

3. Introduction and use of software like Auto Survey, Auto Read, Auto Water

4. Introduction and use of software for regarding structural analysis and design of buildings
6.4 TENDERING AND VALUATION

RATIONALE

A good percentage of diploma engineers start working as small contractors. They require the knowledge of contractorship and associated skills like estimating and costing, tendering and preparation of specifications for various types of jobs. Also diploma holders adopt valuers as their profession. To promote entrepreneurship amongst these engineers, knowledge and associated skills in above field becomes essential. Hence this subject is of great importance to diploma engineers.

DETAILED CONTENTS

1. Contractorship (8 hrs)
   - Meaning of contract
   - Qualities of a good contractor and their qualifications
   - Essentials of a contract
   - Types of contracts, their advantages, dis-advantages and suitability, system of payment
   - Single and two cover-bids; tender, tender forms and documents, tender notice, submission of tender and deposit of earnest money, security deposit, retention money, maintenance period
   - Types of contracting firms/construction companies

2. Preparation of Tender Document (12 hrs)
   - Exercises on writing specifications of different types of building works from excavation to foundations, superstructure and finishing operation
   - Exercises on preparing tender documents for the following
     a) Earth work
     b) Masonry works
     c) Construction of a small house as per given drawing
     d) RCC works
     e) Pointing, plastering and flooring
f) White-washing, distempering and painting


g) Wood work including polishing


h) Sanitary and water supply installations


i) False ceiling, aluminium (glazed) partitioning of tile flooring


j) Construction of an Industrial shed

3. Preparation of tender documents for: (6 hrs)

- Highways

- Culverts

- Layout of sewer lines

4. Exercises on preparation of comparative statements for item rate contract (2 hrs)

5. Valuation (4 hrs)

  a) Purpose of valuation, principles of valuation

  b) Definition of various terms related to valuation like depreciation, sinking fund, salvage and scrap value, market value, fair rent, year’s purchase etc.

  c) Methods of valuation (i) replacement cost method (ii) rental return method

RECOMMENDED BOOKS

1. Pasrija, HD; Arora, CL and S. Inderjit Singh, “Estimating, Costing and Valuation (Civil)”, Delhi, New Asian Publishers

2. Rangwala, BS; Estimating and Costing”. Anand, Charotar Book Stall


5. Dutta, BN; “Estimating and Costing

6. STAAD – Research Engineers - USA
6.5 CONSTRUCTION MANAGEMENT AND ACCOUNTS

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RATIONALE

This is an applied engineering subject. The subject aims at imparting basic knowledge about construction planning and management, site organisation, construction labour, control of work progress, inspection and quality control, accidents and safety and heavy construction equipment.

DETAILED CONTENTS

THEORY

CONSTRUCTION MANAGEMENT:

1. Introduction: (6 hrs)

   1.1 Significance of construction management

   1.2 Main objectives of construction management

   1.3 Functions of construction management, planning, organising, staffing, directing, controlling and coordinating, meaning of each of these with respect to construction job.

   1.4 Classification of construction into light, heavy and industrial construction

   1.5 Stages in construction from conception to completion

   1.6 The construction team: owner, engineer and contractors, their functions and inter-relationship

   1.7 Resources for construction industry: Men, machines, materials and money.

2. Construction Planning: (8 hrs)

   2.1 Importance of construction planning

   2.2 Developing work break down structure for construction works

   2.3 Stages of construction planning

      - Pre-tender stage
      - Contract stage
2.4 Scheduling construction works by bar charts

- Preparation of bar charts for simple construction work
- Preparation of schedules for labour, materials, machinery and finances for small works
- Limitations of bar charts

2.5 Scheduling by network techniques

- Introduction to network techniques; PERT and CPM, differences between PERT and CPM terminology
- Developing CPM networks
- Analysis of CPM networks, determining completion time, identifying critical activities and critical path, floats etc.

3. Organization: (4 hrs)

3.1 Types of organizations: Line, line and staff, functional and their characteristics

3.2 Principles of organisation (only meaning and significance of the following)

- Span of control
- Delegation of authority
- Ultimate responsibility
- Unity of command
- Job definition

4. Site Organization: (4 hrs)

4.1 Factors influencing selection and design of temporary services for a construction

4.2 Principle of storing and stacking materials at site

4.3 Location of equipment

4.4 Preparation of actual job layout for a building

4.5 Organizing labour at site
5. Construction Labour: (7 hrs)

5.1 Conditions of construction workers in India, wages paid to workers

5.2 Trade Unions connected with construction industry

5.3 Important provisions of the following Acts:
   - Trade Union Act 1926 (as amended)
   - Labour Welfare Fund Act 1936 (as amended)
   - Payment of Wages Act 1936 (as amended)
   - Minimum Wages Act 1948 (as amended)
   - Workman Compensation Act 1923 (as amended)
   - Contract Labour (Regulation and Abolition) Act 1970 (as amended)

6. Control of Progress: (4 hrs)

6.1 Methods of recording progress

6.2 Analysis of progress

6.3 Taking corrective actions keeping head office informed

6.4 Cost time optimization for simple jobs - Direct and indirect cost, variation with time, cost optimization

7. Inspection and Quality Control: (6 hrs)

7.1 Need for inspection and quality control

7.2 Principles of inspection

7.3 Major items in construction job requiring quality control

7.4 Stages of inspection and quality control for
   - Earth work
   - Masonry
   - RCC
   - Sanitary and water supply services
   - Electrical services
8. Accidents and Safety in Construction: (6 hrs)

8.1 Accidents – causes

8.2 Safety measures for

- Excavation work
- Drilling and blasting
- Hot bituminous works
- Scaffolding, ladders, form work
- Demolitions

8.3 Safety campaign

CONSTRUCTION EQUIPMENT

9. Introduction: (4 hrs)

Construction economy: Factors affecting the selection of construction equipment, rolling resistance, effect of grade on required tractive effort, effect of altitude and temperature on the performance of internal combustion engines, drawbar pull, rimpull, and acceleration

10. Earth Moving Equipment: (7 hrs)

Crawler and wheel tractors: their functions, types and specifications, gradability; bull dozers and their use, tractors pulled scrapers, their sizes and output; effect of grade and rolling resistance on the output of tractor pulled scrapers, earth loaders, placing and compacting earth fills.

Power shovels: Functions, selection, sizes, shovel dimensions and clearances, output; Draglines: Functions, types, sizes, output; clamshells; safe lifting capacities and working ranges of cranes; hoes, trenching machines: types and production rates

ACCOUNTS

11. PUBLIC WORK ACCOUNTS: (8 hrs)

Introduction, accounts, work- major, repair, administrative approval – expenditure, Technical sanction, allotment of funds, bill, contractor ledger, Running and final account bills complete, completion certificate & report, hand receipt, establishment-permanent, temporary-aquittance roll. WC, Establishment, MR labour, casual labour roll-duties and responsibility of different cadres,
INSTRUCTIONAL STRATEGY

This is a highly practice-based course and efforts should be made to relate the process of teaching with direct experiences at work sites. Participation of students should be encouraged in imparting knowledge about this subject. To achieve this objective, the students should be taken to different work sites for clear conception of particular topics, such as site organization, inspection of works at various stages of construction and working of earth-moving equipment.

RECOMMENDED BOOKS

1. Shrinath, LS, "PERT and CPM - Principles and Applications", New Delhi, East West Press


4. Wakhlo, ON; "Civil Engineering Management", New Delhi, Light and Life Publishers

5. Verma, Mahesh; "Construction Equipment and its Planning and Application"


7. Gahlot PS; Dhir, BM; "Construction Planning and Management", Wiley Eastern Limited, New Delhi

8. MS Project – Microsoft USA

9. Primavera
6.6 ENTREPRENEURSHIP DEVELOPMENT AND MANAGEMENT

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RATIONALE

Entrepreneurship Development and Management is one of the core competencies of technical human resource. Creating awareness regarding entrepreneurial traits, entrepreneurial support system, opportunity identification, project report preparation and understanding of legal and managerial aspects can be helpful in motivating technical/vocational stream students to start their own small scale business/enterprise. Based on the broad competencies listed above, following detailed contents are arrived to develop the stated competencies.

DETAILED CONTENTS

(1) Entrepreneurship (4 hrs)

1.1 Concept/meaning
1.2 Need
1.3 Competencies/qualities of an entrepreneur

(2) Entrepreneurial Support System (6 hrs)

2.1 District Industry Centres (DICs)
2.2 Commercial Banks
2.3 State Financial Corporations
2.4 Small Industries Service Institutes (SISIs), Small Industries Development Bank of India (SIDBI), National Bank for Agriculture and Rural Development (NABARD), National Small Industries Corporation (NSIC) and other relevant institutions/organizations at State level

(3) Market Survey and Opportunity Identification (Business Planning) (6 hrs)

3.1 How to start a small scale industry
3.2 Procedures for registration of small scale industry
3.3 List of items reserved for exclusive manufacture in small scale industry
3.4 Assessment of demand and supply in potential areas of growth
3.5 Understanding business opportunity
3.6 Considerations in product selection
3.7 Data collection for setting up small ventures

(4) Project Report Preparation (6 hrs)

4.1 Preliminary Project Report
4.2 Techno-Economic feasibility report
4.3 Project Viability

(5) Managerial Aspects of Small Business (8 hrs)

5.1 Principles of Management (Definition, functions of management viz planning, organisation, coordination and control
5.2 Operational Aspects of Production
5.3 Basic principles of financial management
5.4 Marketing Techniques
5.5 Personnel and Inventory Management
5.6 Importance of Communication in business

(6) Legal Aspects of Small Business (6 hrs)

6.1 Elementary knowledge of Income Tax, Sales Tax, Patent Rules, Excise Rules
6.2 Factory Act and Payment of Wages Act

(7) Environmental considerations (6 hrs)

7.1 Concept of ecology and environment
7.2 Factors contributing to Air, Water, Noise pollution
7.3 Air, water and noise pollution standards and control
7.4 Personal Protection Equipment (PPEs) for safety at work places

(8) Miscellaneous (6 hrs)

8.1 Human and Industrial Relations
8.2 Human relations and performance in organization
8.3 Industrial relations and disputes
8.4 Relations with subordinates, peers and superiors
8.5 Labour Welfare
8.6 Workers participation in management

RECOMMENDED BOOKS

1. A Handbook of Entrepreneurship, Edited by BS Rathore and Dr JS Saini; Aapga Publications, Panchkula (Haryana)
2. Entrepreneurship Development by CB Gupta and P Srinivasan, Sultan Chand and Sons, New Delhi
3. Environmental Engineering and Management by Suresh K Dhamija, SK Kataria and Sons, New Delhi
4. Sharma BR, Environmental and Pollution Awareness: Satya Prakashan, New Delhi
5. Thakur Kailash, Environmental Protection Law and policy in India: Deep and Deep Publications, New Delhi
6. Handbook of Small Scale Industry by PM Bhandari
7. Marketing Management by Philip Kotler, Prentice Hall of India, New Delhi
8. Total Quality Management by Dr DD Sharma, Sultan Chand and Sons, New Delhi
9. Principles of Management by Philip Kotler TEE Publication
6.7 ELECTIVES

6.7.1 REPAIR AND MAINTENANCE OF BUILDINGS

RATIONALE

One of the major concerns of a civil engineer is to take care of the building works, already constructed, in order to keep these buildings in utmost workable conditions. Usually it is being felt that the buildings deteriorate faster for want of care and proper maintenance. The buildings usually have a shabby appearance due to cracks, leakage from the roofs and sanitary/water supply fittings. Thus the need for teaching the subject is proper perspective has arisen making students aware of importance of maintenance of buildings.

DETAILED CONTENTS

1. Need for Maintenance (6 hrs)
   1.1 Importance and significance of repair and maintenance of buildings
   1.2 Meaning of maintenance
   1.3 Objectives of maintenance
   1.4 Factors influencing the repair and maintenance

2. Agencies Causing Deterioration (Sources, Causes, Effects) (6 hrs)
   2.1 Definition of deterioration/decay
   2.2 Factors causing deterioration, their classification
      2.2.1 Human factors causing deterioration
      2.2.2 Chemical factors causing deterioration
      2.2.3 Environmental conditions causing deterioration
      2.2.4 Miscellaneous factors
   2.3 Effects of various agencies of deterioration on various building materials i.e. bricks, timber, concrete, paints, metals, plastics

   3.1 Importance of maintenance management
   3.2 Organisational structure for maintenance
3.3 Building inspections and reports
3.4 Maintenance budgets and estimates
3.5 Specifications for maintenance jobs

4. Investigation and Diagnosis of Defects (6 hrs)
4.1 Systematic approach/procedure of investigation
4.2 Objectives of investigation of building defects
4.3 Sequence of detailed steps for diagnosis of building defects/problems
4.4 Various tests for correct diagnosis of building defects
4.5 Various tests on materials for investigating defects
4.6 List non-destructive tests on building elements and materials to evaluate the condition of the building and study of three most commonly used tests

5. Defects and their root causes (6 hrs)
5.1 Define defects in buildings
5.2 Describe importance and classification of defects
5.3 Main causes of building defects
5.4 List three main defects and their main causes in various building elements
   5.4.1 Foundations, basements and DPC
   5.4.2 Walls
   5.4.3 Column and Beams
   5.4.4 Roof and Terraces
   5.4.5 Joinery
   5.4.6 Decorative and protective finishes
   5.4.7 Services
5.5 Defects caused by dampness

6. Materials for Repair, maintenance and protection (6 hrs)
6.1 Basic characteristics of repair materials
6.2 Compatibility aspects of repair materials
6.3 List various types of repair materials

6.4 State characteristics of:
   6.4.1 Anti corrosion coatings
   6.4.2 Adhesives/bonding aids
   6.4.3 Repair mortars
   6.4.4 Curing compounds
   6.4.5 Joints sealants
   6.4.6 Waterproofing systems for roofs
   6.4.7 Protective coatings

6.5 Selection procedure of repair materials for specific job

7. Remedial Measures for Building Defects
   (12 hrs)

7.1 Preventive maintenance considerations

7.2 Precautions during repair and maintenance

7.3 Surface preparation for repair

7.4 Crack repair methods
   7.4.1 Epoxy injection
   7.4.2 Grooving and sealing
   7.4.3 Stitching
   7.4.4 Adding reinforcement and grouting
   7.4.5 Flexible sealing by sealant

7.5 Repair of surface defects of concrete
   7.5.1 Bug holes
   7.5.2 Form tie holes
   7.5.3 Honey comb and larger voids

7.6 Repair of corrosion in RCC elements
   7.6.1 Steps in repairing
   7.6.2 Prevention of corrosion in reinforcement

7.7 Material placement techniques with sketches
   7.7.1 Pneumatically applied (The gunite techniques)
   7.7.2 Open top placement
   7.7.3 Pouring from the top to repair bottom face
   7.7.4 Birds month
   7.7.5 Dry packing
   7.7.6 Form and pump
   7.7.7 Preplaced – aggregate concrete
   7.7.8 Trowel applied method
7.8 Repair of DPC against Rising Dampness
   7.8.1 Physical methods
   7.8.2 Electrical methods
   7.8.3 Chemical methods

7.9 Repair of walls
   7.9.1 Repair of mortar joints against leakage
   7.9.2 Efflorescence removal

7.10 Waterproofing of wet areas and roofs
   7.10.1 Water proofing of wet areas
   7.10.2 Water proofing of flat RCC roofs
   7.10.3 Various water proofing systems and their characteristics

7.11 Repair of joints in buildings
   7.11.1 Sealing of joints
   7.11.2 Types of sealant and their characteristics

7.12 Repair and maintenance of public health Services
   7.12.1 Low pressure
   7.12.2 Cisterns defects, blocked drains, damaged china ware
   7.12.3 Maintenance of GI Pipes
   7.12.4 Repair of traps
   7.12.5 Repair of overhead and underground water tanks

INSTRUCTIONAL STRATEGY

This is very important course and efforts should be made to find damaged/defective work spots and students should be asked to think about rectifying/finding solution to the problem. Visits to work site, where repair and maintenance activities are in progress can be very useful to students.

RECOMMENDED BOOKS

1. Nayak, BS; "Maintenance Engineering for Civil Engineers", Khanna Publishers, Delhi

2. Ransom, WH; "Building Failures - Diagnosis and Avoidance", Publishing E and F.N. Span

3. Hutchinson, BD; etc, "Maintenance and Repair of Buildings", Published by Newness - Butterworth
6.7.2 ENVIRONMENTAL ENGINEERING

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RATIONALE

Civil Engineering diploma holders must have the knowledge of different types of environmental aspects due to development activities so that they may help in maintaining the ecological balance and control pollution. They should also be aware of the environmental laws for effectively combating environmental pollution. The class room instructions should be supplemented by field visits to show the pollution caused by urbanization and the combatment measures being adopted at site. Extension lectures by experts may be encouraged.

DETAILED CONTENTS

1. Environment and Ecology (4 hrs)

   Definition and understanding of environment and ecology concept, ecosystem and types of ecosystems, energy flow in an ecosystem, food chain, ecological pyramids, consortium and ecological balance, important biogeo chemical and material cycles, (water, carbon, sulphur, oxygen and nitrogen etc)

2. Protection of Environment (2 hrs)

   Importance of clean environment, control of environmental pollution with respect to air, land and water. Conservation of natural resources, environmental education and awareness

3. Water Pollution (8 hrs)

   Causes of pollution in surface and underground water; BIS standards for water quality, preventive measures to control water pollution, harmful effects of domestic wastes and industrial effluent, BIS standards for waste water disposal, measures to combat pollution due to waste water, eutrophication of lakes

4. Air Pollution (6 hrs)

   Definition, principal air pollutants, atmospheric parameters influencing air pollution, types of air contaminants and their sources, effects of air pollution on human beings, plants, animals and economic effects, automobile pollution, BIS ambient air quality standards and measures to combat air pollution
5. **Noise Pollution** (2 hrs)

Definition, unit of measurement of noise, sources and effects of noise pollution and control of noise pollution

6. **Effects of mining, blasting and deforestation** (6 hrs)

Environmental deterioration due to mining, open cast mining; land damage by subsidence, blocking of land by refuse heaps; effects of deforestation and killing of wild animals. Case studies on mining, blasting and deforestation

7. **Land Use** (6 hrs)

Effect of land use on environmental quality, land use and natural disasters, soil degradation problems - erosion, salinization and water logging, soil pollution, planning for land use and environmental improvement, environmental consideration in housing and city planning, Land reclamation - waste land and wet land development and case studies

8. **Environmental Impact Assessment** (4 hrs)

Definition and requirements, environmental impact assessment as a result of constructional activities – housing, dams, multi-storeyed buildings, roads, etc, case studies, environmental auditing - basic concepts, sustainable development – concept of carrying capacity

9. **Legislation to Control Environmental Pollution** (4 hrs)

Indian legislative acts for water, land and air pollution control – provisions, scope and implementation

10. **Global Issues of Environmental Engineering** (4 hrs)

Global warming, ozone depletion, acid rain, oil pollution; radiation hazards and their control

11. **Renewable Source of Energy** (2 hrs)

Role of non-conventional sources of energy (biogas, solar, wind etc) in environmental protection

**INSTRUCTIONAL STRATEGY**

Students should be encouraged to undertake project work related to environmental problems. They should visit at least three industrial effluent treatment plants and study the impact of utilization of reclaimed by products
RECOMMENDED BOOKS

1. Environmental Engineering by Deswal and SS Deswal; Dhanpat Rai and Company (P) Ltd., Delhi
3. Environmental Engineering and Management by SK Dhamija; SK kataria and Sons, Delhi
6.7.3 RURAL TECHNOLOGY

RATIONALE

Considerable employment opportunities are available in rural sector if diploma holders in civil engineering are trained to undertake small entrepreneur activity in the rural areas. This subject aims at imparting knowledge and skill in the use of local materials for low cost housing, rural water supply and sanitation rural roads and other appropriate technologies, which can be promoted for upgrading standards of life in rural areas.

DETAILED CONTENTS

1. Introduction:
   Scope and concept of appropriate technology as applicable to civil engineering, importance of low cost construction in rural areas.

2. Materials:
   Importance of locally available material, bamboo, tree bushes, grass, mud, sand etc., treatment of materials for protection against termite, decay and for increasing their strength

3. Mud Walls:
   Construction of plane and block mud walls, bamboo/bush reinforced mud walls, water proofing of mud walls, thickness of mud walls, mud plaster, Bitumen combine and plaster.

4. Thatched Roofs:
   Constructional method of thatched roofs, fire proofing of thatched roof, low cost treatment of thatched roof.

5. Low Cost Housing:
   Planning and construction of low cost houses, cluster of houses, ventilation, low cost doors, construction of mud floors, construction of smokeless chullaha, construction of cement treated gunny bags, sheds, construction of sheds for animals

6. Rural Water Supply:
   Construction of open well, chlorination of open well, construction of hand pumps, constructions of bathing cubicals, construction of low cost drains.
7. Rural Sanitations:

Construction of low cost latrines, construction of pre-fabricated septic tanks, construction of soak pits.

8. Soil stabilization and construction of fair weather roads, construction of bunds

9. Miscellaneous:

Low lift pumps, Ferro-cement storage tanks, Ferro-cement grain bins, red clay tiles for roof and floors, construction of rapid burning low cost brick kilns solar seasoning plants. Solar cookers, fiber corrugated sheets, individual and community biogas plants. Concrete blocks for wall construction, Brick, panels, precast lintels, slabs and beam etc.
6.8 PROJECT WORK

As far as possible students should be given live project problems with a view to:

i) Develop understanding regarding the size and scale of operations and nature of
field work in which students are going to play their role after completing the
courses of study.

ii) Develop understanding of subject based knowledge given in the classroom in the
context of its application at work places.

iii) Develop first hand experience and confidence amongst the students to enable
them to use and apply polytechnic/institute based knowledge and skills to solve
practical problems of the world of work.

iv) Develop special skills and abilities like interpersonal skills, communication skills,
attitudes and values.

For the fulfillment of above objectives, polytechnic may establish close linkage with 8-10
relevant organization for providing such an experience. It is necessary that each
organisation is visited well in advance and activities to be performed by students are well
defined. The chosen activities should be such which are of curricular interest to students
and of professional value to industrial/field organisations. Each teacher is expected to
supervise and guide 5-6 students.

Effort should be made to identify actual field problems to be given as project work to the
students. Project selected should not be too complex which is beyond the level of the
students. The placement of the students for such a practical cum project work should
match with the competency profile of students and the project work assigned to them.
Students may be assessed both by industry and polytechnic faculty. The suggested
performance criteria is given below:

a) Punctuality and regularity
b) Initiative in learning/working at site
c) Level/proficiency of practical skills acquired
d) Sense of responsibility
e) Self expression/Communication skills
f) Interpersonal skills
g) Report Writing skills
h) Viva voce
Some of suggested projects are given below:

1. Construction of a small concrete road consisting of following activities
   - Survey and preparation of site plan
   - Preparation of drawings i.e. L-Section and X-Section
   - Estimating and earth work
   - Preparation of sub grade with stone ballast
   - Laying of concrete
   - Testing of slump, casting of cubes and testing
   - Material estimating and costing with specifications
   - Technical report writing

2. Water Supply system for a one or two villages
   - Surveying
   - Design of water requirements and water distribution system
   - Preparation of drawing of overhead tank
   - Material estimating and costing
   - Specifications
   - Technical report writing

3. Construction of sitting benches in polytechnic campus

4. Welding of angle iron and Expanded metal jali to prepare fencing in polytechnic campus

5. Construction of toilets and baths for a shopping complex in a township

6. Construction of a Chowkidar hut

7. Construction of bridal path 4 kms long

8. Construction of shopping complex detailing of RCC drawings, estimating and costing of material

9. Rainwater harvesting
   - Assessment of catchment area
   - Intensity of rainfall
   - Collection of water
   - Soak pit design
   - Supply of water
   - Monitoring during rainy season

10. Providing of septic tank with soak pits
11. Preparing plumbing detailed drawings of a two storey building and material estimate and costing

12. Planning and design of sports stadium in a township or cluster of villages

13. Design and drawings of fishery ponds in a village

14. Design of small residential building including structural members, specifications, estimating and costing of materials, report writing and municipal drawings for water supply and sewerage system