CURRICULUM

FOR

DIPLOMA PROGRAMME

IN

Civil Engineering

2nd Year (i.e. 3rd & 4th Semester)

FOR THE STATE OF HIMACHAL PRADESH

(Implemented w.e.f. Session 2013-14)

Prepared by:-

Composite Curriculum Development Centre

Directorate of Technical Education,

Vocational & Industrial Training, Sundernagar(H.P.)

CONTENTS

THIRD SEMESTER

FORTH SEMESTER

PREFACE

India, in last two decades, has made significant progress in all major spheres of activity. Since 1947, the Technical Education System has grown into fairly large sized system, offering opportunities for education and training in vide variety of trades / disciplines at different levels. Needless to say that well trained technical manpower is the backbone of any growing economy in the era of fast industrialization. It has been the endeavor of the Technical Education Department to take decisive steps to enhance the capacities of technical institutions with major emphasis on quality and excellence in technical education .Our country is the only country in the world which has 50% population below the age of 25 years whereas America has 30% and China 40%.Working Age Population (WAP) is increasing in India whereas it is decreasing in other parts in the world. Challenge before us is to train this WAP for the world of work .Updated curriculum is one of the most powerful tools to improve the quality of training.

Curriculum Document is a comprehensive plan or a blue print for developing various curriculum materials and implementing given educational programme to achieve desired and formally pre-stated educational objectives. Moreover it (the document) is the output of exhaustive process of curriculum planning and design, undertaken by the implementers under the expert guidance of curriculum designer.

While working out the detailed contents and study and evaluation scheme, the following important elements have been kept in mind:

i) Major employment opportunities of the diploma holders.
ii) Modified competency profile of the diploma holders with a view to meet the changing needs due to technological advancement and requirements of various employment sectors.
iii) Vertical and horizontal mobility of diploma pass outs for their professional growth.
iv) Pragmatic approach in implementing all the curricula of diploma programmes in engineering and technology in the state of H.P.

The document is an outcome of the feedback received from field organizations/ industry of different categories viz. small, medium and large scale which offer wage employment for the diploma pass outs. In every stage of planning and designing of this curriculum, suggestions and advice of experts representing industry, institutions of higher learning, research organizations etc. were sought and incorporated as per the requirement of curriculum . The document contains the study and evaluation scheme and detailed subject/course contents to enable the H.P. Polytechnics to implement revised curriculum and to achieve the desired objectives.

Time has specifically been allocated for undertaking extra-curricular activities. Emphasis has been laid on developing and improving communication skills in the students for which Communication Lab has been introduced during the first year itself.

We hope that this revision will prove useful in producing competent diploma holders in the state of Himachal Pradesh. The success of this curriculum depends upon its effective implementation and it is expected that the managers of polytechnic education system in Himachal Pradesh will make efforts to create better facilities, develop linkages with the world of work and foster conducive and requisite learning environment.

Sh. L.R. Rana
HOD(CCDC)
Directorate of Technical Education,
Vocational & Industrial Training,
Himachal Pradesh, Sundernagar.

2nd YEAR OF THREE YEAR DIPLOMA PROGRAMME IN CIVIL ENGINEERING

1. SALIENT FEATURES

1) Name of the Programme : Three year Diploma Programme Civil Engineering
2) Duration of the Programme : Three years (06 Semesters)
3) Entry Qualification : As prescribed by H.P. Takniki Shiksha Board
4) Intake : As approved by H.P. Takniki Shiksha Board
5) Pattern of the Programme : Semester Pattern
6) Curriculum for : 2nd year of Three year Diploma Programme(Technical Stream)
7) **Student Centred Activities:**

A provision of 2-4 hrs per week has been made for organizing Student Centred Activities for overall personality development of students. These activities will comprise of co-curricular & other activities such as expert lectures, games, seminars, declamation contests, educational field visits, NCC, NSS and cultural activities & hobby classes like photography, painting, singing etc.

8) **Industrial Training:-**

It is needless to emphasize further the importance of Industrial Training of students during their 3 years of studies at Polytechnics. It is industrial training, which provides an opportunity to students to experience the environment and culture of industrial production units and commercial activities undertaken in field organizations. It prepares student for their future role as diploma engineers in the world of work and enables them to integrate theory with practice. Polytechnics have been arranging industrial training of students of various durations to meet the above objectives.

This document includes guided and supervised industrial training of a minimum of 4 weeks duration to be organised during the semester break starting after second year i.e. after IV Semester examinations. The concerned HODs along with other teachers will guide and help students in arranging appropriate training places relevant to their specific branch. It is suggested that a training schedule may be drawn for each student before starting of the training in consultation with the training providers. Students should also be briefed in advance about the organizational setup, product range, manufacturing process, important machines and materials used in the training organization.

Equally important with the guidance is supervision of students training in the industry/organization by the teachers. A minimum of one visit per week by the teacher is recommended. Students should be encouraged to write daily report in their diary to enable them to write final report and its presentation later on.

An internal assessment of 50 and external assessment of 50 marks have been provided in the study and evaluation scheme of V Semester. Evaluation of professional industrial training report through viva-voce/presentation aims at assessing students understanding of materials, industrial process, practices in industry/field organization and their ability to engage in activities related to problem solving in industrial setup as well as understanding of application of knowledge and skills learnt in real life situations. The formative and summative evaluation may comprise of weightage to performance in testing, general behaviour, quality of report and presentation during viva-voce examination. It is recommended that such evaluations may be carried out by a team comprising of concerned HOD, teachers and representative from industry.

Teachers and students are requested to see the footnote below the study and evaluation scheme of IV Semester for further details.

2. GUIDELINES

2.1 GUIDELINES FOR ASSESSMENT OF STUDENT CENTRED ACTIVITIES (SCA)

Distribution of 25 marks for SCA will be as follows:

i. 5 Marks shall be given for general behaviour

ii. 5 Marks for attendance shall be based on the following distribution:

1.	Less than 75%	Nil
2.	75-79.9%	3 Marks
3.	80-84.9%	4 Marks
4.	Above 85%	5 Marks

iii. 15 Marks shall be given for the Sports/NCC/Cultural and Co-curricular activities/other activities after due consideration to the following points:

1. For participation in sports/NCC/Cultural/Co-curricular activities at National or above level, shall be rewarded with minimum of 10 marks
2. For participation in sports/NCC/Cultural/Co-curricular activities at Inter-polytechnic level, shall be rewarded with minimum of 08 marks
3. For participation in two or more of the listed activities, 5 extra marks should be rewarded

Note: *Head of Department shall ensure that these marks are conveyed to the H.P. Takniki Shiksha Board, Dharamsala at the end of semester along with sessional record.*

2.2 GUIDELINES FOR SESSIONAL ASSESSMENT

- The distribution of marks for Internal Assessment in theory subjects and drawing shall be made as per the following guidelines:
  i. 60% of internal assessment shall be based on the performance in the tests. At least three tests shall be conducted during the semester out of which at least one should be house test. 30% weightage shall be given to house test and 30% to class test(One best out of two).
  ii. 20% marks shall be given to home assignments, class assignments, seminars etc.
  iii. 20% marks shall be given for attendance/punctuality in the subject concerned.
- The distribution of marks for Internal/External Assessment in practical subjects shall be made as per the following guidelines:
  i. 60% marks shall be awarded for performance in practical.
  ii. 20% marks shall be given for Report/Practical book and punctuality in equal proportion.
  iii. 20% marks shall be for Viva-voce conducted during the practicals.
- The distribution of mark for internal assessment in drawing subjects shall be as per following guidelines:-
  i. 60% marks for sheets ii. 40% for test.

Study & Evaluation Scheme

THIRD SEMESTER (CIVIL ENGINEERING)

S.No.	SUBJECTS	STUDY MARKS IN EVALUATION SCHEME SCHEME Hrs/Week		MARKS IN EVALUATION SCHEME								Total Marks
				INTERNAL ASSESSMENT			EXTERNAL ASSESSMENT					
		Th	Pr.	Th	Pr	Total	Th	Hrs	Pr	Hrs	Total	
3.1	Fluid Mechanics	4	2	30	20	50	100	3	50	3	150	200
3.2	**Applied Mechanics	3	2	30	20	50	100	3	50	3	150	200
3.3	Surveying – I	2	6	20	30	50	100	3	50	3	150	200
3.4	Construction Materials	3	2	30	20	50	100	3	50	3	150	200
3.5	Building Construction	4	2	30	20	50	100	3	50	3	150	200
3.6	Building Drawing	-	6	-	50	50	100	4			100	150
# Student Centred Activities		-	4	-	25	25						25
TOTAL		16	24	130	195	325	600		250		850	1175

*** Applied Mechanics (Th & Lab.)will be engaged by Mechanical Engineering Department.*

FOURTH SEMESTER (CIVIL ENGINEERING)

S.No.	SUBJECTS	STUDY MARKS IN EVALUATION SCHEME Hrs/Week		MARKS IN EVALUATION SCHEME								Total Marks
				INTERNAL ASSESSMENT			EXTERNAL ASSESSMENT					
		Th	Pr.	Th	Pr	Total	Th	Hrs	Pr	Hrs	Total	
4.1	Concrete Technology	4	2	30	20	50	100	3	50	3	150	200
4.2	Water Supply and Waste Water Engineering	5	2	30	20	50	100	3	50	3	150	200
4.3	Soil and Foundation Engineering	4	2	30	20	50	100	3	50	3	150	200
4.4	Surveying-II	3	6	20	30	50	100	3	50	3	150	200
4.5	* Structural Mechanics	4	2	30	20	50	100	3	50	3	150	200
4.6	Public Health Engineering Drawing	-	2	-	50	50	100	4			100	150
# Student Centred Activities		-	4	-	25	25						25
TOTAL		20	20	140	185	325	600		250		850	1175

** Structural Mechanics(P) will be engaged by Mechanical Engineering Department.*

3.1 FLUID MECHANICS

L T P
4 - 2

RATIONALE

Subject of Hydraulics is a basic engineering subject and helps in solving fluid flow problems in the field of Civil Engineering. The subject deals with basic concepts and principles in hydrostatics, hydro kinematics and hydrodynamics and their application in solving fluid -mechanics problems.

DETAILED CONTENTS

THEORY

1. Properties of fluid : (6 Hrs.)

1.1 Properties of fluid
- 1.1.1 Density or mass density
- 1.1.2 Specific volume
- 1.1.3 Specific gravity

1.2 Viscosity
- 1.2.1 Units of viscosity
- 1.2.2 Kinematic viscosity
- 1.2.3 Newton's law of viscosity
- 1.2.4 Variation of viscosity with temperature

1.3 Surface tension and capillarity
1.4 Numerical Problems on all properties
1.5 Fluid Kinematics, Fluid dynamics
1.6 Types of fluid

2. Pressure and its measurement: (8 Hrs.)

2.1 Fluid pressure at a point
2.2 Pascal Law
2.3 Absolute, Gauge, Atmospheric, and vacuum pressure (Numerical Problems)
2.4 Simple manometer (numerical problems)
- 2.4.1 Piezometer
- 2.4.2 U-tube manometer
- 2.4.3 Single column manometer

2.5 Differential manometer
- 2.5.1 U- tube differential manometer
- 2.5.2 Inverted U-tube differential manometer

3 Hydrostatic forces on surfaces: (6Hrs.)

3.1 Total pressure and centre of pressure
3.2 Vertical plane surfaces submerged in water (Derivation & Numerical problems)
3.3 Inclined plane surfaces submerged in water (Derivation & Numerical problems)

4. Kinematics of flow: (8 Hrs.)

4.1 Type of fluid flow
- 4.1.1 Steady and Unsteady flow
- 4.1.2 Uniform and Non uniform flow
- 4.1.3 Laminar and Turbulent flow
- 4.1.4 Compressible and Incompressible flow
- 4.1.5 Rotational and Irrotational flow

4.2 Rate of flow or discharge
4.3 Continuity equation (No Derivation only Numerical problems)

5. Dynamics of Fluid flow : (6 Hrs.)

5.1 Euler equation of motion (No derivation)
5.2 Bernoulli's equation (No derivation)
5.3 Applications of Bernoulli's equation
5.3.1 Venturimeter (Numerical problems, No derivations of formulae)
5.3.2 Pitot tube (Numerical problems)

6 Notches and weirs: (8 Hrs.)

6.1 Classification of notches and weir
6.2 Discharge over a rectangular notch or weir (With derivation of formula and numerical problems)
6.3 Discharge through a triangular notch (With derivation of formula and numerical problems)
6.4 Advantages of Triangular notch over Rectangular notch
6.5 Discharge through a trapezoidal notch (With derivation of formula and numerical problems)

7. **Flow through Pipes: (12 Hrs.)**

7.1 Loss of energy in pipe
7.2 Loss of energy due to friction (Numerical Problems)
7.3 Minor energy losses (no derivation of formula)
7.3.1 Loss of head due to sudden enlargement
7.3.2 Loss of head due to sudden contraction
7.3.3 Loss of head at the entrance of pipe
7.3.4 Loss of head at the exit of pipe
7.3.5 Loss of head due to an obstruction in a pipe
7.3.6 Loss of head due to bend in pipe
7.3.7 Loss of head in various pipe fitting
7.3.8 (Numerical problems on all above losses)
7.4 Flow through pipe in series or flow through compound pipe (Numerical Problems)
7.5 Flow through parallel pipe (Numerical Problems)

8. **Flow through open channels: (10 Hrs.)**

8.1 Introduction
8.2 Classification of flow in channel
8.2.1 Steady flow and unsteady flow
8.2.2 Uniform flow and non uniform flow
8.2.3 Laminar flow and turbulent flow
8.2.4 Sub-critical, Critical and super critical flow
8.3 Discharge through open channel by Chezy's formula (No derivation, Numerical problem only)
8.4 Most economical section of channel
8.4.1 Most economical rectangular channel (Derivation &Numerical problem)
8.4.2 Most economical Trapezoidal channel (Derivation &Numerical problem)
8.4.3 Best side slope for most economical trapezoidal channel

PRACTICAL EXERCISES

i) To verify Bernoulli's Theorem
ii) To find out venturimeter coefficient
iii) To determine coefficient of velocity (Cv), Coefficient of discharge (Cd) Coefficient of contraction (Cc) of an orifice and verify the relation between them.
iv) To perform Reynold's experiement
v) To verify loss of head in pipe flow due to
   a) Sudden enlargement
   b) Sudden contraction
vi) Demonstration of working of current meter.
vii) Demonstration of working of pitot tube.
viii) To determine coefficient of discharge of a rectangular notch/triangular notch.

INSTRUCTIONAL STRATEGY

Hydraulics being a fundamental subject, teacher is expected to lay considerable stress on understanding the basic concepts, principles and their applications. For this purpose, teacher is 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

1. *Jagdish Lal, "Fluid Mechanics and Hyraulics" Delhi Metropolitan Book Co.Pvt Ltd.*
2. *Modi, PN, and Seth, SM; "Hydraulics and Fluid Mechanics", Delhi Standard Publishers Distributors.*
3. *Khurmi RS, "Hydraulics and Hydraulics Machines", Delhi S Chand and Co.*
4. *Likhi SK., Laboratory Manual in Hydraulics, Delhi Wiley Eastern.*
5. *Fluid Mechanics by Birinder Singh, Kaption Publishing, New Delhi.*

SUGGESTED DISTRIBUTION OF MARKS

Topic No.	Time Allotted (Hrs)	Marks Allotted (%)
1	6	6
2	8	12
3	6	12
4	8	16
5	6	14
6	8	12
7	12	16
8	10	12
Total	64	100

3.2 APPLIED MECHANICS

L	T	P
3	-	2

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 (Applied Mechanics), definition of mechanics, statics, dynamics, application of engineering mechanics in practical fields.

1.2 Definition of mass and weight basic quantities and derived quantities of basic units and derived units

1.3 Concept of rigid body, scalar and vector quantities

2 Laws of forces (10 Hrs)

2.1 Definition of force, measurement of force in SI units, its representation, types of force: Point force/concentrated force & Uniformly distributed force, effects of force, characteristics of a force

2.2 Different force systems (coplanar and non-coplanar), principle of transmissibility of forces, law of super-position

2.3 Composition and resolution of coplanar concurrent forces, resultant force, method of composition of forces, laws of forces, triangle law of forces, polygon law of forces - graphically, analytically, resolution of forces,resolving a force into two rectangular components

2.4 Free body diagram

2.5 Equilibrant force and its determination

2.6 Lami's theorem (concept only)

[Simple problems on above topics]

3. Moment (8 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 (Levers – simple and compound,
balance steel yard, safety valve, reaction at support)

3.5 Parallel forces (like and unlike parallel force), calculating their resultant

3.6 Concept of couple, its properties and effects

3.7 General conditions of equilibrium of bodies under coplanar forces

3.8 Position of resultant force by moment

[Simple problems on the above topics]

4. **Friction (8 Hrs.)**

4.1 Definition and concept of friction, types of friction, force of friction

4.2 Laws of static friction, coefficient of friction, angle of friction, angle of repose, cone of friction

4.3 Equilibrium of a body lying on a horizontal plane, equilibrium of a body lying on a

4.4 Rough inclined plane, friction in simple screw jack.
4.5 Calculation of least force required to maintain equilibrium of a body on a rough inclined plane subjected to a force:
a) Acting along the inclined plane horizontally
b) At some angle with the inclined plane.

5. **Centre of Gravity** **(6 Hrs.)**

3.1 Concept, definition of centroid of plain figures and centre of gravity of symmetrical solid bodies
3.2 Determination of centroid of plain and composite lamina using moment method only, centroid of bodies with removed portion.
3.3 Determination of center of gravity of solid bodies - cone, cylinder, hemisphere and sphere; composite bodies and bodies with portion removed.
[Simple problems on the above topics]

6. **Simple Lifting Machines** **(10 Hrs.)**

6.1 Definition of effort, velocity ratio, mechanical advantage and efficiency of a machine and their relationship, law of machines
6.2 Simple and compound machine (Examples)
6.3 Definition of ideal machine, reversible and self locking machine.
6.4 Effort lost in friction, Load lost in friction, determination of maximum mechanical advantage and maximum efficiency
6.5 System of pulleys (first, second and third system of pulleys), Determination of velocity ratio, mechanical advantage and efficiency
6.6 Working principle and application of inclined plane, wheel and axle, differential pulley blocks, simple screw jack, worm and worm wheel, single and double winch crab. Expression for their velocity ratio and field of their application.
[Simple problems on the above topics]

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 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 (M.A), velocity ratio (V.R) and efficiency (η) 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 crab.
8. To find M.A, V.R, and η of :
   (i) First system of pulleys
   (ii) Second system of pulleys
9. To find out center of gravity of regular lamina and irregular lamina.
10. To determine coefficient of friction between three pairs of given surface.

RECOMMENDED BOOKS

1. *A Text Book of Applied Mechanics by S Ramamurtham,Dhanpat Rai Publishing Co. Ltd.*
2. *Applied Mechanics By, Col. Harbhajan Singh, TL Singla and Parmod Kumar Singla Published By Abhishek Publication, 57-59, Sector-17, Chandigarh*
3. *A Text Book of Engineering Mechanics (Applied Mechanics) by RK Khurmi; S Chand and Co. Ltd., New Delhi.*
4. *Text Book of Applied Mechanics by Birinder Singh, Kaption Publishing House,New Delhi.*
5. *Engineering Mechanics by Parsad, Standard Publications, New Delhi.*

SUGGESTED DISTRIBUTION OF MARKS

Topic No.	Time Allotted (Hrs)	Marks Allotted (%)
1	6	10
2	10	22
3	8	18
4	8	18
5	6	10
6	10	22
Total	48	100

3.3 SURVEYING - I

L T P
3 - 6

RATIONALE

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 leveling, that the Civil Engineering diploma holder will normally be called upon to perform and plane table surveying, 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:** **(2 Hrs.)**
   - 1.1 Basic principles of surveying
   - 1.2 Concept, Purpose and Classification of surveying, measurements- linear and angular, units of measurements.
   - 1.3 Instruments used for taking these measurements

2. Chain surveying: **(4 Hrs.)**
   - 2.1 Introduction Principle, and operations involved in chaining, advantages and disadvantages. Instruments used for setting right angles, different types of chains.
   - 2.2 Direct and indirect ranging, offsets and recording of field notes, Conventional signs used in chain surveying.
   - 2.3 Error in length due to incorrect chain & its numerical problems

3. **Compass surveying:** **(6Hrs.)**
   - 3.1 Purpose of compass surveying. Use of prismatic compass: Setting and taking observations.
   - 3.2 Types of compass- Prismatic & Surveyor's
   - 3.3 Concept of following with simple numerical problems:
     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
   - 3.4 Local attraction - causes, detection, errors and corrections, problems on local attraction, magnetic dip, declination and calculation of local attraction, correct bearing & true bearing & included angles in a compass traverse.

4. **Leveling:** **(8 Hrs.)**
   - 4.1 Purpose of leveling, concept of a level surface, horizontal surface, vertical surface, datum, reduced level and bench marks
   - 4.2 Identification of various parts of Dumpy level and IOP level and use of Dumpy level
   - 4.3 Concepts of line of collimation, axis of the bubble tube, axis of the telescope and vertical axis

4.4 Leveling staffs: single piece, folding, invar precision staff and telescopic
4.5 Temporary adjustment: of dumpy level
4.6 Concept of back sight, foresight, intermediate sight, change point and to determine reduce levels.
4.7 Use of Level book and calculation of reduced levels by:
4.7.1 Height of collimation method and
4.7.2 Rise and fall method
4.8 Arithmetic checks, problems on reduction of levels, fly leveling, check leveling and profile leveling, errors in leveling, permissible limits, reciprocal leveling. (Numerical problems)

5. **Plane Table Surveying** **(08 Hrs.)**
5.1 Purpose of plane table surveying, equipment used in plane table survey:
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, LEHMAN'S RULES method.
5.6 Errors in plane table survey and precautions to control them.

6. **Auto Level** **(04Hrs.)**
Introduction, principle of auto level, use of auto level, advantages and disadvantages of auto level

PRACTICAL EXERCISES

I. **Chain surveying:**
i) a) Ranging a line
b) Chaining a line and recording in the field book
c) Taking offsets - perpendicular and oblique (with a tape only)
d) Setting out right angle with a tape
ii) Chaining of a line involving reciprocal ranging
iii) Chaining a line involving obstacles to ranging
iv) Chain Survey of a small area.

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

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) To find out difference of level between two distant points by shifting the instrument
iii) Longitudinal and cross sectioning of a road/railway/canal
iv) Setting a gradient by dumpy or auto-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, radiation and resection 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 &Error method.

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

1. Hussain, SK and Nagraj, MS; "Text Book of Surveying"; New Delhi, S Chand and Co Ltd.
2. Deshpande, RS; "A Text Book Surveying and Levelling"; Poona, United Book Corporation
3. Kocher, CL; "A Text Book of Surveying"; Ludhiana, Katson Publishing House
4. Kanetkar,TP and Kulkarni, SV., "Surveying and Leveling", Poona, AVG Parkashan
5. Kanetkar, TP; and Kulkarni, SV; "Surveying and Leveling" Poona, AVG Prakashan
6. Punmia, BC; "Surveying and Leveling", Delhi Standard Publishers Distributors.
7. Shahai, PB; "A Text Book of Surveying", Oxford and IBH Publishing Co

SUGGESTED DISTRIBUTION OF MARKS

Topic No.	Time Allotted (Hrs)	Marks Allotted (%)
1	2	5
2	4	12
3	6	20
4	8	28
5	8	25
6	4	10
Total	32	100

3.4 CONSTRUCTION MATERIALS

L T P
3 - 2

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**: **(6Hrs.)**
   - 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 , startified and foliated rocks
   - 1.2 General characteristics of stones – Marble, Kota stone, Granite, Sand, Trap, Basalt stone, Lime stone and Slate
   - 1.3 Requirements of good building stones
   - 1.4 Various uses of stones in construction

2. **Bricks:** **(10Hrs.)**
   - 2.1 Introduction to bricks
   - 2.2 Raw materials for brick manufacturing and properties of good brick making earth,
   - 2.4 Classification and specifications of bricks as per BIS: 1077

3. **Cement:** **(10Hrs.)**
   - 3.1 Introduction, raw materials, flow diagram of manufacturing of cement by wet process
   - 3.2 Various types of Cements, 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 sulphate cement
   - 3.3 Properties of Compounds of cement.

4. **Lime:** **(6Hrs.)**
   - 4.1 Introduction: Lime as one of the cementing materials
   - 4.2 Classification and types of lime as per BIS Code
   - 4.3 Calcination and slaking of lime
   - 4.4 Process of setting and hardening action of lime.

5. **Timber and Wood Based Products: 10Hrs.)**

5.1 Seasoning of timber: Purpose, methods of seasoning as per BIS Code
5.2 Properties of timber and specifications of structural timber
5.3 Defects in timber, decay in timber
5.4 Preservation of timber and methods of treatment as per BIS
5.5 Other wood based products, their brief description and uses of laminated board, block board, hard board.

6. **Paints and Varnishes: (6Hrs.)**

6.1 Introduction, purpose and use of paints
6.2 Types, ingredients, properties and uses of oil paints, water paints and cement paints
6.3 Covering capacity of various paints
6.4 Types, properties and uses of varnishes

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

PRACTICAL EXERCISES:

i) To determine the crushing strength of bricks
ii) To determine the water absorption of bricks
iii) To determine fineness (by sieve analysis) of cement
iv) To conduct field test of cement.
v) To determine normal consistency of cement
vi) To determine initial and final setting times of cement
vii)To determine soundness of cement
viii 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. *Sharma, SK; and Mathur, GC; "Engineering Materials;" Delhi-Jalandhar, S. Chand and Co.*
2. *Bahl, SK; "Engineering Materials;" Delhi, Rainbow Book Co.*
3. *TTTI, Chandigarh "Civil Engineering Materials:" New Delhi Tata McGraw Hill Pub.*
4. *Kulkarni, GJ; "Engineering Materials;" Ahmedabad, Ahmedabad Book Depot.*
5. *Shahane; "Engineering Materials"; Poona, Allied Book Stall.*
6. *Gurcharan Singh; "Engineering materials", Delhi Standard Publishers Distributors*
7. *SC Rangawala, "Construction Materials", Charotar Publishers*
8. *Dr. Hemant Sood "Lab Manual in Testing of Engineering Materials", New Age International (P) Ltd., New Delh*
9. *Handbook of Civil Engineering by PN Khanna*

SUGGESTED DISTRIBUTION OF MARKS

Topic No.	Time Allotted (Hrs)	Marks Allotted (%)
1	6	15
2	10	20
3	10	20
4	6	10
5	10	20
6	6	15
Total	48	100

3.5 BUILDING CONSTRUCTION

L T P
4 - 2

RATIONALE

Diploma holders in Civil Engineering are supposed to effectively supervise construction of buildings. Effective supervision is essential to obtain/provide a fault free service from contractors to users. To perform above task, it is essential that students should have knowledge of various sub components of buildings like foundations, walls, roofs, staircases, floors etc., and their constructional details as well as preventive, remedial and corrective methods of common construction faults. Therefore, the subject of Building Construction is very important for Civil Engineering diploma holders.

DETAILED CONTENTS

THEORY: **(2 Hrs.)**

1. Introduction:

1.1 Definition of a building, classification of buildings based on occupancy

1.2 Different parts of a building.

2. **Foundations:** **(8 Hrs.)**

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,

2.3 Earthwork

2.3.1 Layout/setting out of building foundation

.

3. **Walls:** **(5 Hrs.)**

3.1 Purpose of walls

3.2 Classification of walls - load bearing, non-load bearing, dwarf wall, retaining, breast walls and partition walls

4.**Brick Masonry :** **(8Hrs.)**

4.1 Brick Masonry: Definition of terms like header, stretcher, queen closer, king closer, frog and quoin, course, bond, facing, backing, hearting, jambs, reveals, soffit, plinth, pillars and pilasters

4.1.1 Bond – meaning and necessity; English, Flemish bond and other types.

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

5 Stone Masonry: **(6 Hrs.)**

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

5.2 Types of stone masonry: rubble masonry - random and coursed; Ashlar masonry, principles to be observed in construction of stone masonry walls.

6 **Arches and Lintels:** **(8 Hrs.)**

6.1 Meaning and use of arches and lintels:

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

6.3 Arches:

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

6.4 Lintels

6.4.1 Purpose of lintel

6.4.2 Materials used for lintels

6.4.3 Cast-in-situ and pre-cast lintels.

7. **Doors, Windows and Ventilators: **(6 Hrs.)**

7.1 Glossary of terms with neat sketches

7.2 Classification based on materials i.e. wood, metal and plastic and their suitability for different situations. Different type of doors- paneled door, flush door, glazed door, rolling shutter, steel door, sliding door, plastic and aluminum doors.

7.3 Window – Panel window, glazed windows (fixed and openable), ventilators, sky light window, Louvres shutters, plastic and aluminum windows.

*8. **Damp Proofing and Water Proofing:** **(4 Hrs.)**

8.1 Dampness and its ill effects sources and causes of dampness

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

9. **Floors : **(6 Hrs.)**

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

9.2 Types of floor finishes - cast-in-situ, concrete flooring (monolithic, bonded) Terrazzo tile flooring, stone (marble and kota) flooring, PVC flooring, Terrazzo flooring, glazed tiles flooring, Timber flooring, description with sketches. The methods of construction of concrete, terrazzo and timber floors.

10. **Roofs :** **(4 Hrs.)**

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

10.2 Glossary of terms for pitched roofs - batten, eaves, facia board, gable, hip, lap, purlin, rafter, rag bolt, valley, ridge, rain water gutter, anchoring bolts

11. **Stairs:** **(4Hrs.)**

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

11.2 Classification of staircase on the basis of material – RCC, timber, steel, Aluminum

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

11.4 Various types of layout - straight flight, dog legged, open well, quarter

turn, half turn (newel and geometrical stairs), bifurcated stair, spiral stair

12. **Surface Finishes: (3Hrs.)**

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

12.2 Painting - preparation of surface, primer coat and application of paints on wooden, steel and plastered wall surfaces(New and old surface)

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*

PRACTICAL EXERCISES

i) Layout of a building: one & two rooms building
ii) To construct brick bonds (English bond only) in one, one and half and two brick thick: walls for L, T Junction
iii) cross junction
iv) Columns
v) Field Visit/Demonstration of following items of work at construction site:
  a) Damp proof courses
  b) Construction of masonry walls
  c) Flooring: Laying of different types of flooring like cement concrete ,terrazo,marble, tiles.
  d) Plastering
  e) RCC work
  f) White washing & distempering
  g) Painting

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 subcomponents 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 construction yard where enough raw materials is made available for students to perform practical work

RECOMMENDED BOOKS

1. Gupta, Sushil Kumar, Singla, DR, and Juneja BM; "A Text Book of Building Construction"; Ludhiana, Katson Publishing House.
2. Deshpande, RS and Vartak, GV; "A Text Book of Building Construction"; Poona, United Book Corporation.
3. Rangwala, SC: "Building Construction"; Anand, Charotar Book Stall
4. Kulkarni, GJ; "A Text Book of Building Construction"; Ahmedabad Book Depot
5. Arora, SP and Bindra, SP; "A Text Book of Building Construction"; New Delhi Dhanpt Rai and Sons.
6. Sharma,SK and Kaul, BK; "A Text Book of Building Construction"; Delhi, S Chand and Co.
7. Sushil Kumar; "Building Construction"; Standard Publishers Distributors, Delhi
8. Moorthy, NKR; "A Text Book of Building Construction"; Poona, Engineering

Book Publishing Co.
9. Handbook of Civil Engineering by PN Khanna

SUGGESTED DISTRIBUTION OF MARKS

Topic No.	Time Allotted (Hrs)	Marks Allotted (%)
1	2	4
2	8	10
3	5	10
4	8	12
5	6	10
6	8	10
7	6	8
8	4	8
9	6	6
10	4	6
11	4	10
12	3	6
Total	**64**	**100**

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

Drawing No. 1:

Details of spread footing foundations, load bearing and non-load bearing wall for given thickness of walls with the help of given data or rule of the thumb, showing offsets, position of DPC. The details of the concrete and brick apron have to be shown in the drawing.

Drawing No. 2:

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

Drawing No. 3:

Elevation, sectional plan and sectional side elevation of flush door (Single Shutter), panelled & glazed door (Double shutter)

Drawing No. 4:

Drawing plan, elevation of a one room building from the given site plan, the foundation detail and sectional elevation.

Drawing No.5:

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

Drawing No.6:

Planing & Designing of a two room residential building including elevation (No section) for a given plot size.

Drawing No.7:

Dog legged stair Case (without reinforcement detail)

NOTE:

a) All drawings should be as per BIS code and specifications in SI Units

b) Intensive practice of reading and interpreting building drawings should be given

RECOMMENDED BOOKS

1. Civil Engineering Drawing by RS Malik, Asia Publishing House
2. Civil Engineering Drawing by V.B.Sikka. Katson Publishing, Ludhiana
3. Civil Engineering Drawing by NS Kumar; IPH, New Delhi
4. Principles of Building Drawing by MG Shah and CM Kale, MacMillan, Delhi
5. Building Construction by Moorthy NRK
6. Civil Engg Drawing by Layal
7. Zaidi, SKA and Siddiqui, Suhail; Drawing and Design of Residential and Commercial Buildings, Standard Publishers and Distributors, Delhi.
8. SP : 20
9. National Building Code

4.1 CONCRETE TECHNOLOGY

L T P
4 - 2

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: (2 Hrs.)

1. **Introduction:** Definition of concrete, uses of concrete in comparison to other building materials.

2. **Ingredients of Concrete: (8Hrs.)**
   - 2.1 Overview of OPC & PPC only (Properties and uses only)
   - 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
   - 2.3 Water: Quality requirements as per IS:456-2000

3. **Water Cement Ratio: (4Hrs.)**
   - 3.1 Hydration of cement principle of water-cement ratio, Duff Abram's Water-cement ratio law: Limitations of water-cement ratio law and its effects on strength of concrete.

4. **Workability: (5Hrs.)**
   - 4.1 Workability factors affecting workability, Measurement of workability: slump test, compacting factor and Vee Bee consistometer; Recommended slumps for placement in various conditions as per IS:456-2000/SP-23

5. **Properties of Concrete: (8Hrs.)**
   - 5.1 Properties in plastic state: Workability, Segregation, Bleeding and Harshness
   - 5.2 Properties in hardened state: Strength, Durability, Impermeability, Dimensional changes;

6. **Proportioning for Normal Concrete: (6Hrs.)**
   - 6.1 Objectives of mix design, introduction to various grades as per IS:456-2000; proportioning for nominal mix design as prescribed by IS 456-2000
   - 6.2 Adjustment on site for: Bulking of fine aggregate, water absorption of aggregate, workability

6.3 Difference between nominal and controlled concrete.

7. **Storing & batching of concrete ingradients: (8 Hrs.)**

**7.1 Storing of Cement:

- 7.1.1 Storing of cement in a warehouse
- 7.1.2 Storing of cement at site
- 7.1.3 Effect of storage on strength of cement
- 7.1.4 Determination of warehouse capacity for storage of Cement

**7.2 Storing of Aggregate: Storing of aggregate on site

7.3 Batching

- 7.3.1 Batching of Cement
- 7.3.2 Batching of aggregate by: Volume, using gauge box (farma)
  selection of proper gauge box.
- 7.3.3 Weight spring balances and by batching machines
- 7.3.4 Measurement of water.

8. **Mixing, Transportation & placement of concrete: (9Hrs.)**

8.1 Hand mixing

8.2 Machine mixing - types of mixers

**8.3Transportation of concrete: Transportation of concrete using pans, wheel barrows, transit mixers, chutes, belt conveyors, pumps, tower crane and hoists etc.

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

9. **Compaction, Finishing & Curing of concrete: (8 Hrs.)**

9.1 Hand compaction

9. 2 Machine compaction - types of vibrators, internal screed vibrators and form vibrators

9.3 Selection of suitable vibrators for different situations

9.4 Finishing concrete slabs - screeding, floating and trowelling

9.5 Curing: Objective, methods of curing like ponding, membrane curing, steam curing, chemical curing

9.6 Duration for curing and removal of form work

10. **Admixtures: (2 Hrs.)**

10.1 types of admixtures along with their suitability.

11. **Special Concrete**: **4Hrs.)**

Fibre reinforced concrete , Ready Mix concrete , High fly ash concrete

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

PRACTICAL EXERCISES:

i) To determine flakiness and elongation index of coarse aggregates
ii) Method to determine silt in fine aggregate
iii) Determination of specific gravity and water absorption of aggregates
iv) Determination of bulk density and voids of aggregates

v) To determine surface moisture in fine aggregate by displacement method
vi) Determination of particle size distribution of fine, coarse and all in aggregate by sieve analysis (grading of aggregate)
vii) To determine necessary adjustment for bulking of fine aggregate
viii) To determine workability by slump test:
ix) Compaction factor test for workability
x) Non destructive test on concrete by:
    a) Rebound Hammer Test
    b) Ultrasonic Pulse Velocity Test
xi) Tests for compressive strength of concrete cubes for 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) *Kulkarni, PD; Ghosh, RK and Phull, YR; "Text Book of Concrete Technology"; New Delhi Oxford and IBH Publishing Co.*
ii) Krishnamurthy, KT; Rao, A Kasundra and Khandekar, AA; "Concrete Technology"; Delhi, Dhanpat Rai and Sons.
iii) Gupta BL and Gupta Amit; "Text Book of Concrete Technology"; Standard Publishers Distributors, Delhi.
iv) Varshney, RS;"Concrete Technology";New Delhi, Oxford and IBH Publishing
v) Neville, AM; "Properties of Concrete" London, Pitman (ELBS Edition available)
vi) Orchard; "Concrete Technology"; Vol I, II, and III
vii) Handoo, BL; and Puri, LD;"Concrete Technology"; New Delhi, Satya Prakashan
viii) Birinder Singh, "Concrete Technology", Ludhiana, Kaption Publications
ix) Module on 'Special Concretes by Dr Hemant Sood , NITTTR Chandigarh
x) Gambhir, ML; "Concrete Technology"; New Delhi, MacMillan India Ltd.

SUGGESTED DISTRIBUTION OF MARKS

Topic No.	Time Allotted (Hrs)	Marks Allotted (%)
1	2	4
2	8	12
3	4	6
4	5	8
5	8	16
6	6	8
7	8	6
8	9	12
9	8	20
10	2	2
11	4	6
Total	64	100

4.2 WATER SUPPLY AND WASTE WATER ENGINEERING

L	T	P
5	-	2

RATIONALE

One of the basic necessities of life is water which is not easily available to a lot of people. Providing potable water at the first place then collection and disposal of waste solids and liquids are important activities of civil engineering field. This subject provides basic knowledge and skills in the field of water supply system and waste disposal system. Classroom instructions should be suplimented by field visits to show functional details of water supply and waste disposal systems. It will also be advantageous to invite professionals from field to deliver extension lectures on specialized operations.

DETAILED CONTENTS

THEORY

A. WATER SUPPLY

1. **Introduction :** **(1 Hr.)**
   1.1 Necessity and brief description of water supply system.

2. **Quantity of Water:** **(6 Hrs.)**
   2.1 Water requirement
   2.2 Rate of demand and variation in rate of demand
   2.3 Per capita consumption for domestic, industrial, public and fire fighting uses as per BIS standards (no numerical problems)
   2.4 Methods of Population Forecasting (Numerical Problems)

3. **Quality of Water:** **(6 Hrs.)**
   3.1 Meaning of pure water and methods of analysis of water
   3.2 Physical, Chemical and bacteriological tests and their significance
   3.3 Standard of potable water as per Indian Standard

4. **Water Treatment:** **(10 Hrs.)**
   **4.1 Sedimentation - purpose, types of sedimentation tanks
   **4.2 Coagulation flocculation - usual coagulation and their feeding
   **4.3 Filtration - significance, types of filters, their suitability
   4.4 Necessity of disinfection of water, forms of chlorination, break point chlorine, residual chlorine, application of chlorine.
   4.5 Flow diagram of different treatment units,
   functions of (i)Aeration fountain (ii) mixer (iii) flocculator, (iv)classifier,

5. **Conveyance of Water:** **(8 Hrs.)**
   **5.1 Different types of pipes - cast iron, G.I.pipes and PVC and uses
   5.2 Appurtenances: Sluice, Air, Reflux valve, Relief valves and Scour valve. Fire Hydrants, Water Meters their working & uses
   5.3 Distribution Systems: Gravity, Pumping, Combined Gravity & pumping
   5.4 Layout of distribution systems along with their suitability

6. **Building Water Supply:** **(4 Hrs.)**

6.1 Water supply fixtures and installations and terminology related to plumbing

6.2 The House Water Connection

B. WASTE WATER ENGINEERING

7. **Introduction:** **(5 Hrs.)**

7.1 Purpose of sanitation

7.2 Necessity of systematic collection and disposal of waste

7.3 Definition of terms in sanitary engineering

7.4 Collection and conveyance of sewage

7.5 Conservancy and water carriage systems, their advantages and disadvantages

8. **Sewerage System:** **(10 Hrs.)**

8.1 Types of sewerage systems, materials for sewers, their sizes and joints

8.2 Appurtenance: Location, function and construction features. Manholes, catch basin, flushing tanks, oil & grease traps, ventilating shafts etc.

9. **Laying and Construction of Sewers:** **(6 Hrs.)**

9.1 Setting out/alignment of sewers

9.2 Excavations, checking the gradient with boning rods, preparation of bedding, handling, jointing, testing and back filling of sewers/pipes.

10 **Sewage characteristics:** **(6 Hrs.)**

10.1 Properties of sewage and BIS standards for analysis of sewage

10.2 Physical, chemical and bacteriological parameters

11 **Sewage Treatment :** **(12 Hrs.)**

11.1 Meaning and principle of primary and secondary treatment, aerobic & anaerobic treatment, activated sludge process with their flow diagrams.

11.2 Introduction and uses of screens, grit chambers, detritus tanks, skimming tanks, plain sedimentation tanks, primary clarifiers, secondary clarifiers, filters, control beds, intermittent sand filters, trickling filters, sludge treatment and disposal, oxidation ponds

11.3 Disposal by dilution

11.4 Self purification of stream

12. **Building Drainage:** **(6 Hrs.)**

12.1 Aims of building drainage and its requirements

**12.2 Different sanitary fittings and installations

12.3 Traps, seals, causes of breaking seals

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

LIST OF PRACTICALS

1) To determine turbidity of water sample
2) To determine dissolved oxygen of given sample
3) To determine pH value of water
4) To perform jar test for coagulation
5) To determine residual chlorine in water
6) To determine conductivity of water and total dissolved solids.
7) Demonstration/Awareness & Use of different Water Supply & Sanitary fittings.

8) Field visit to construction site of Septic Tank.

INSTRUCTIONAL STRATEGY:

Before imparting the instructions in the class room, visits to water works and sewage treatment plants can go a long way for increased motivation of students for learning in the class room. As the subject is of practical nature, lecture work be supplemented by field visits from time to time. Home assignments related to collection of information, pamphlets and catalogues from hardware shop dealing water supply and sanitary fittings

will be very helpful for the students.

REFERENCES

1. *Duggal, KN; "Elements of Public Health Engineering"; New Delhi, S. Chand and Co.*
2. *Rangwala, SC; "Water Supply and Sanitary Engineering"; Anand Charotar Book Stall*
3. *Kshirsagar, SR; "Water Supply Engineering"; Roorkee Publishing House*
4. *Kshirsagar, SR; "Sewage and Sewage Tratement"; Roorkee, Roorkee Publishing House*
5. *Hussain, SK; "Text Book of Water Supply and Sanitary Engineering"; New Delhi, Oxford and IBH Publishing Co*
6. *Birdie, GS; "Water Supply and Sanitary Engineering"; Delhi Dhanpat Rai and Sons*
7. *Garg, Santosh Kumar; "Water Supply Engineering"; Delhi Khanna Publishers*
8. *Garg, Santosh Kumar; "Sewage and Waste Water Disposal Engineering"; Delhi Khanna Publisher*
9. *Steel, EW; "Water Supply and Sewerage"; McGraw Hill.*
10. *Duggal, Ajay K and Sharma, Sanjay, "A Laboratory Manual in Public Health Engineering", New Delhi, Galgotra Publications, 2006.*
11. *Gurjar,B.R. sludge Treatment & Disposal" Oxford and IBH Co Pvt Ltd New Delhi.*

SUGGESTED DISTRIBUTION OF MARKS

Topic No.	Time Allotted (Hrs)	Marks Allotted (%)
1	1	2
2	6	10
3	6	6
4	10	16
5	8	10
6	4	6
7	5	6
8	10	10
9	6	8
10	6	4
11	12	16
12	6	6
Total	80 Hrs.	100

4.3 SOIL ENGINEERING

L	T	P
4	-	2

RATIONALE

Civil Engineering diploma engineers are required to supervise the construction of roads, 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 which 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:** **(4 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, local soil found in H.P., dunes and loess, glacial deposits, conditions in which above deposits are formed and their engineering characteristics.

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

3. **Classification and Identification of Soils:** **(6 Hrs.)**
   - 3.1 Particle size, shape and their effect on engineering properties of soil, particle size classification of soils
   - 3.2 Gradation and its influence on engineering properties
   - 3.3 Relative density and its use in describing cohesion less soils Atterberg's limit - definitions, use and practical significance
   - 3.5 Field identification tests for soils
   - 3.6 Soil classification system as per BIS 1498; basis, symbols, major divisions and sub divisions, groups, plasticity chart; procedure for classification of a given soil.

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 Methods of finding out permeability- Constant Head & Falling Head Test (No Derivation only simple numerical problems)

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

5.5 Quick sand Phenomenon

6. **Deformation of Soils:** **(10 Hrs.)**

6.1 Meaning, conditions/situations of occurrence with emphasis on practical significance of:

a) Consolidation and settlement

b) Creep

c) Plastic flow

d) Heaving

e) Lateral movement

f) Freeze and thaw of soil

6.2 Definition and practical significance of compression index, coefficient of consolidation, degree of consolidation.(Numerical based on above)

6.3 Meaning of total settlement, uniform settlement and differential settlement; rate of settlement and their effects

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:** **(10 Hrs.)**

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

7.2 Determination of shearing strength by direct shear test, unconfined compression test and Tri-axial Test only along with their advantages & disadvantages.

7.3 Drainage conditions of test and their significance

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

7.5 Examples of shear failure in soils

8. **Compaction:** **(6 Hrs.)**

8.1 Definition and necessity of compaction and its differences with consolidation.

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

8.3 Compaction control; Density control, measurement of field density by core cutter method and sand replacement method, moisture control, Proctor's needle and its use, thickness control, jobs of an embankment supervisor in relation to compaction.

9. **Soil Exploration:** **(6 Hrs.)**

9.1 Purpose and necessity of soil exploration

9.2 Reconnaissance, methods of soil exploration, Trial pits, borings (auger, wash, rotary, percussion to be briefly dealt)

9.3 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,

setting, sealing and preservation of samples.

10. **Bearing Capacity of soil: (10 Hrs.)**
    - 10.1 Concept of bearing capacity
    - 10.2 Definition and significance of ultimate bearing capacity, net safe bearing capacity and allowable bearing pressure
    - 10.3 Guidelines of BIS (IS 6403) for estimation of bearing capacity
    - 10.4 Factors affecting bearing capacity, Concept of vertical stress distribution in soils due to foundation loads, pressure bulb
    - 10.6 Plate load test and its limitations
    - 10.7 Applications of SPT

PRACTICAL EXERCISES

1. To determine the moisture content of the given sample of soil

2. **Auger Boring**
   a) Identifying the equipment and accessories
   b) Collecting soil samples and their identification

3. **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

4. **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

5. **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

6. **Laboratory Compaction Tests (Standard Proctor test)**
   a) Preparation of sample
   b) Conducting the test
   c) Computation of results and plotting
   d) Determination of optimum moisture and maximum dry density

.

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

1. *Punmia, BC; "Soil Mechanics and Foundations"; Delhi Standard Publishers Distributors.*
2. *Bharat Singh and Shamsher Prakash; "Soil Mechanics and Foundations Engineering"; Roorkee, Nem Chand and Bros.*
3. *Sehgal, SB; "A Text Book of Soil Mechanics"; Delhi, CBS Publishers and Distributors*
4. *Bowles,Joseph E; "Engineering Properties of soils and their Measurement"; Delhi, Tata McGraw Hill.*
5. *Gulati, SK and Manoj Dutta; "Geotechnical Engineering ", Delhi, Tata McGraw Hill*
6. *Khan, Iqbal H, "A Text Book of Geotechnical Engineering", Delhi, Prentice Hall of India*
7. *Ranjan Gopal and Rao ASR "Basic and Applied Soil Mechanics", New Age Publication (P) Ltd., New Delhi*
8. *S Mittal and JP Shukla, "Soil Testing for Engineers", Khanna Publishers Ltd.*
9. *Duggal, AK., Ramana, TR.,Krishnamurthy, S., "Soil Sampling and Testing - A Laboratory Manual, Galgotra Publications, 2006*
10. *BIS Codes IS 6403 (latest edition) and IS 1498 (latest edition)*
11. *Jagroop Singh, Soil and Foundation Engineering, Eagle Parkashan, Jalandhar*
12. *Rabinder Singh" Soil and foundation engg SK Kataria and sons, Ludiana*
13. *Shallow Foundations, NITTTR Chandigarh*

SUGGESTED DISTRIBUTION OF MARKS

Topic No.	Time Allotted (Hrs)	Marks Allotted (%)
1	4	4
2	4	10
3	6	8
4	4	10
5	4	10
6	10	16
7	10	8
8	6	14
9	6	10
10	10	10
Total	64	100

4.4 SURVEYING – II

L	T	P
2	-	6

RATIONALE

The important functions of a 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 knowledge and skill in theodolite surveying, tachometry surveying, curves and use of minor and modern instruments have been 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, interpolation of contours; use of contour map, Drawing cross section from a contour map; alignment of a road on contour map, computation of earth work and reservoir capacity from a contour map.

2. **Theodolite Surveying:** **(14 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; plotting a traverse; concept of coordinate and solution of omitted measurements (one side affected), errors in theodolite survey.

Height of objects – accessible and non-accessible bases

3. **Tacheometric surveying:** **(10 Hrs.)**

Tacheometry, Instruments to be used in tacheometry, methods of tacheometry, stadia system of tachometry, general principles of stadia tachometry, examples of stadia tachometry and Numerical problems.

4. **Curves:** **(14 Hrs.)**

4.1 Simple Circular Curve:

* 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

Setting out of simple circular curve (No derivations, only brief description):

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 (with numerical problems)

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;
4.3 Vertical curve brief description only

5. Computation of Areas: (4 Hrs)

By Graphical & Instrumental Methods
Areas by use of Field Notes

NOTE: No sketch of the instruments should be asked in the examination.

PRACTICAL EXERCISES

I. **Contouring:**

i) Preparing a contour plan by radial line method by the use of a Auto level/Dumpy level
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 Theodilite, 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,
Iv)Measurement of horizontal angles by repetition and reiteration methods
v) Measurement of vertical angles and use of tachometric tables
vi) Measurement of magnetic bearing of a line
vii) Running a closed traverse with a theodolite (at least five sides) and its plotting
viii) Height of objects with and without accessible bases

III Total station

i. Demonstration of total station
ii. Measurement of linear distances
iii. Measurements of included angles
iv. Measurement of R.L.s of station points

IV **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

V. Minor instruments:

i) Demonstration and use of minor instruments like Ceylon Ghat Tracer, Tangent Clinometer, Pantagraph, Abney level.
ii) Use of planimeter for computing areas

VI. Modern surveying equipments (Demonstration only).

i. Digital Theodolite
ii. Digital Level
iii. Digital Planimeter
iv. GPS

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

1. Hussain, SK and Nagraj, MS; "Text Book of Surveying"; New Delhi, S Chand and Co Ltd.
2. Deshpande, RS; "A Text Book Surveying and Levelling"; Poona, United Book Corporation
3. Kocher, CL; "A Text Book of Surveying"; Ludhiana, Katson Publishing House
4. Kanetkar,TP and Kulkarni, SV., "Surveying and Leveling", Poona, AVG Parkashan
5. Kanetkar, TP; and Kulkarni, SV; "Surveying and Leveling-Vol.2" Poona, AVG Prakashan
6. Punima, BC; "Surveying and Leveling ", Delhi Standard Publishers Distributors, Delhi
7. Shahai, PB; "A Text Book of Surveying ", Oxford and IBH Publishing Co.
8. Lilly Sant "Remote Sensing and Image Interpretation"

SUGGESTED DISTRIBUTION OF MARKS

Topic No.	Time Allotted (Hrs)	Marks Allotted (%)
1	6	18
2	14	22
3	10	25
4	14	30
5	4	5
Total	48	100

4.5 STRUCTURAL MECHANICS

L T P
4 - 2

RATIONALE

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 seful for designing simple structural components. This subject is very important to develop basic concepts and principles related to strength of materials. 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.

2. **Simple Stresses and Strains: (8 Hrs.)**
   - 2.1 Concept of stress, normal and shear stresses,
   - 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 Temperature stresses and strains

3. **Shear Force and Bending Moment: (12 Hrs.)**
   - 3.1 Concept of a beam and supports (Hinges, Roller and Fixed), types of beams: simply supported, cantilever, propped, over hang, and continuous beams (only concept).
   - 3.2 Types of loads (dead load, live load, snow load, wind load seismic load as per IS Codes 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,uniformly varying load
   - 3.5 Relationship between load, shear force and bending moment, point of maximum bending moment, and point of contraflexure

4. **Moment of Inertia: (6 Hrs.)**

   Concept of moment of inertia and second moment of area and radius of gyration, theorems of parallel and perpendicular axis, second moment of area of common geometrical sections: rectangle, triangle, circle (without

derivations). Second moment of areas for shapes made of simple rectangle (L, T , Channel and I sections)only, section modulus.

5. **Bending Stresses in Beams: (8 Hrs.)**
   - 5.1 Concept of pure/simple bending
   - 5.2 Assumptions made in the theory of simple bending, derivation and application of bending equation to circular cross-section, I section, T and L sections only
   - 5.3 Moment of resistance
   - 5.4 Calculations of bending stresses in simply supported beam

6. **Combined Direct and Bending Stresses: (8 Hrs.)**
   - 6.1 Concentric and eccentric loads single axis eccentricity only
   - 6.2 Effect of eccentric load on the section stresses due to eccentric loads, Numerical in the case of short columns.

7. **Shear Stresses in Beams: (8 Hrs.)**
   - 7.1 Concept of shear stresses in beams, shear stress distribution in rectangular, circular I, T, L sections (Formula to be stated, no derivation)

8. **Slope and Deflection: (6 Hrs.)**
   - 8.1 Necessity for determination of slope and deflection Moment area theorem (no derivation, simple numerical problems)

9. **Columns: (6 Hrs.)**
   - 9.1 Theory of columns
   - 9.2 Eulers and Rankine Formula

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) Testing of HYSD Steel
iii) Determination of Young's modulus of elasticity for steel wire with searl's apparatus
iv) Determination of maximum deflection and young's modulus of elasticity in simply supported beam with load at middle third.

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

i. *Ramamrutham, S., "Strength of Materials", New Delhi Dhanpat Rai and Sons.*
ii. *Ram Chandra, "Applied Mechanics and Strength of Materials", Delhi: Standard Publishers.*

iii. *Punmia, BC., "Strength of Materials", Delhi, Standard Publishers Distributors.*
iv. *VS Prasad " Structural mechanics Galgotia publications Pvt Ltd*
v. *Sadhu Singh "Strengths of Materials" Standard Publishers, New Delhi*
vi. *Structural Mechanics by Birinder Singh Kaption Publishers Ludhiana*
vii. *Structure Mechanics by Prof. Harbhajan Singh, Abhishek Publishers, Chandigarh*
viii. *Design of Masonry and Timber Structures by Prof. Harbhajan Singh, Abhishek Publishers, Chandigarh.*

SUGGESTED DISTRIBUTION OF MARKS

Topic No.	Time Allotted (Hrs)	Marks Allotted (%)
1	2	4
2	8	14
3	12	24
4	6	8
5	8	10
6	8	10
7	8	10
8	6	10
9	6	10
Total	64 Hrs.	100

4.6 PUBLIC HEALTH ENGINEERING DRAWING

L	T	P
-	-	2

RATIONALE

Diploma holders in Civil Engineering are expected to supervise construction of water supply and wastewater 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

Drawings Exercises

1. Sewers

1.1 Cross section of earthen ware and RCC sewer pipes

1.2 Cross sections of masonry sewers (circular and egg shaped)

2. Manhole and inspection chamber

2.1 Detailed plan and section of an inspection chamber

2.2 Detailed plan and section of a manhole (Square only)

3. Septic Tank and Soak Pit

3.1 Detailed plan and cross sections of a domestic septic tank with soak pit for 5-10 users

4. Draw sectional elevation of a two storeyed building showing details of one pipe and two pipes systems with sanitation system.

INSTRUCTIONAL STRATEGY

Teachers are expected to develop skills in preparation and interpretation 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 Drawing by JS Layal, Satya Parkashan, New Delhi

2. Civil Engineering Drawings by RP Chandel

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

4. Civil Engineering Drawing by RS Malik and GA Meo; Asian Publishing House,New Delhi