Curriculum for
Diploma Programme in

CIVIL ENGINEERING
(BATCH 2018)

For the State of Haryana

Prepared by:

Curriculum Development Centre
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Sector 26, Chandigarh - 160 019

Haryana State Board of Technical Education
Bays 7-12, Sector 4
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FIRST YEAR (Civil Engineering)

Sr. No.	SUBJECTS	STUDY SCHEME HOURS / WEEK			CREDIT	MARKS IN EVALUATION SCHEME								Total Marks of Internal & External
						INTERNAL ASSESSMENT			EXTERNAL ASSESSMENT					
		L	T	P		Th	Pr	Tot	Th	Hrs	Pr	Hrs	Tot	
1.1*	English	2	-	2	6	40	25	65	60	3	50	3	110	175
1.2*	Applied Mathematics	3	1	-	7	40	-	40	60	3	-	-	60	100
1.3*	Applied Physics	2	1	2	7	40	25	65	60	3	50	3	110	175
1.4*	Applied Chemistry	2	-	1	5	40	25	65	60	3	50	3	110	175
1.5*	Applied Mechanics	2	-	2	6	40	25	65	60	3	50	3	110	175
1.6*	Environmental Studies	2	-	1	5	40	25	65	60	3	50	3	110	175
1.7*	Engg. Graphics	-	-	3	3	40	25	65	60	3	25 (viva)	3	85	150
1.8*	Information Technology	-	-	2	2	-	50	50	-	-	50	3	50	100
1.9*	Internet of Things & Artificial Intelligence	-	-	2	2	-	50	50	-	-	100	3	100	150
1.10*	General Workshop Practice	-	-	3	3	-	50	50	-	-	50	3	50	100
#	Student Centered Activities(SCA)	-	-	2	2	-	25	25	-	-	-	-	-	25
Total		13	02	20	48	280	325	605	420	-	475	-	895	1500

*Common with other diploma programmes

SCA will comprise of co-curricular activities like extension lectures, games, hobby clubs, seminars, declamation contests, educational field visits, N.C.C., N.S.S., Cultural Activities and Disaster management etc.

THIRD SEMESTER (CIVIL ENGINEERING)

Sr. No	Subject	STUDY SCHEME			Credit	EVALUATION SCHEME						Total Marks
						Internal Assessment		External Assessment (Examination)				
						Theory	Practical	Written Paper		Practical		
		Hrs/week				Max. Marks	Max. Marks	Max. Marks	Hrs	Max. Marks	Hrs	
		L	T	P								
3.1	Fluid Mechanics	3	-	2	4	25	25	100	3	50	3	200
3.2	Structural Mechanics	4	-	2	5	25	25	100	3	50	3	200
3.3	Surveying – I	3	-	5	6	25	25	100	3	50	3	200
3.4	Construction Materials	3	-	2	4	25	25	100	3	50	3	200
3.5	Building Construction	4	-	2	5	25	25	100	3	50	3	200
3.6	Building Drawing	-	-	3	2	50	-	100	3	-	-	150
Soft Skills-I		-	-	2	-	-	25	-	-	-	-	25
Total		**17**	**-**	**18**	**26**	**175**	**150**	**600**	**-**	**250**	**-**	**1175**

FOURTH SEMESTER (CIVIL ENGINEERING)

Sr. No	Subject	STUDY SCHEME Hrs/week L	T	P	Credit	EVALUATION SCHEME						Total Marks
						Internal Assessment		External Assessment (Examination)				
						Theory	Practical	Written Paper		Practical		
						Max. Marks	Max. Marks	Max. Marks	Hrs	Max. Marks	Hrs	
4.1	Concrete Technology	4	-	2	5	25	25	100	3	50	3	200
4.2	Water Supply & Waste Water Engineering	4	-	2	5	25	25	100	3	50	3	200
4.3	Irrigation Engineering	3	-	-	3	25	-	100	3	-	-	125
4.4	Surveying – II	3	-	6	6	25	25	100	3	50	3	200
4.5	Soil Mechanics & Foundation Engineering	4	-	2	5	25	25	100	3	50	3	200
4.6	Water Supply & Waste Water Engineering and Irrigation Engineering Drawing	-	-	3	2	50	-	100	3	-	-	150
Soft Skills-II		-	-	2	-	-	25	-	-	-	-	25
Total		**18**		**17**	**26**	**175**	**125**	**600**	**-**	**200**	**-**	**1100**

Note: **1.** Survey camp will be held after 4th semester for minimum 10 days in a sub mountainous area away from polytechnic preferably in camp conditions. Details are given at Sr. No. 5.3 in 5th Semester.

2. **Industrial Training:** After examination of 4th Semester, the students shall go for training in a relevant industry/field organization for a period of 8 weeks and will prepare a diary. It shall be evaluated during 5th semester by his/her teacher in charge for 100 marks. The students shall also prepare a report at the end of training and shall present it in a seminar, which will be evaluated for another 100 marks. This evaluation will be done by assigned lecturer in charge in the presence of one subject expert from other Institution/representative from Industry or field/representative from Construction Sector Skill Council/Training and Placement Officer.

FIFTH SEMESTER (CIVIL ENGINEERING)

Sr. No	Subject	STUDY SCHEME Hrs/week L	T	P	Credit	EVALUATION SCHEME						Total Marks
						Internal Assessment		External Assessment (Examination)				
						Theory	Practical	Written Paper		Practical		
						Max. Marks	Max. Marks	Max. Marks	Hrs	Max. Marks	Hrs	
Industrial /Field Training		-	-	-	5	-	100	-	-	100	3	200
5.1	Highway Engineering	4	-	2	5	25	25	100	3	50	3	200
5.2	Reinforced Cement Concrete Design & Drawing	5	-	3	7	50*	-	150	6	-	-	200
5.3	Survey Camp[1]	-	-	-	3	-	50	-	-	100	3	150
5.4	Computer Applications in Civil Engineering	-	-	6	3	-	50	-	-	100	3	150
5.5	Railways, Bridges & Tunnels	5	-	-	5	25	-	100	3	-	-	125
5.6	Plumbing Services	3	-	2	4	25	25	100	3	50	3	200
5.7	Elective**	3	-	-	3	25	-	100	3	-	-	125
Soft Skills - III		-	-	2	-	-	25	-	-	-	-	25
Total		**20**	**-**	**15**	**35**	**150**	**275**	**550**	**-**	**400**	**-**	**1375**

*Sessional test including Drawing also with 2 hours duration.

**Elective: To choose any one from the following:

5.7.1 Pre-stressed Concrete 5.7.2 Repair and Maintenance of Buildings

Use of the IS: 456-2000 is permissible in the theory exam of Reinforced Cement Concrete Design & Drawing.

SIXTH SEMESTER (CIVIL ENGINEERING)

Sr. No	Subject	STUDY SCHEME Hrs/week L	T	P	Credit	EVALUATION SCHEME						Total Marks
						Internal Assessment		External Assessment (Examination)				
						Theory	Practical	Written Paper		Practical		
						Max. Marks	Max. Marks	Max. Marks	Hrs	Max. Marks	Hrs	
6.1	Steel Structures Design and Drawing	4	-	3	6	50*	-	150	3	-	-	200
6.2	Earthquake Resistant Building Construction	3	-	-	3	25	-	100	3	-	-	125
6.3	Quantity Surveying & Valuation	4	-	2	5	25	25	100	3	50	3	200
6.4	Construction Management & Accounts	5	-	-	5	25	-	100	3	-	-	125
6.5	Major Project Work	-	-	12	6	-	100	-	-	100	3	200
Soft Skills-IV		-	-	2	-	-	25	-	-	-	-	25
Total		**16**	**-**	**19**	**25**	**125**	**150**	**450**	**-**	**150**	**-**	**875**

*Sessional test including Drawing also with 2 hours duration.

Use of the IS: 800-2007 is permissible in the theory exam of Steel Structures Design and Drawing.

FIRST YEAR

(Annual System)

1.1 ENGLISH

L	T	P
2	-	2

RATIONALE

Knowledge of English Language plays an important role in career development. This subject aims at introducing basic concepts of communication besides laying emphasis on developing listening, speaking, reading and writing skills as parts of Communication Skill.

LEARNING OUTCOMES

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

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- Understand the importance of good communication
- Describe process of communication.
- Explain, Compare and re-write the types of communication
- Identify and match the parts of speech
- Rewrite sentences correctly
- Modify sentences and relate them with real life situations.
- Reproduce and match words and sentences in a paragraph.
- Re-write the sentences according to given situation.
- Relate and use various words using proper vocabulary and grammar.
- Write the various types of paragraphs, notices and composition on picture with appropriate format.

DETAILED CONTENTS

1. **Basics of Communication** **(06 Hrs)**
   - 1.1. Definition and process of communication
   - 1.2. Types of communication – Verbal (Listening, Speaking, Reading and Writing) and Non-verbal

2. **Functional Grammar** **(22 Hrs)**
   - 2.1. Noun and Pronoun
   - 2.2. Punctuation
   - 2.3. Preposition
   - 2.4. Conjunction
   - 2.5. Tenses (verb (Main verb and Auxiliary verb)

3. Reading Skills (12 Hrs)

3.1. Unseen passage for comprehension. Based upon the passage, flowing aspects may be covered

- Questions from the passage
- One-word substitution
- Prefixes and Suffixes
- Antonyms and Synonyms etc.

4. Writing skills (30 Hrs)

4.1. Correspondence – Business and official
4.2. Notice, including Press Releases
4.3. Memos
4.4. Circular
4.5. Basics of Report Writing
4.6. Resume Writing
4.7. Writing E-mail
4.8. Paragraph writing
4.9. Picture composition

LIST OF PRACTICALS

1. Listening Exercises
2. Self and Peer Introduction
3. Debate
4. Situational Conversations: Offering - Responding to offers; Requesting – Responding to requests; Congratulating; Expressing sympathy and condolence; Apologizing and Forgiving; Complaining; Warning; Asking and giving information; Getting and giving permission; Asking for and giving opinions; Talking about likes and dislikes
5. Just a minute sessions – Extempore
6. Group Discussion
7. Newspaper reading
8. Mock Interviews: Telephonic and Personal

INSTRUCTIONAL STRATEGY

Student should be encouraged to participate in role play and other student centered activities in class room and actively participate in listening exercises

MEANS OF ASSESSMENT

- Assignments and quiz/class tests, mid-term and end-term written tests
- Actual practical work, exercises and viva-voce
- Presentation and viva-voce

RECOMMENDED BOOKS

1. Communicating Effectively in English, Book-I by Revathi Srinivas; Abhishek Publications, Chandigarh.
2. Communication Techniques and Skills by R. K. Chadha; Dhanpat Rai Publications, New Delhi.
3. High School English Grammar and Composition by Wren & Martin; S.Chand & Company Ltd., Delhi.
4. e-books/e-tools/relevant software to be used as recommended by AICTE/HSBTE/NITTTR.

Section	Percentage of syllabus to be covered	Units to be covered	Type of assessment	Weightage of Marks	Pass Percentage
A	20%	Unit 1.1, 2.1, 4.1	1st Internal	40%	40% (Combined in internal & final assessment) with minimum 25% marks in final assessment)
B	20%	Unit 2.2, 4.2, 4.3	2nd Internal		
C	60%	Unit 1.2, 2.3 to 2.5 , 3, 4.4 to 4.9	FINAL	60%	

1.2 APPLIED MATHEMATICS

L	T	P
3	1	-

RATIONALE

Contents of this course provide fundamental base for understanding engineering problems and their solution algorithms. Contents of this course will enable students to use basic tools like logarithm, binomial theorem, partial fractions, matrices, t-ratios and co-ordinates for solving complex engineering problems with exact solutions in a way which involve less computational task. By understanding the logarithm, they will be able to make long calculations in short time and it is also a pre-requisite for understanding Calculus. Statistics is important for understanding of tolerances, quality assurance and quality control and it is also essential for data analysis.

LEARNING OUTCOMES

After undergoing this course, the students will be able to:

- Apply complex number in engineering problems.
- Apply permutation and combination to count without actual counting.
- Apply permutation and combination to understand binomial theorem.
- Calculate the approximate value of roots of certain expressions in engineering problems by application of binomial theorem.
- Resolve rational functions to partial fractions for the use in Integral Calculus.
- Use matrices to provide solution to engineering problems.
- Solve different problems using trigonometry.
- Understand the geometric shapes used in engineering problems by Co-ordinate Geometry.
- Explore the idea of location, graph, and linear relationships between two variables.
- Compute slope, the equation of tangent and normal to a curve at a point using differentiation.
- Find maximum and minimum values of a function by application of differential calculus..
- Calculate simple integration by using concepts of integration.
- Find the velocity from acceleration and displacement from velocity using integration.
- Evaluate area under curves by using definite integrals
- Calculate the area under a curve and axes.
- Calculate the approximate area under a curve by applying numerical integration using Trapezoidal and Simpson's rules.
- Solve engineering and industrial problems using differential equations.

- Apply differential Equations and numerical methods for higher learning of mathematics and engineering applications.

DETAILED CONTENTS

1. Algebra (30 Hrs)

- Law of Indices, Formula of Factorisation and expansion i.e. $(a+b)^2$, (a^3+b^3) etc.
- Partial fraction:- Definition of Polynomial fraction proper & improper fractions and definition of partial fractions. To resolve proper fraction into partial fraction with denominator containing non-repeated linear factors, only.
- Complex numbers: definition of complex number, real and imaginary parts of a complex number, Polar and Cartesian Form and their inter conversion, Conjugate of a complex number, modulus and amplitude, addition subtraction, multiplication and division of complex number.
- Logarithms and its basic properties
- Determinants and Matrices – Evaluation of determinants (up to 3 order) by laplace method. Solution of equations (up to 3 unknowns) by Cramer's Rule. Definition of Matrices and types, addition subtraction and multiplication of Matrices (up to 2 order).
- Permutation, combination formula, Values of ${}^nP_r$ and ${}^nC_r$.
- Binomial theorem for positive integral index , General term, simple problems

2. Trigonometry (14 Hrs)

- Concept of angle: measurement of angle in degrees, grades, radians and their conversions.
- T-Ratios of standard angle (0^0,30^0,45^0etc) and fundamental Identities, Allied angles (without proof) Sum, Difference formulae and their applications (without proof). Product formulae (Transformation of product to sum, difference and vice versa)
- Applications of Trigonometric terms in engineering problems such as to find an angle of elevation, height, distance etc.

3. Co-ordinate Geometry (12 Hrs)

- Point: Distance Formula, Mid Point Formula, Centroid of triangle and area of triangle.
- Straight line: Slope of a line, equation of straight line in various standards forms (without proof); (slope intercept form, intercept form, one-point form, two-point form, normal form, general form), angle between two straight lines.
- Circle: General equation of a circle and identification of centre and radius of circle. To find the equation of a circle, given:
    * Centre and radius

* Coordinates of end points of a diameter

4. Differential Calculus (40 Hrs)

- Definition of function; Concept of limits (Introduction only) and problems related to four standard limits only.

- Differentiation of standard function (Only formulas), Differentiation of Algebraic function, Trigonometric functions, Exponential function, Logarithmic function

- Differentiation of sum, product and quotient of functions.
- Successive differentiation (up to 2nd order)
- Application of differential calculus in:
  (a) Rate measures
  (b) Maxima and minima

5. Integral Calculus (28 Hrs)

- Integration as inverse operation of differentiation with simple examples.
- Simple standard integrals, Integrations by parts and related Simple problems
- Evaluation of definite integrals with given limits.

  Evaluation of $\int_0^{\pi/2} \sin^n x.\, dx$, $\int_0^{\pi/2} \cos^n x\, dx$, $\int_0^{\pi/2} \sin^m x \cos^n x\, dx$

  using formulae without proof (m and n being positive integers only) using pre-existing mathematical models.
- Applications of integration: for evaluation of area under a curve and axes (Simple problems where the limits are given).
- Numerical integration by Trapezoidal Rule and Simpson's $1/3^{rd}$ Rule using pre-existing mathematical models

6. Differential Equations (04 Hrs)

Definition, order, degree and linearity, of an ordinary differential equation. Solution of I^{st} order and I^{st} degree differential equation by variable separable method (Simple problems)

7. Statistics (12 Hrs)

- Measures of Central Tendency: Mean, Median, Mode
- Measures of Dispersion: Mean deviation from mean, Standard deviation
- Correlation coefficient and Coefficient of rank correlation (Simple problems)

INSTRUCTIONAL STATREGY

Activity based teaching and learning process using Mathematics lab consisting of physical models and computer based tools/software emphasising Practice => Theory => Practice.
Basic elements of algebra, trigonometry and co-ordinate geometry can be taught in the light of their applications in the field of engineering and technology. By laying more emphasis on applied part, teacher can also help in providing a good continuing education base to the students. Students need to be taught the skills needed to use software tools built by experts through multiple problem solving based on the topics related to Algebra, Trigonometry and Coordinate Geometry that the industry requires. Examples to be used should be related to engineering. Students should be able to relate to the actual use of these examples and the way mathematical calculations will help them in doing their job.

MEANS OF ASSESSMENT

- Assignments and quiz/class tests, mid-term and end-term written tests, model/prototype making

RECOMMENDED BOOKS

1. Elementary Engineering Mathematics by BS Grewal, Khanna Publishers, New Delhi
2. Engineering Mathematics Vol. I & II by S Kohli, IPH, Jalandhar
3. Applied Mathematics, Vol. I & II by SS Sabharwal & Dr Sunita Jain, Eagle Parkashan, Jalandhar
4. Engineering Mathematics, Vol I, II & III by V Sundaram et al, Vikas Publishing House (P) Ltd., New Delhi
5. Engineering Mathematics, Vol I & II by SS Sastry, Prentice Hall of India Pvt. Ltd.,
6. Applied Mathematics I, by Archana Sharma, Lords Publications, Jalandhar.
7. Engineering Mathematics by Srimanta Pal and Subodh C. Bhunia; Oxford University Press, New Delhi
8. e-books/e-tools/relevant software to be used as recommended by AICTE/HSBTE/NITTTR.

Websites for Reference:

http://swayam.gov.in

Section	Percentage of syllabus to be covered	Units to be covered	Type of assessment	Weightage of Marks	Pass Percentage
A	20%	Unit 1	1st Internal	40%	40%(Combined in internal & final assessment)with minimum 25% marks in final assessment)
B	20%	Unit 2,3	2nd Internal		
C	60%	Unit 4,5,6,7	FINAL	60%	

1.3 APPLIED PHYSICS

L	T	P
2	1	2

RATIONALE

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

Note: Teachers should give examples of engineering/technology applications of various concepts and principles in each topic so that students are able to appreciate learning of these concepts and principles. In all contents, SI units should be followed. Working in different sets of units can be taught through relevant software.

LEARNING OUTCOMES

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

- Identify physical quantities, parameters and select their units for use in engineering solutions.
- Find units and dimensions of different physical quantities.
- Represent physical quantities as scalar and vectors.
- Use basic laws of motions,
- Analyse and design banking of roads and apply conservation of momentum principle to explain recoil of gun etc.
- Define work, energy and power and their units. Solve problems about work and power
    - State the principle of conservation of energy.
    - Identify forms of energy, conversion from one form to another.
    - Compare and contrast the physical properties associated with linear motion and rotational motion and give examples of conservation of angular momentum.
    - Describe the surface tension phenomenon and its units, applications, effects of temperature on surface tension.
    - Describe the viscosity of liquids.
    - Define stress and strain, modulus of elasticity.
    - State Hooke's law.
    - Measure temperature in various processes on different scales.
    - Distinguish between conduction, convection and radiation.
    - Use equipments like Vernier calliper, screw gauge, Spherometer.

- Differentiate between Transverse and Longitudinal, Periodic and Simple Harmonic Motion.
- Explain the terms: frequency, amplitude, wavelength, wave velocity, frequency and relation between them.
- Explain various engineering and industrial applications of ultrasonics.
- Apply acoustics principles to various types of buildings to get best sound effect.
- Explain the laws of reflection and refraction of light.
- Explain total internal reflection as applied to optical fibers.
- Define capacitance and its unit and solve simple problems using C=Q/V
- Explain the role of free electrons in insulators, conductors and semiconductors.
- Application of semiconductors as diode, rectifiers, concept of transistors
- Explain electric current as flow of charge, the concept of resistance, heating effect of current.
- State and apply Ohm's law.
- Calculate the equivalent resistance of a variety of resistor combinations.
- Apply the concept of light amplification in designing of various LASER based instruments and optical sources.
- Apply the use of optical fibre in medical field and optical fibre communication.

DETAILED CONTENTS

1. Units and Dimensions (11Hrs)

1.1 Definition of Physics, Physical quantities (Fundamental and derived),

1.2 Units: fundamental and derived units,

1.3 Systems of units: CGS, FPS, MKS, SI

1.4 Definition of Dimensions;

1.5 Dimensional formulae and SI units of physical quantities (distance, displacement, area, volume, velocity, acceleration, momentum, force, impulse, work, power, energy, pressure, surface tension, stress, strain)

1.6 Principle of homogeneity of dimensions

1.7 Dimensional equations, Applications of dimensional equations; checking of correctness of equation, Conversion of system of unit (force, work)

2. Force and Motion (14 Hrs)

2.1 Scalar and vector quantities –(Definition and examples),

2.2 Addition of Vectors, Triangle & Parallelogram Law (Statement only),

2.3 Scalar and Vector Product (statement and formula only)

2.4 Definition of Distance, displacement, speed, velocity, acceleration
2.5 Force and its units, concept of Resolution of force
2.6 Newton's Law of motion (Statement and examples),
2.7 Linear Momentum, conservation of momentum (Statement only), Impulse
2.8 Circular motion: definition of angular displacement, angular velocity, angular acceleration, frequency, time period; Relation between linear and angular velocity.
2.9 Centripetal and centrifugal forces(definition and formula only)
2.10 Application of centripetal force in Banking of roads (derivation for angle of banking)

3. Work, Power and Energy (08 Hrs)

3.1 Work (Definition, Symbol, Formula and SI units)
3.2 Energy (Definition and its SI units), Examples of transformation of energy.
3.3 Kinetic Energy (Formula, examples and its derivation)
3.4 Potential Energy (Formula, examples and its derivation)
3.5 Law of conservation of mechanical energy for freely falling bodies (With . Derivation)
3.6 Power (definition, formula and units)
3.7 Simple Numerical problems based on formula of Power

4. Rotational Motion (05 Hrs)

4.1 Rotational motion with examples
4.2 Definition of torque and angular momentum and their examples
4.3 Conservation of angular momentum (quantitative) and its examples
4.4 Moment of inertia and its physical significance, radius of gyration (definition, derivation and formula).

5. Properties of Matter (10 Hrs)

5.1 Definition of Elasticity, Deforming force, Restoring force, example of Elastic and plastic body,
5.2 Definition of Stress and strain with their types,
5.3 Hooke's law, Modulus of Elasticity (Young's, Bulk modulus and shear)
5.4 Pressure (definition, formula, unit), Pascals Law
5.5 Surface tension: definition, its units, applications of surface tension, effect of temperature on Surface tension

5.6 Viscosity: definition, units, effect of temperature on viscosity

5.7 Fluid motion, stream line and turbulent flow.

6. Heat and temperature (05 Hrs)

6.1 Definition of heat and temperature (on the basis of kinetic theory),

6.2 Difference between heat and temperature

6.3 Principles of measurement of temperature.

6.4 Modes of transfer of heat (Conduction, convection and radiation with examples).

6.5 Properties of heat radiation

6.6 Different scales of temperature and their relationship

7. Wave motion and its applications (09 Hrs)

7.1 Wave motion, transverse and longitudinal wave motion with examples, Terms used in wave motion like displacement, amplitude, time period, frequency, wavelength, wave velocity; relationship among wave velocity, frequency and wave length .

7.2 Simple Harmonic Motion (SHM): definition, examples

7.3 Cantilever (definition, formula of time period (without derivation).

7.4 Free, forced and resonant vibrations with examples

7.5 Acoustics of buildings – reverberation, reverberation time, echo, noise, coefficient of absorption of sound, methods to control reverberation time.

7.6 Ultrasonics: Introduction and their engineering applications (cold welding, drilling, SONAR)

8. Optics (05 Hrs)

8.1. Reflection and refraction with laws, refractive index, lens formula (no derivation), power of lens (related numerical problems).

8.2. Total internal reflection and its applications, Critical angle and conditions for total internal reflection

8.3. Microscope, Telescope (definition)

8.4. Uses of microscope and telescope.

9. Electrostatics (09 Hrs)

9.1. Electric charge, unit of charge, conservation of charge.

9.2. Coulombs law of electrostatics,

9.3. Electric field, Electric lines of force (definition and properties), Electric field intensity due to a point charge.

9.4. Definition of Electric flux, Gauss law (Statement and derivation)

9.5. Capacitor and Capacitance (with formula and units), Series and parallel combination of capacitors (simple numerical problems)

10. Current Electricity (08 Hrs)

10.1 Electric Current and its Unit, Direct and alternating current,

10.2 Resistance, Specific Resistance and Conductance (definition and units)

10.3 Series and Parallel combination of Resistances.

10.4 Ohm's law (statement and formula),

10.5 Heating effect of current, Electric power and its units

10.6 Kirchhoff's laws (statement and formula)

11 Electromagnetism (05 Hrs)

11.1. Introduction to magnetism, Types of magnetic materials. Dia, para and ferromagnetic materials with examples.

11.2. Magnetic field, magnetic intensity, magnetic lines of force, magnetic flux and their units

11.3. Electromagnetic induction (definition)

12. Semiconductor physics (08 Hrs)

12.1. Definition of Energy level, Energy bands,

12.2. Types of materials (insulator, semi conductor, conductor) with examples,

12.3. Intrinsic and extrinsic semiconductors, p-n junction diode and its V-I characteristics

12.4. Diode as rectifier – half wave and full wave rectifier (centre tap only)

12.5. Semiconductor transistor; pnp and npn (Introduction only), symbol.

13. Modern Physics (08 Hrs)

13.1. Lasers: full form, principle, spontaneous emission, stimulated emission, population inversion, engineering and medical applications of lasers.

13.2. Fibre optics: Introduction to optical fibers (definition, parts), applications of optical fibers in different fields.

13.3. Introduction to nanotechnology (definition of nanomaterials with examples) and its applications.

LIST OF PRACTICALS (To perform minimum fourteen experiments)

1. To find diameter of solid cylinder using a vernier calliper
2. To find internal diameter and depth of a beaker using a vernier calliper and hence find its volume.
3. To find the diameter of wire using screw gauge
4. To find thickness of paper using screw gauge.
5. To determine the thickness of glass strip using a spherometer

6. To determine radius of curvature of a given spherical surface by a spherometer.
7. To verify parallelogram law of forces
8. To determine the atmospheric pressure at a place using Fortin's Barometer
9. To determine force constant of spring using Hooke's law
10. Measuring room temperature with the help of thermometer and its conversion in different scale.
11. To find the time period of a simple pendulum
12. To determine and verify the time period of Cantilever
13. To verify ohm's laws by plotting a graph between voltage and current.
14. To verify laws of resistances in series combination.
15. To verify laws of resistance in parallel combination.
16. To find resistance of galvanometer by half deflection method
17. To verify laws of reflection of light using mirror.
18. To verify laws of refraction using glass slab.
19. To find the focal length of a concave lens, using a convex lens
20. To study colour coding scheme of resistance.

INSTRUCTIONAL STATREGY

Teacher may use various teaching aids like models, charts, graphs and experimental kits etc. for imparting effective instructions in the subject. Students need to be exposed to use of different sets of units and conversion from one unit type to another. Software may be used to solve problems involving conversion of units. The teacher should explain about field applications before teaching the basics of mechanics, work, power and energy, rotational motion, properties of matter etc. to develop proper understanding of the physical phenomenon. Use of demonstration can make the subject interesting and develop scientific temper in the students.

MEANS OF ASSESSMENT

- Assignments and quiz/class tests, mid-term and end-term written tests, model/prototype making
- Actual laboratory and practical work, exercises and viva-voce

RECOMMENDED BOOKS

1. Text Book of Physics for Class XI (Part-I, Part-II); N.C.E.R.T., Delhi
2. Applied Physics, Vol. I and Vol. II by Dr. HH Lal; TTTI Publications, Tata McGraw Hill, Delhi
3. Concepts in Physics by HC Verma, Vol. I & Vol.II, Bharti Bhawan Ltd. New Delhi
4. Engineering Physics by PV Naik, Pearson Education Pvt. Ltd, New Delhi

5. e-books/e-tools/relevant software to be used as recommended by AICTE/ HSBTE/ NITTTR.
6. Practical Physics, by C. L. Arora, S Chand Publication

Websites for Reference:

http://swayam.gov.in

Section	Percentage of syllabus to be covered	Units to be covered	Type of assessment	Weightage of Marks	Pass Percentage
A	20%	Unit 1,2	1st Internal	40%	40%(Combined in internal & final assessment)with minimum 25% marks in final assessment)
B	20%	Unit 3,4,5	2nd Internal		
C	60%	Unit 6,7,8,9, 10,11, 12, 13	FINAL	60%	

1.4 APPLIED CHEMISTRY

L	T	P
2	-	1

RATIONALE

The use of various chemical and chemical products in diverse technical and engineering field have repeatedly proved the importance of applied chemistry, which enhances its role to a new peak. On the other hand, ever increasing use of such materials will compel engineers, technocrats to acquire essential applied chemistry knowledge in order to select engineering material, which not only suit them but also provide more environmental compatibility. This situation demands principles of applied chemistry in diploma-engineering courses. Principles of Applied Chemistry will enable budding engineers and technocrats to develop scientific temper and appreciate physical, chemical and engineering properties of materials. Hence the subject of applied chemistry.

LEARNING OUTCOMES

After undergoing this subject, the students will able to:

- Classify matter based on state of aggregation.
- Calculate percentage composition of chemical compounds.
- Substantiate the laws and principles on which structure of atom is established.
- Prepared solution of required concentration.
- Understand pH and prepare buffer solution and understand their significance in industrial processes such as electrolysis, electrochemical machining of materials etc.
- Explain various characteristics of water.

- Explain cause and facture factors which adversely affecting natural water quality and remedial measure available for water purification to achieve water quality standards required for domestic, agriculture and industrial applications .
- Explain chemistry and technology of industrial metal extraction processes.
- Explain chemistry of fuel and relative advantages.
- Select most efficient fuel for engine and engineering applications.
- Explain mechanism of lubrication and their advantages.
- Explain the chemistry of various polymers and plastics.
- Verify suitability and select polymer/ plastic material for engineering applications.

DETAILED CONTENTS

1. Some Basic Concepts in Chemistry (8 Hrs)

1.1 General introduction: Importance and scope of chemistry.

1.2 Classification of matter:

a) Physical classification: Solid, Liquid and Gases (only definition with examples).

b) Chemical Classification: elements, compounds and mixture (Definition and examples Types of mixture excluded).

1.3 Definition of atom, molecule, symbol and significance of symbol.

1.4 Molecular Formula, Writing the formula of compounds containing CI^-, OH^-, HCO_3^-, SO_4^{2-},CO_3^{2-} and NH_4^+, Na^+, K^+, Ca^{2+}, Mg^{2+}, Fe^{2+}, Zn^{2+}, Fe^{3+}, Al^{3+} ions

1.5 Calculation of molecular mass (Atomic mass of constituents should be provided), Calculation of mass percentage composition of elements in compound (Atomic masses of elements should be provided)

2. Structure of Atom (8 Hrs)

2.1 Fundamental particles of atom: electron, proton and neutron, charge and mass of electron, proton and neutron.

2.2 Bohr's model of atom (postulates only) i,e concept of orbit or shell.

2.3 Atomic number (Z), mass number (A), calculation of protons, electrons and neutrons in $^{A}_{z}X$.

2.4 Isotopes, isobars and isotones (definition with examples).

2.5 Concept of orbital (wave nature of electron), difference between orbit and orbital.

2.6 Principles of filling electrons in various orbital: a) Aufbau principle b) Hund's Rule of maximum multiplicity c) Pauli's exclusion principle.

2.7 Electronic configuration of atoms (upto Z=30)

3. Chemical Bonding (5 Hrs)

3.1 Valence electrons, Lewis symbol.

3.2 Octet rule (Limitation excluded).

3.3 Chemical bond (definition) and its type.

3.4 Electrovalent or Ionic Bond with example of NaCI,

3.5 Covalent Bonding in H_2, O_2

4. Solution (8 Hrs)

4.1 Definition of solution, Binary solution, aqueous solution.

4.2 Definition of solute, solvent.

4.3 Definition of acid and base and salt.

4.4 Definition of acidity and basicity.

4.5 Concentration of solution

4.6 Modes of expressing concentration of solution

a) Strength

b) Molarity (M)

c) Normality (N) and

d) simple numerical problems based on (a) and (b)

4.7 Definition of pH and industrial application of pH. (Numericals excluded)

5. Electrochemistry. (8 Hrs)

5.1 Electronic concept of oxidation, reduction

5.2 Definition of terms electrolyte, non electrolyte with example

5.3 Types of electrolytes: strong and weak with examples

5.4 Definition of electrolysis.

5.5 Faradays laws of electrolysis

5.6 Industrial applications of electrolysis: Electroplating, electrolytic refining, electrometallurgy.

6. General Principles of extraction of metals (8 Hrs)

6.1 Metals and Non-metals (definition)

6.2 Definition of Mineral, Chief ores of iron, aluminum and copper.

6.3 Definition of metallurgy, types of metallurgy

6.4 General Steps of metallurgy

a) Crushing

b) Pulverization of ore

c) Concentration or purification of ore:

i) Gravity separation method ii) froth flotation method.

d) Oxidation of ore:

i) Roasting ii) Calcination

e) Reduction:

i) Smelting (Pyrometallurgy) and ii) Electrolytic reduction

f) Refining of Metal:

i) Electrolytic refining

6.5 Definition of alloy, types of alloys and purpose of alloying.

7. Fuel
(8Hrs)

7.1 Definition of fuel, classification of fuel a) on the basis of physical state b) on the basis of source.

7.2 Definition of calorific value

7.3 Characteristics of good fuel, advantages of gaseous fuel over solid fuels.

7.4 Coal- Proximate analysis of coal and its importance.

7.5 Fuel quality rating- octane number and cetane number (definition only)

7.6 Gaseous fuel: Composition, calorific value and application of CNG, LPG and biogas.

8. Water (8 Hrs)

8.1 Type of water: Soft and hard water.

8.2 Types of hardness of water

8.3 Units of hardness of water: ppm, mg/L (with simple numericals).

8.4 Disadvantages of using hard water in boiler. a) Scale and sludge formation b) Boiler Corrosion c) Caustic embrittlement

8.5 Qualities of drinking (potable) water

9. Lubricants (4 Hrs)

9.1 lubricant and lubrication.

9.2 Functions of lubricants.

9.3 Classification of lubricants: solid, semisolid and liquid lubricants with examples.

9.4 Type of lubrications – hydrodynamic and boundary lubrication with illustrative diagrams.

9.5 Properties of lubricants

a) Physical properties- viscosity, viscosity index, cloud point, pour point, flash point, fire point, oiliness

b) Chemical properties- TAN or TAV (Total acid number), emulsification, aniline point and iodine value.

10. Polymer and Plastic (5 Hrs)

10.1 Definition of polymer, Monomer, Degree of Polymerization

10.2 Monomer and uses of PE, PVC, PS, Teflon, Nylon-66, Bakelite

10.3 Brief introduction to addition and condensation polymers with suitable examples

(PE, PVC, PS, Teflon, Nylon-66, Bakelite).

10.4 Definition of plastics, thermoplastic and thermosetting polymer with example, difference between thermoplastic and thermosetting polymers.

10.5 Uses of polymer and plastic in daily life and in industries.

LIST OF PRACTICALS

1. Volumetric analysis and apparatus used their in.
2. To prepare standard solution of oxalic acid (N/20).
3. To determine the strength of given sodium hydroxide solution by titrating against standard oxalic acid (N/10) solution using phenolphthalein as indicator.
4. Gravimetric analysis and apparatus used their in.
5. To determine the percentage of moisture in given sample of coal.
6. To determine the percentage of ash in given sample of coal.
7. To determine the percentage of volatile and non volatile substance in given mixture.
8. To determine the viscosity of lubricant by using Redwood viscometer.

9. To determine total acid number (TAN) or Total acid value of given lubricant (liquid).

10. Detection of iron metal in the given solution of rust.

INSTRUCTIONAL STRATEGY

Teachers may take help of various models and charts while imparting instructions to make the concept clear. Awareness of the contents should be done through examples using you-tubes and subsequent discussions. More emphasis should be laid on discussing and explaining practical applications of various chemical process and reactions. In addition, students should be encouraged or motivated to study those processes in more details, which may find practical application in their future professional career.

MEANS OF ASSESSMENT

- Assignments and quiz/class tests, mid-term and end-term written tests, model/prototype making
- Actual laboratory and practical work, exercises and viva-voce

RECOMMENDED BOOKS

1. Chemistry in Engineering by J.C. Kuricose & J. Rajaram, Tata McGraw Hill, Publishing Company Limited, New Delhi.
2. Engineering Chemistry by P.C. Jain & Monika Jain, Dhanapat Rai Publishing Company, New Delhi.
3. Eagle's Applied Chemistry - I by S. C. Ahuja & G. H. Hugar, Eagle Prakashan, Jalandhar.
4. Engineering Chemistry – A Text Book by H. K. Chopra & A. Parmar, Narosa Publishing House, New Delhi.
5. Engineering Chemistry by Dr.Himanshu Pandey, Goel Publishing House, Meerut, India.
6. e-books/e-tools/relevant software to be used as recommended by AICTE/HSBTE/NITTTR.

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1.5 APPLIED MECHANICS

(Common for Civil Engineering, Automobile Engineering, Mechanical Engineering, Production Engineering, Plastic Technology, Mechanical Engineering (Tool &Die), Mechanical Engineering (Production), Mechanical Engineering (CAD/CAM), Aircraft Maintenance Engineering, Packaging Technology, Mechatronics Engineering)

L	T	P
2	-	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.

LEARNING OUTCOMES

After undergoing this course, the students will be able to:

- Interpret various types of units and their conversion from one to another.
- Analyze different types of forces acting on a body and draw free body diagrams.
- Determine the resultant of coplanar concurrent forces.
- Use the principle of movement in various applications.
- Calculate the co-efficient of friction for different types of surfaces.
- Calculate the least force required to maintain equilibrium on an inclined plane.
- Determine the centroid/centre of gravity of plain and composite laminar and solid bodies.
- Determine velocity ratio, mechanical advantage and efficiency of simple machines

DETAILED CONTENTS

1. Introduction (06 Hrs)

1.1 Concept of engineering mechanics definition of mechanics, statics, dynamics, application of engineering mechanics in practical fields.

1.2 Different systems of units (FPS, CGS, MKS and SI) and their conversion from one to another e.g. density, force, pressure, work, power, velocity, acceleration(Simple Numerical Problems), Fundamental Units and Derived Units.

1.3 Concept of rigid body, scalar and vector quantities

2. Laws of forces (12 Hrs)

2.1 Definition of force, Bow's Notations, types of force: Point force/concentrated force & Uniformly distributed force, effects of force, characteristics of a force.
2.2 Different force systems, 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
2.4 Free body diagram
2.5 Equilibrant force and its determination
2.6 Lami's theorem
[Simple problems on above topics]

3. Moment (12 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, 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 (14 Hrs)

4.1 Definition and concept of friction, types of friction, force of friction, Limiting Friction.
4.2 Laws of static friction, coefficient of friction, angle of friction, angle of repose.
4.3 Equilibrium of a body lying on a horizontal plane, equilibrium of a body lying on a rough inclined plane.
4.4 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

b) At some angle with the inclined plane

4.5 Ladder friction

4.6 Advantages and Disadvantages of friction

4.7 Methods of increasing/decreasing the force of friction.

[Simple problems on the above topics]

5. Centre of Gravity (10 Hrs)

5.1 Concept, definition of centroid of plain figures and centre of gravity of symmetrical solid bodies, difference between centroid and C.G.

5.2 Determination of centroid of plain and composite lamina using moment method only, centroid of bodies with removed portion

5.3 Determination of center of gravity of solid bodies - cylinder, cube, cuboid and sphere; composite bodies and bodies with portion removed

[Simple problems on the above topics]

6. Simple Machines (16 Hrs)

6.1. Definition of Simple and compound machine (Examples)

6.2. Definition of load, effort, velocity ratio, mechanical advantage and efficiency of a machine and their relationship, law of machines

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, third system of pulleys), determination of velocity ratio, mechanical advantage and efficiency

6.6. Working principle and application of wheel and axle, Weston's Differential Pulley Block , 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 polygon law of forces using Gravesand's apparatus.
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, 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 crab.
8. To find out center of gravity of regular lamina.
9. To find out center of gravity of irregular lamina.
10. To determine coefficient of friction between three pairs of given surface.

INSTRUCTIONAL STRATEGY

Applied Mechanics being a fundamental subject, the teachers are expected to emphasize on the applications of "Applied Mechanics" in various subjects so that students are able to appreciate the importance of the subject. Students should also be made conversant with the use of scientific calculator to solve numerical problems.

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B	20%	Unit 3	2nd Internal		
C	60%	Unit 4 to 6	FINAL	60%	

1.6 ENVIRONMENTAL STUDIES

L	T	P
2	-	1

RATIONALE

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 ecosystem and controlling pollution by various control measures. He should also be aware of environmental laws related to the control of pollution. He should know how to manage the waste. Energy conservation is the need of hour. He should know the concept of energy management and its conservation.

LEARNING OUTCOMES

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

- Comprehend the importance of ecosystem and sustainable
- Demonstrate interdisciplinary nature of environmental issues
- Identify different types of environmental pollution and control measures.
- Take corrective measures for the abetment of pollution.
- Explain environmental legislation acts.
- Define energy management, energy conservation and energy efficiency
- Demonstrate positive attitude towards judicious use of energy and environmental protection
- Practice energy efficient techniques in day-to-day life and industrial processes.
- Adopt cleaner productive technologies
- Identify the role of non-conventional energy resources in environmental protection.
- Analyze the impact of human activities on the environment

DETAILED CONTENTS

1. Introduction (4 Hrs)
    - Basics of ecology, eco system- concept, and sustainable development, Resources renewable and non renewable.

2. Air Pollution (12 Hrs)
    - Source of air pollution. Effect of air pollution on human health, economy, plant, animals. Air pollution control methods.

3. Water Pollution (16 Hrs)
    - Impurities in water, Cause of water pollution, Source of water pollution. Effect of water pollution on human health, Concept of dissolved O_2, BOD, COD. Prevention of water pollution- Water treatment processes, Sewage treatment. Water quality standard.

4. Soil Pollution (14 Hrs)
    - Sources of soil pollution
    - Types of Solid waste- House hold, Hospital, From Agriculture, Biomedical, Animal and human, excreta, sediments and E-waste
    - Effect of Solid waste
    - Disposal of Solid Waste- Solid Waste Management

5. Noise pollution (8 Hrs)
    - Source of noise pollution, Unit of noise, Effect of noise pollution, Acceptable noise level, Different method of minimize noise pollution.

6. Environmental Legislation (10 Hrs)
    - Introduction to Water (Prevention and Control of Pollution) Act 1974, Introduction to Air (Prevention and Control of Pollution) Act 1981 and Environmental Protection Act 1986, Role and Function of State Pollution Control Board and National Green Tribunal (NGT), Environmental Impact Assessment (EIA).

7. Impact of Energy Usage on Environment (6 Hrs)
    - Global Warming, Green House Effect, Depletion of Ozone Layer, Acid Rain. Eco-friendly Material, Recycling of Material, Concept of Green Buildings.

LIST OF PRACTICALS

1. Determination of pH of drinking water
2. Determination of TDS in drinking water
3. Determination of TSS in drinking water
4. Determination of hardness in drinking water
5. Determination of oil & grease in drinking water
6. Determination of alkalinity in drinking water
7. Determination of acidity in drinking water
8. Determination of organic/inorganic solid in drinking water
9. Determination of pH of soil
10. Determination of N&P (Nitrogen & Phosphorus) of soil
11. To measure the noise level in classroom and industry.
12. To segregate the various types of solid waste in a locality.
13. To study the waste management plan of different solid waste

14. To study the effect of melting of floating ice in water due to global warming

INSTRUCTIONAL STRATEGY

In addition to theoretical instructions, different activities pertaining to Environmental Studies like expert lectures, seminars, visits to green house, effluent treatment plant of any industry, rain water harvesting plant etc. may also be organized.

MEANS OF ASSESSMENT

- Assignments and quiz/class tests, mid-term and end-term written tests

RECOMMENDED BOOKS

1. Environmental and Pollution Awareness by Sharma BR; Satya Prakashan, New Delhi.
2. Environmental Protection Law and Policy in India by Thakur Kailash; Deep and Deep Publications, New Delhi.
3. Environmental Pollution by Dr. RK Khitoliya; S Chand Publishing, New Delhi
4. Environmental Science by Deswal and Deswal; Dhanpat Rai and Co. (P) Ltd. Delhi.
5. Engineering Chemistry by Jain and Jain; Dhanpat Rai and Co. (P) Ltd. Delhi.
6. Environmental Studies by Erach Bharucha; University Press (India) Private Ltd., Hyderabad.
7. Environmental Engineering and Management by Suresh K Dhamija; S K Kataria and Sons, New Delhi.

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1.7 ENGINEERING GRAPHICS

L	T	P
-	-	3

RATIONALE

Drawing is the language of engineers and technicians. Reading and interpreting engineering drawing is their day to day responsibility. The subject is aimed at developing basic graphic skills in the students so as to enable them to use these skills in preparation of engineering drawings, their reading and interpretation. The emphasis, while imparting instructions, should be to develop conceptual skills in the students following BIS SP 46 – 1988.

Note:

i) First angle projection is to be followed
ii) Minimum of 30 sheets to be prepared
iii) Instructions relevant to various drawings may be given along with appropriate demonstrations, before assigning drawing practice to students
iv) For better understanding, students should be encouraged to use engineering graph book, and computer based software like Auto CAD for free hand and orthographic projection practice.

LEARNING OUTCOMES

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

- Identify and use of different grades of pencils and other drafting instruments which are used in engineering field
- Draw free hand sketches of various kinds of objects.
- Utilize various types of lines used in engineering drawing.
- Read and apply different dimensioning methods on drawing of objects.
- Use different types of scales and their utilization in reading and reproducing drawings of objects and maps.
- Draw 2 - dimensional view of different objects viewed from different angles (orthographic views)
- Draw and interpret complete inner hidden details of an object which are otherwise not visible in normal view
- Generate isometric (3D) drawing from different 2D (orthographic) views/sketches
- Identify conventions for different engineering materials, symbols, sections of regular objects and general fittings used in Civil and Electrical household appliances

- Use AutoCAD or other drafting software for making fast engineering drawings and even animating the assembly drawings.

DETAILED CONTENTS

1. Introduction to Engineering Drawing (4 sheets)

   1.1 Definition of Engineering Drawing, Introduction to drawing instruments, materials, layout and sizes of drawing sheets and drawing boards, engineering graph book, different grades of pencils to be used.
   1.2 Different types of lines in engineering drawing as per BIS specifications
   1.3 Practice of vertical, horizontal and inclined lines
   1.4 Principles of dimensioning: Types, elements, placing, different methods of dimensioning
   1.5 Practice of geometrical figures such as –triangles, rectangles, circles, ellipses and parabola, hexagonal, pentagon with the help of drawing instruments.
   1.6 Definition and classification of lettering, single stroke vertical and inclined lettering at 75^0 (alphabet and numerals)
   1.7 Freehand letter writing and sketches of various kind of objects in graph Sketch book/graph paper.

2 Scales (2 sheets)

   2.1 Scales-their needs and importance(theoretical instructions), types of scales, definition of Representative Fraction(R.F.) and length of scale.
   2.2 Construction of Plain and diagonal scale.

3 Orthographic Projection (5 sheets)

   3.1 Theory of orthographic projections (Elaborate theoretical instructions)
   3.2 Projections of points in different quadrants
   3.3 Projection of line (1^{st} angle and 3^{rd} angle)
      3.3.1 Line parallel to both planes
      3.3.2 Line perpendicular to any one of the principal plane
      3.3.3 Line inclined to any one of the principal plane and parallel to other
   3.4 Projection of Solid-Cube, Cuboid, Cone, Prism, pyramid
   3.5 Three views of orthographic projections of different objects (At least one sheet in 3^{rd} angle)

4 Sectioning and Identification of surfaces (2 sheets)

4. 1 Identifications of surfaces, Importance and salient features of sectioning of objects.

4. 2 Description of full section, half section.

5 Isometric Views (2 sheets)

5.1 Fundamental of isometric projections and isometric scale

5.2 Isometric views of different objects

6 Graphics using CAD (5 sheets)

6.1 Meaning, requirement of computer graphics, CAD, screen structure and toolbars in AutoCAD, coordinate system, Drawing Limits, Units.

6.2 Practice of LINE command, coordinates-Absolute, incremental, polar. POLYLINE, CIRCLE(3P,2P, TTR), ARC, ELLIPSE

6.3 Using above geometrical commands for making figure e.g. triangle, rectangle, hexagon, pentagon, parabola.

6.4 Editing commands-Scale, erase, copy, stretch, lengthen and explode.

6.5 Use of SNAP, GRID and ORTHO mode for selection of points quickly. Use of these modes while picking points in LINE, CIRCLE, PLINE, ARC, ELLIPSE etc commands.

6.6 Drawing projections of lines and solids.

6.7 Drawing orthographic projections of different objects (at least 2 sheets)

6.8 AutoCAD for the isometric views sheets. Making single computer sheet showing all the three views and an isometric (in single split screen view) of any object showing understanding of use of AutoCAD in making isometric views – at least 1 sheet

7 Common Symbols and conventions used in Engineering (1 sheet)

7.1 Civil Engineering sanitary fitting symbols

7.2 Electrical fitting symbols for domestic interior installations

7.3 Safety symbols used in engineering works

8 Development of surfaces (cylinder, cuboid, cone) (1 sheet)

8.1 Parallel line, radial line method

(The teacher may explain both methods but will use one method in sheet in classroom and other method on sketchbook)

9 Detailed and assembly drawing (3 sheets)

9.1 Principle and utility of detailed and assembly drawings

9.2 Wooden joints i.e. corner mortise and tenon joint, Tee Halving joint, Mitre faced corner joint, Tee bridle joint , crossed wooden joint, cogged joint, dovetail joint,

through Mortise and tenon joint, furniture drawing – freehand and with the help of drawing instruments

9.3 Making Wooden Joint sheets in AutoCAD, rendering & showing assembly animation at least 1 sheet

10 Screw threads and threaded fasteners (5 sheets)

10.1 Type of threads-external and internal threads, right and left hand threads (actual conventional representation), Single and multiple start thread.

10.2 Different forms of screw threads –V threads (B.S.W. threads, B.A thread, American National and Metric thread), Square threads (Square, Acme, buttress and Knuckle thread)

10.3 Different views of hexagonal and square nuts. Square and hexagonal headed bolt.

10. 4 Foundations bolts-Rag bolt, Lewis bolt, Curved bolt and eye bolt.

10. 5 Freehand sketches of various types of screws and studs.

11 Keys and Cotters (3 sheets)

11. 1 Various types of keys and cotters - their practical application, drawings of various keys and cotters showing keys and cotters in position.

11. 2 Various types of Joints

-Spigot and Socket Joints
-Gib and cotter joint
-Knuckle joint

12 Couplings (2 sheets)

12.1 Introduction to coupling, their use and types

12.2 Muff coupling

12.3 Flange coupling (protected)

12.4 Flexible Coupling

MEANS OF ASSESSMENT

- Drawing sheets
- Assignments and quiz/class tests

RECOMMENDED BOOKS

1. A Text Book of Engineering Drawing by Surjit Singh; Dhanpat Rai & Co., Delhi
2. Engineering Drawing by PS Gill; SK Kataria & Sons, New Delhi

3. Elementary Engineering Drawing in First Angle Projection by ND Bhatt; Charotar Publishing House Pvt. Ltd., Anand
4. Engineering Drawing I & II by JS Layall; Eagle Parkashan, Jalandhar
5. Engineering Drawing I by DK Goel, GBD Publication.
6. CAD/CAM by J.S.Narang, Dhanpat Rai & Sons Publishers, New Delhi.
7. e-books/e-tools/relevant software to be used as recommended by AICTE/HSBTE/NITTTR.
8. Engineering Drawing with AutoCAD 2000 by T. Jeyapooran, Vikas Publishing House, Delhi
9. AutoCAD for Engineering Drawing Made Easy by P. Nageswara Rao; Tata McGraw Hill;, New Delhi.

Websites for Reference:

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1.8 INFORMATION TECHNOLOGY

L	T	P
-	-	2

RATIONALE

Information technology has great influence on all aspects of life. Primary purpose of using computer is to make the life easier. Almost all work places and living environment are being computerized. The subject introduces the fundamentals of computer system for using various hardware and software components. 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 using MS Office/Open Office/Libre Office using internet etc.,. This exposure will enable the students to enter their professions with confidence, live in a harmonious way and contribute to the productivity.

Note:
Explanation of Introductory part should be demonstrated with practical work. Following topics may be explained in the laboratory along with the practical exercises. There will not be any theory examination.

LEARNING OUTCOMES

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

- Identify Computer hardware components, network components and peripherals.
- Explain the role of an operating System.
- Install system and application software.
- Explain the function of the system components including processor, motherboard and input-output devices.
- Use Word Processing software to prepare document.
- Use spreadsheet software to create workbooks and automate calculation.
- Use presentation software to create interactive presentation.
- Perform fundamental tasks common to most application software including print, save, edit, cut, copy, paste, format, spell and grammar check.
- Find and evaluate information on the Web.
- Install antivirus.
- Safeguard against online frauds, threats and crimes.

TOPICS TO BE EXPLAINED THROUGH DEMONSTRATION

1. Basic Concepts of IT and Its Application

   Information Technology concept and scope, applications of IT. in office, Air and Railway Ticket reservation, Banks financial transactions, E-Commerce and E- Governance applications etc., Ethics of IT, concept of online frauds, threats of IT crimes.

2. Computer Hardware:

   Block diagram of a computer, components of computer system, CPU, Memory, Input devices; keyboard, Scanner, mouse etc; Output devices; VDU, LCD, Printers etc. Primary and Secondary Memory: RAM, ROM, magnetic disks – tracks and sectors, optical disk (CD, DVD & Blue Ray Disk.), USB/Flash Drive.

3. Software Concepts:

   System software, Application software, Virtualization software and Utility software, Introduction of Operating System, Installation of Window / linux, Features of OPEN OFFICE/MS_OFFICE(MS word, Excel, PowerPoint) .

4. Internet Concepts:

   Basics of Networking – LAN, WAN, Wi-Fi technologies and sharing of printers and other resources, Concept of IP addresses, DNS, introduction of internet, applications of internet like: e-mail and browsing, concept of search engine and safe searching. Various browsers like Internet explorer/Microsoft Edge, Mozilla Firefox, use of cookies and history, WWW (World Wide Web), hyperlinks, introduction to Anti-virus.

LIST OF PRACTICAL EXERCISES

1. Given a PC, name its various components and peripherals. List their functions .
2. Installing various components of computer system and installing system software and application software
3 Installation of I/O devices, printers and installation of operating system viz. Windows/BOSS/ LINUX
4. Features of Windows as an operating system
   - Start
   - Shut down and restore
   - Creating and operating on the icons
   - Opening, closing and sizing the windows and working with windows interfacing elements (option buttons, checkbox, scroll etc.)

- Using elementary job commands like – creating, saving, modifying, renaming, finding and deleting a file and folders
- Changing settings like, date, time, colour (back ground and fore ground etc.)
- Using short cuts
- Using on line help

5. Word Processing (MS Office/Open Office)

a) 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

b) Page set up:
   - Setting margins, tab setting, ruler, indenting

c) Editing a document:
   - Entering text, cut, copy, paste using tool- bars

d) 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, line spacing
   - Use of headers, footers: Inserting footnote, end note, use of comments, autotext
   - Inserting date, time, special symbols, importing graphic images, drawing tools

e) 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

f) Using Tools like:
   - Spell checker, help, use of macros, mail merge, thesaurus word content and statistics, printing envelops and lables
   - Using shapes and drawing toolbar,
   - Working with more than one window .

6. Spread Sheet Processing (MS Office/Open Office)

a) Starting excel, open worksheet, enter, edit, data, formulae to calculate values, format data, save worksheet, switching between different spread sheets

b) Menu commands:

Create, format charts, organise, manage data, solving problem by analyzing data. Programming with Excel Work Sheet, getting information while working

c) Work books:

Managing workbooks (create, open, close, save), working in work books, selecting the cells, choosing commands, data entry techniques, formula creation and links, controlling calculations

Editing a worksheet, copying, moving cells, pasting, inserting, deletion cells, rows, columns, find and replace text, numbers of cells, formatting worksheet, conditional formatting

d) 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

e) Retrieve data with query:

Create a pivot table, customizing a pivot table. Statistical analysis of data

f) Exchange data with other application:

Embedding objects, linking to other applications, import, export document.

7. PowerPoint Presentation (MS Office/Open Office)

a) Introduction to PowerPoint
   - How to start PowerPoint
   - Working environment: concept of toolbars, slide layout & templates.
   - Opening a new/existing presentation
   - Different views for viewing slides in a presentation: normal, slide sorter.

b) Addition, deletion and saving of slides

c) Insertion of multimedia elements
   - Adding text boxes
   - Adding/importing pictures
   - Adding movies and sound
   - Adding tables and charts etc.
   - Adding organizational chart
   - Editing objects
   - Working with Clip Art

d) Formatting slides
   - Using slide master
   - Text formatting
   - Changing slide layout
   - Changing slide colour scheme
   - Changing background
   - Applying design template

e) How to view the slide show?

- Viewing the presentation using slide navigator
- Slide transition
- Animation effects, timing, order etc.

f) Use of Pack and Go Options.

8. Internet and its Applications

a) Establishing an internet connection.
b) Browsing and down loading of information from internet.
c) 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
d) Assigning IP Addresses to computers and use of domain names.

9. Functioning of Antivirus

a) Installation and updation of an antivirus.
b) How to scan and remove the virus.

INSTRUCTIONAL STRATEGY

Since this subject is practice oriented, the teacher should demonstrate the capabilities of computers to students while doing practical exercises. The students should be made familiar with computer parts, peripherals, connections and proficient in making use of MS Office/Open Office in addition to working on internet. The student should be made capable of working on computers independently.

RECOMMENDED BOOKS

1. Fundamentals of Computer by V Rajaraman; Prentice Hall of India Pvt. Ltd., New Delhi
2. Computers Fundamentals Architecture and Organisation by B Ram, revised Edition, New Age International Publishers, New Delhi
3. Computers Today by SK Basandara, Galgotia publication Pvt Ltd. Daryaganj, New Delhi.
4. A First Course in Computer by Sanjay Saxena; Vikas Publishing House Pvt. Ltd., Jungpura, New Delhi
5. Computer Fundamentals by PK Sinha; BPB Publication, New Delhi

6. Fundamentals of Information Technology by Leon and Leon; Vikas Publishing House Pvt. Ltd., Jungpura, New Delhi
7. Fundamentals of Information Technology by Vipin Arora, Eagle Parkashan, Jalandhar

1.9 INTERNET OF THINGS AND ARTIFICIAL INTELLIGENCE

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LEARNING OUTCOMES

At the end of this course, the students will be able to:

- Understand the concepts of Internet of Things
- Build small IoT applications
- Understand and analysing sensor generated data using analytic techniques in Excel

DETAILED CONTENTS

1. Introduction to Internet of Things (IoT) (8 hrs)
   - Applications, architecture, protocols
   - Characteristics of IoT
   - Physical Design/Logical Design of IoT
   - Functional blocks of IoT, Communication Models.

2. Basics of C language using Arduino IDE (14 hrs)
   - Understating basics of Arduino IDE
   - Variables, datatype, loops, control statement, function

3 Practical using Arduino-interfacing sensors (28 hrs)

   i. Interfacing Light Emitting Diode(LED)- Blinking LED
   ii. Interfacing Button and LED – LED blinking when button is pressed
   iii. Interfacing Light Dependent Resistor (LDR) and LED, displaying automatic night lamp
   iv. Interfacing Temperature Sensor(LM35) and/or humidity sensor (e.g. DHT11)
   v. Interfacing Liquid Crystal Display(LCD) – display data generated by sensor on LCD
   vi. Interfacing Air Quality Sensor-pollution (e.g. MQ135) - display data on LCD , switch on LED when data sensed is higher than specified value.
   vii. Interfacing Bluetooth module (e.g. HC05)- receiving data from mobile phone on Arduino and display on LCD
   viii. Interfacing Relay module to demonstrate Bluetooth based home automation application. (using Bluetooth and relay).

4 Introduction to Artificial Intelligence (AI), Machine Learning (ML), (20 hrs)

Deep Learning (DL).

- Role of AI in IoT and its applications
- Managing and Analysing data generated by IoT devices – Big Data
- Machine learning (ML) Techniques e.g. classification, linear regression, etc.
- Numerical based on above techniques.
- Understanding excel for analysing data

INSTRUCTIONAL STRATEGY:

Since this subject is practical oriented, the teacher should demonstrate functioning of various sensors and demonstrate building of IoT applications. Solution to various regression and classification problems should also be built.

LIST OF REFERENCE BOOKS:

1. Vijay Madisetti, Arshdeep Bahga, "Internet of Things: A Hands On Approach, University Press
2. Yashavant Kanetkar, Shrirang Korde, "21 Internet Of Things (IOT) Experiments"
3. Neerparaj Rai , "Arduino Projects For Engineers"
4. Chandra S.S.V, "Artificial Intelligence and Machine Learning"

LIST OF COMPONENTS

1. One kit for 3-4 students : Arduino Uno, sensors(Bluetooth module(HC05), MQ135, DHT11, breadboard , LCD, 2-relay module etc)
2. Consumables : LED, button, connecting wires, LDR, LM35, battery, etc

1.10 GENERAL WORKSHOP PRACTICE

(Common for Agriculture Engineering, Automobile Engineering, Aircraft Maintenance Engineering, Civil Engineering, Mechanical Engineering, Mechanical Engineering (Tool & Die), Mechanical Engineering (Production), Mechanical Engineering (CAD/CAM), Production Engineering, Packaging Technology, Plastic Technology)

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SCHEDULING

The students will visit the different workshops in two major rounds in a year. In 1st round, they will learn basic skills of each workshop and in 2nd round, they will refine their skills further**.**

RATIONALE

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

LEARNING OUTCOMES

After completing the course, the students will be able to:

- Identify tools and equipment used and their respective functions.
- Identify different types of materials and their basic properties.
- Use and take measurements with the help of basic measuring tools/equipment.
- Select materials, tools, and sequence of operations to make a job as per given specification/drawing.
- Prepare simple jobs independently and inspect the same.
- Inspect visually to identify various types of defects in different type of materials.
- Follow safety procedures and precautionary measures.
- Use safety equipment and Personal Protection Equipment(PPE).
- Maintain good housekeeping practices.

DETAILED CONTENTS (PRACTICAL EXERCISES)

1st ROUND

Workshop Safety Induction Session:
First turn of each shop shall be dedicated to safety practices and the contribution of safety to quality. The safety aspects should be categorised into 3 categories

- PSS (Process Safety System)
- SSS (Safety Shutdown System)
- ESD (Emergency Shutdown) or Emergency Depressurisation System.

The following practices should be included:

- Use of PPE (Personal Protection Equipment)
- Use of Safety Equipment like fire extinguishers etc.
- Paramedic teaching suite, First aid
- Reports to be prepared for the damages
- At the end of this session the student must sign "Student Safety Declaration form".

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

The following shops are included in the syllabus:

1. Welding Shop – I
2. Fitting Shop – I
3. Sheet Metal Shop – I
4. Electric Shop - I
5. Carpentry Shop – I
6. Smithy Shop – I
7. Painting Shop

1. WELDING SHOP – I

1.1 Introduction and importance of welding process as compared to other material joining processes. Specifications and type of ARC welding machines, parts identification, classification, selection and coding of electrodes, welding parameters, welding joints and welding positions. Common weldable Materials, safety precautions, use of PPEs, welding screens, Hazards and remedies during welding, Elementary symbolic representations, demo of types of welding defects.

1.2 Jobs to be prepared

Job I Practice of striking arc (Minimum 4 continuous beads on 100 mm long M.S. flat).

Job II Practice of depositing beads on plate at different current levels. (Minimum 4 beads on M.S. plate at four setting of current level and differentiating their characteristics).

Types of joints and their edge preparations:

Job III Preparation of lap joint using arc welding process.

Job IV Preparation of butt joint using arc welding process. (100 mm long).

Job V Preparation of T Joint using arc welding (100mm x 6 mm M.S. Flat).

2. FITTING SHOP – I

2.1 Introduction and Practical Importance of fitting jobs
2.2 Basic deburring processes.
2.3 Introduction to fitting shop tools, marking and measuring devices/equipment.
2.4 Identification of materials. (Iron, Copper, Stainless Steel, Aluminium etc.)
2.5 Identification of various steel sections (flat, angle, channel, bar etc.).
2.6 Introduction to various fitting shop operations/processes (Hacksawing, Drilling, Chipping and Filing). Demonstration of wrong fitting practices causing damage to filed surfaces(outsized, out angled etc.) and tool/blade breakages.
2.7 Jobs to be prepared:

- Job I Marking of job, use of marking tools and various types of files, use of tri square, surface plate, filing and use of measuring instruments. (zero error and least count of Vernier calliper, Micrometer and Vernier height gauge).
- Job II Filing a rectangular/square piece to maintain dimensions within an accuracy of ±0.5 mm.
- Job III Making a cut-out from a square piece of MS flat using hand hacksaw and chipping.

3. SHEET METAL SHOP – I

3.1. Introduction and practical importance of sheet metal jobs, use of hand tools and accessories e.g. different types of hammers, hard and soft mallet, sheet and wire gauge, necessary allowance required during job fabrication, selection of material.
3.2 Introduction and demonstration of hand tools used in sheet metal shop.
3.3 Introduction and demonstration of various machines and equipment used in sheet metal shop e.g. Shearing Machine, Bar Folder, Burring Machine, Turning Machine, Wiring Machine, Setting Down Machine, Forming Machine, Stake etc.
3.4 Introduction and demonstration of various raw materials used in sheet metal shop e.g. black-plain sheet, galvanized-iron plain sheet, galvanised corrugated sheet, aluminium sheet etc.
3.5 Study of various types of nuts, bolts, rivets, screws etc.

- Job I Shearing practice on a sheet using hand shears.
- Job II Prepare a seam joint of G.I. Sheet
- Job III Practice on making Single(/double) riveted lap joint/Butt Joint.
- Job IV Development of sheet for preparation of cubical container(300x150x25 mm)

4. ELECTRIC SHOP - I

4.1 Study, demonstration and identification of common electrical materials with standard ratings and specifications such as wires, cables, switches, MCB & ELCB, fuses, cleats, clamps and allied items, tools and accessories.
4.2 Study of electrical safety measures and protective devices.

Job I Identification of phase, Neutral and Earth wires for connection to domestic electrical appliances and their connections to three pin plugs. Difference between series and parallel wiring.

Job II Carrying out house wiring circuits using fuse, switches, sockets, ceiling rose etc. in batten or P.V.C. casing-caping. Demo of conduit wiring through junctions

Job III To prepare a three level Godown wiring circuit with PVC conduit wiring system.

4.3 Introduction to the construction of lead acid battery, its working and its specification parameters(maH, specific gravity), precautions while handling battery, Introduction to battery charger and its functioning. Types of charging

Job IV Installation of battery and connecting two or three batteries in series and parallel and its effect. Charging a battery and testing with hydrometer and cell tester

4.4 Introduction to solar energised lighting or water heater system and their defects.

Job V Installation of Solar cells, costing according to capacity

5. CARPENTRY SHOP - I

5.1 Introduction and industrial applications of carpentry jobs.

5.1.1 Name and use of raw materials used in carpentry shop : wood & alternative materials(board, plywood)

5.1.2 Names, uses, care, precautions and maintenance of hand tools such as different types of Saws, C-Clamp, Chisels, Mallets, Carpenter's vices, Marking gauges, Try-squares, Rulers and other commonly used tools and materials used in carpentry shop by segregating as cutting tools, supporting tools, holding tools , measuring tools etc.

5.1.3 Specification of tools used in carpentry shop.

5.1.4 Identification of different types of Timbers, their properties, uses & defects. Study of the joints in roofs, doors, windows and furniture available in Polytechnic

5.1.5 Seasoning of wood and its need.

5.1.6 Estimation of wood.

5.2 Practice

5.2.1 Practices for Basic Carpentry Work

5.2.2 Sawing practice using different types of saws

5.2.3 Assembling jack plane — Planning practice including sharpening and blade adjustment of jack plane cutter

5.2.4 Chiselling practice using different types of chisels including sharpening of chisel

5.2.5 Making of different types of wooden pin and fixing methods. Marking measuring and inspection of jobs.

5.2.6 Housekeeping practices and instructions.

5.3 Job Practice

Job 1	Marking, sawing, planning to size , chiselling and their practice
Job II	Half Lap Joint (cross, L or T – any one)
Job III	Mortise and Tenon joint (T-Joint)
Job IV	Dove tail Joint (Half lap dovetail joint or Bridle Joint)

6. SMITHY SHOP - I

6.1 Introduction and industrial applications of smithy jobs.

6.1.1 Purpose of Smithy shop

6.1.2 Different types of Hearths used in Smithy shop, Types of fuel used and maximum temperature obtained

6.1.3 Purpose, specifications, uses, care and maintenance of various tools and equipments used in hand forging by segregating as cutting tools, supporting tools, holding tools, measuring tools, punches etc.

6.1.4 Types of raw materials used in Smithy shop

6.1.5 Uses of Fire Bricks & Clays in Forging workshop.

6.2 Practice

6.2.1 Practice of firing of hearth/Furnace, Cleaning of Clinkers and Temperature Control of Fire.

6.2.2 Practice on different basic Smithy/Forging operations such as Cutting, Upsetting, Drawing down, Setting down, Necking, Bending, Fullering, Swaging, Punching and Drifting

a) Demonstration — Making cube, hexagonal cube, hexagonal bar from round bar

6.2.3 Practice of Simple Heat treatment processes like Tempering, Normalizing, and Hardening etc

Job Practice: Job Preparation

Job I	Making a cold / hot, hexagonal flat chisel including tempering of edges.
Job II	Production of utility goods e.g. hexagonal bolt / square shank boring tool, fan hook (long S-type) [Two jobs are to be done by the students].
Job III	To prepare a cube from a M.S. round by forging method.

7 PAINTING SHOP

Introduction to painting shop and its necessity. Different types of paints. Introduction of powder coating plant and spray painting with their uses.

Job I Preparation of surface before painting such as cleaning, sanding, applying putty, filling procedure and application of primer coat and painting steel item.

Job II Painting practice by brush on MS sheet

Job III Practice of dip painting

Job IV Practice of lettering: name plates / sign board

Job V Polishing and painting on wooden and metallic surfaces(furniture or utility of Polytechnic)

Job VI Practical demonstration of powder coating

Job VII Practical demonstration of spray painting on a utility object

2nd ROUND

DETAILED CONTENTS (PRACTICAL EXERCISES)

The following shops are included in the syllabus.

1 Welding Shop – II
2 Fitting Shop – II
3 Sheet Metal Shop – II
4 Electric Shop -II
5 Carpentry Shop – II
6 Smithy Shop – II (Not for Civil Engg. Branch)
7 Plumbing Shop (only for Civil Engg. Branch)

1. WELDING SHOP - II

1.1 Introduction to gas welding, gas welding equipment, introduction to soldering and brazing, introduction to resistance welding, safety precautions.

1.2 Jobs to be prepared

Job I Identification and adjustment of various types of gas flames. Practice them on pipe joint in round and linear fashion

Job II Preparation of lap joint on 75 mm × 35 mm × 3mm M.S. plate using gas welding.

Job III Preparation of butt joint on 75mm×35mm×3mm M.S.flat using gas welding process.

Job IV Preparation of a small cot frame (M.S. steel bed frame) from M.S. conduit pipe using gas welding process.

Job V Preparation of a square pyramid from M.S. rod by welding (Arc or Gas welding).

Job VI Practice of Spot/Seam welding or repair of an iron furniture of institute or demo of Gas cutting process

2. FITTING SHOP - II

2.1 Care and maintenance of various measuring tools.

2.2 Handling of measuring instruments, finding least count and checking of zero error. Use of dial gauges and feeler gauges.

2.3 Description and demonstration of various types of drills, taps and dies.

2.4 Selection of drills and taps.

2.5 Precautions while drilling soft metals (Aluminium, Copper, Brass etc.).

Job I Drilling practice on soft metals-Aluminium

Job II Preparation of a job by filing on non ferrous metals upto an accuracy of ±0.1 mm.

2.6 file and make angle, surfaces (Bevel gauge accuracy 1 degree) make simple open and sliding fits Inside square fit, make combined open and sliding fit, straight sides

Job III Step fit(.02mm accuracy) or angular V fit(30 minute) or radius fitting(40x40x3mm MS sheet)

2.7 Sliding fitting, Diamond fitting, Lapping flat surfaces using lapping plate. Application of lapping, material for lapping tools, lapping abrasives, charging of lapping tool. Surface finish importance, equipment for testing-terms relation to surface finish

Job IV T fit or H fit with highest lapped accuracy to be checked by feeler gauge or any as deemed to be.

3. SHEET METAL SHOP - II

3.1 Introduction to various metal forming processes e.g. Spinning, Punching, Blanking, cup drawing

3.2 Introduction to soldering and brazing.

3.3 Introduction to metal spinning process.

Job I Preparation of job involving shearing, circular shearing, rolling, folding, beading and soldering process e.g. Funnel/oil can/bucket or any other job involving above operations.

Job II Exercise on job involving brazing process

Job III Spinning a bowl/cup/saucer

Job IV Visit to a sheet metal industry e.g. coach builders etc.

4. ELECTRIC SHOP - II

4.1 Introduction to single phase and three phase supply and wiring system. Importance of three phase supply (RYB)& its sequence and wiring system.

Job I Connecting Generator and 3 phase wiring through Change over Switch.

4.2 Estimating and costing of power consumption

Job II Connecting single phase energy meter with supply and load. Reading and working out power consumption and cost of energy.

4.3 Study of internal wiring diagram of common electrical appliances such as auto electric iron, electric kettle, ceiling/table fan, desert cooler etc.Demonstration of dismantling, servicing and reassembling of table/ceiling fan, air-cooler, auto electric iron, heater etc.

Job III Dismantling, servicing and reassembling of any of the above electrical appliances, finding faults with series testing lamp and multimeter.

4.4 Testing and reversing direction of rotation of single phase and three phase motors.

Job IV Acceptance Testing of single phase/three phase motors by using voltmeter, ammeter and tachometer.

Job V Reversing direction of rotation of single phase and three phase motors.

4.5 Identification and familiarisation with the following tools:

Tweezers, Screw Drivers (Different sizes), Insulated pliers, Cutters, Sniper, Philips Screw driver (star screw driver), L-Keys, Soldering Iron and their demonstration and uses.

Job VI Practice on joining using soldering flux and removing components/wires by desoldering

5. CARPENTRY SHOP – II

5.1 Introduction to joints, their relative advantages and uses.

Job I Preparation of glued joint. *

Job II Preparation of mitre joint *

Job III Preparation of a lengthening joint *

* These jobs should be more prepared for utility articles like coat-hanger, shoe-rack, book-shelf etc.

5.2 Demonstration of job showing use of Rip Saw, Bow saw and Tenon saw, method of sharpening various saws.

5.3 Demonstration of job on Band Saw and Circular Saw, Chain and Chisel, Universal wood working machine, Saw re-sharpening machine, Saw Brazing unit.

5.4 Importance and need of polishing wooden items, Introduction to polishing materials.

5.5 Practice on Wood Working Lathe

a) Safety precaution on wood working machines
b) Study of wood working lathe
c) Sharpening of lathe tools
d) Setting of jobs and tools
e) Different type of wood turning practice

Job IV a) Making Handles of chisels/files/screw drivers etc.
b) Making legs of cabinets: Straight, Tapered and Ornamental

Job V Repair of wooden furniture of the Institute

6. SMITHY SHOP – II (Not for Civil Engg Branch)

6.1 Introduction to various heat treatment processes e.g annealing, hardening, tempering, normalizing etc.

6.2 Description of various types of power hammers and their usage (Demonstration only).

Job I To forge a ring to acquaint the students with forge welding.

Job II To forge a chisel and acquaint the students with simple idea of hardening and tempering.

Job III To forge squares on both ends of a circular rod.*

Job IV To prepare a job involving drawing down process*

* Prepare utility articles like screw drivers, hinges, hexagonal nut, gib head key, chain links

7. PLUMBING SHOP (only for Civil Engg. Branch)

7.1 Introduction to various types of threads (internal and external)-single start, multi-start, left hand and right hand threads.

7.2 Description and demonstration of various types of drills, taps and dies. Selection of dies for threading, selection of drills, taps and reamers for tapping operations.

7.3 Introduction to use of plumbing tools like pipe wrench , plumber vice and materials like Putty, thread, duct(Teflon) tape, epoxy resin, araldite, m-seal.

Job I Making internal and external threads on a job by tapping and dieing operations (manually)

7.4 Precautions while drilling soft metals, e.g. copper, brass, aluminium etc.

Job II Fitting of all components of wash basin and ball valve in a tank

Job III Practice on opening a jammed pipe(MS or PVC) joint with least damage and repair of a leaking joint, reconditioning of a tap.

Job IV Preparation of job involving thread on GI pipe/ PVC pipe and fixing of at least 5 types of fittings (viz. elbow, tee, union, socket, reducer, nipple, stopcock, taps etc)

MEANS OF ASSESSMENT

- Workshop jobs
- Report writing, presentation and viva voce

RECOMMENDED BOOKS

1. Workshop Technology I,II,III, by SK Hajra, Choudhary and AK Choudhary; Media Promoters and Publishers Pvt. Ltd. Mumbai.
2. Workshop Technology Vol. I, II, III by Manchanda; India Publishing House, Jalandhar.

3. Workshop Training Manual Vol. I, II by S.S. Ubhi; Katson Publishers, Ludhiana.
4. Manual on Workshop Practice by K Venkata Reddy; MacMillan India Ltd., New Delhi
5. Basic Workshop Practice Manual by T Jeyapoovan; Vikas Publishing House (P) Ltd., New Delhi
6. Workshop Technology by B.S. Raghuwanshi; Dhanpat Rai and Co., New Delhi
7. Workshop Technology by HS Bawa; Tata McGraw Hill Publishers, New Delhi
8. e-books/e-tools/relevant software to be used as recommended by AICTE/HSBTE/NITTTR.

Websites for Reference:

http://swayam.gov.in

THIRD SEMESTER

3.1 FLUID MECHANICS

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RATIONALE

Subject of Fluid Mechanics 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.

LEARNING OUTCOMES

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

- Interpret the different terms related to fluids.
- Calculate the pressure exerted by fluids on the walls of containers.
- Calculate discharge through pipes, irrigation channels, water supply pipe lines.
- Use different flow measurement devices like venturimeter, mouthpiece, notches, weir, orificemeter
- Calculate size of the pipe for carrying a particular discharge.
- Prepare the details like dimensions, slope of the irrigation, canals and water courses
- Differentiate between different type of water pumps used in the field.
- Measure the loss of head in pipes and channels

DETAILED CONTENTS

THEORY

1. Introduction: (1 Hours)

   1.1 Fluids: Real and ideal fluids

   1.2 Fluid Mechanics, Hydrostatics, Hydrodynamics, Hydraulics

2. Properties of Fluids (definition only) (3 Hours)

   2.1 Mass density, specific weight, specific gravity, viscosity, surface tension - cohesion, adhesion and, capillarity, vapour pressure and compressibility.

3. Hydrostatic Pressure: (8 Hours)

   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 horizontal, vertical and inclined plane surfaces of rectangular, triangular, trapezoidal shapes and circular.
(No derivation - Simple Numerical Problems)

4. Measurement of Pressure: (5 Hours)

4.1 Atmospheric pressure, gauge pressure, vacuum pressure and absolute pressure.

4.2 Piezometer, simple manometer and differential manometer, Bourden gauge and dead weight pressure gauge.

5. Fundamentals of Fluid Flow: (6 Hours)

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) {No derivation}, Simple numerical problems.

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

5.4 Bernoulli's theorem; statement and description (without proof of theorem), Simple numerical problems.

6. Flow Measurements (6 Hours)

Brief description with simple numerical problems of :

6.1 Venturimeter and orificemeter

6.2 Pitot tube

6.3 Orifices and mouthpieces

6.4 Current meters

6.5 Notches and weirs

7. Flow through Pipes: (8 Hours)

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

7.2 Critical velocity and velocity distributions in a pipe for laminar flow

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), Simple numerical problems

7.4 Hydraulic gradient line and total energy line

7.5 Pipes in series and parallel

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

8. Flow through open channels: (9 Hours)

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 (no derivation, only simple numerical problems)
- i) Rectangular
- ii) Trapezoidal

8.4 Head loss in open channel due to friction

9. Hydraulic Pumps: (2 Hours)

Hydraulic pump, reciprocating pump, centrifugal pumps (No numericals and derivations) (may be demonstrated with the help of working models)

PRACTICAL EXERCISES

1. To verify Bernoulli's Theorem
2. To find out venturimeter coefficient
3. 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

4. To perform Reynold's experiment

5. To verify loss of head in pipe flow due to
    a. Sudden enlargement
    b. Sudden contraction
    c. Sudden bend

6. Demonstration of use of current meter and pitot tube

7. To determine coefficient of discharge of a rectangular notch and triangular notch.

INSTRUCTIONAL STRATEGY

Fluid Mechanics 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. Visit to hydraulic research stations must be carried out.

MEANS OF ASSESSMENT

- Assignments and quiz/class tests
- Mid-term and end-term written tests
- Laboratory and practical work
- Report Writing
- Viva-Voce

RECOMMENDED BOOKS

1. Fluid Mechanics and Hyraulics by Jagdish Lal; Delhi Metropolitan Book Co. Pvt Ltd.
2. Hydraulics and Fluid Mechanics by Modi, PN, and Seth, SM; Delhi Standard Publishers Distributors.
3. Hydraulics and Hydraulics Machines by Khurmi RS ; S Chand and Co., Delhi
4. Laboratory Manual for Fluid Mechanics by Poonia MP and Jakhar OP; Standard Publishers Distributors, Delhi
5. Fluid Mechanics by Birinder Singh; Kaption Publishing, New Delhi.
6. Fluid Mechanics by Sarao A.S; Tech. India Publication, New Delhi
7 e-books/e-tools/relevant software to be used as recommended by AICTE/HSBTE/NITTTR.

Websites for Reference:

http://swayam.gov.in

SUGGESTED DISTRIBUTION OF MARKS

Topic No.	Time Allotted (Hours)	Marks Allotted (%)
1	1	1
2	3	5
3	8	16
4	5	10
5	6	13
6	6	13
7	8	18
8	9	20
9	2	4
Total	**48**	**100**

3.2 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 useful 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.

LEARNING OUTCOMES

After undergoing the subject, students will be able to:

- Conduct different tests on mild steel
- Calculate modulus of elasticity
- Analyse and explain stress-strain diagram of mild and HYSD steel
- Calculate various forces used in design of structures
- Calculate shear force, bending moment for simply supported, cantilever and overhanging beams with concentrated and uniformly distributed loads
- Calculate moment of inertia, second moments of inertia, radius of gyration, section modulus for L, T, channel and I sections
- Calculate the bending stresses, moment of resistance of simply supported beams
- Explain shear stress, stress distribution diagram for rectangular, circular, I,T and L sections
- Calculate slope and deflection of determinate structures
- Verify forces in a framed structure

DETAILED CONTENTS

THEORY:

1. Properties of Materials (04 Hours)

    1.1 Classification of materials, elastic materials, plastic materials, ductile materials, brittle materials.

1.2 Introduction to tensile test, compressive test, impact test, fatigue test, torsion test on metals.

2. Simple Stresses and Strains: (14 Hours)

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 tPeriodsee) due to axial load.

2.5 Stress-strain diagram for mild steel and HYSD steel, mechanical properties, factor of safety.

2.6 Temperature stresses and strains

3. Shear Force and Bending Moment: (18 Hours)

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

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

4. Moment of Inertia: (04 Hours)

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 area for L, T and I sections, section modulus.

5. Bending Stresses in Beams: (06 Hours)

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&L sections only

5.3 Moment of resistance

5.4 Calculations of bending stresses in simply supported beam

6. Shear Stresses in Beams (04 Hours)

6.1 Concept of shear stresses in beams, shear stress distribution in rectangular, circular I, T, L sections for S.S. beams and Portland

7. Slope and Deflection: (04 Hours)

Determination of slope and deflection using Moment Area Theorem for simply supported beam for pointed load and U.D.L.(no derivation, numerical problems)

8. Columns: (04 Hours)

8.1 Theory of columns

8.2 Problem solving using Eulers and Rankine Formula

9. Analysis of Trusses: (06 Hours)

9.1 Concept of a perfect, redundant and deficient frames

9.2 Assumptions and analysis of trusses by:

a) Method of joints
b) Method of sections

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 modulus of rupture of a concrete beam

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

vi) 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.

MEANS OF ASSESSMENT

- Assignments and quiz/class tests
- Mid-term and end-term written tests
- Laboratory and practical work,
- Report writing
- Viva-Voce

RECOMMENDED BOOKS

1. "Strength of Materials" by Ramamrutham, S ; Dhanpat Rai and Sons., New Delhi
2. "Applied Mechanics and Strength of Materials" by Ram Chandra; Standard Publishers. Delhi:
3. "Strength of Materials" by Punmia, BC ; Standard Publishers, Delhi,
4. “Strengths of Materials” by Sadhu Singh; Standard Publishers, New Delhi
5. “Structural Mechanics” by Singh Birinder; Kaption Publishers, Ludhiana
6. e-books/e-tools/relevant software to be used as recommended by AICTE/HSBTE/NITTTR.

Websites for Reference:

http://swayam.gov.in

SUGGESTED DISTRIBUTION OF MARKS

Topic No.	**Time Allotted (**Hours**)**	**Marks Allotted (%)**
1	04	06
2	14	21
3	18	30
4	04	06
5	06	10
6	04	06
7	04	07
8	04	07
9	06	07
Total	**64**	**100**

3.3 SURVEYING - I

L	T	P
3	-	5

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.

LEARNING OUTCOMES

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

- Measure a long line with chain or tape
- Prepare maps for closed traverse and open traverse with survey instruments
- Measure bearing of line
- Perform leveling with digital level
- Find difference of level between two points with dumpy level, auto level and digital level
- Perform temporary adjustments of leveling instruments

DETAILED CONTENTS

1. Introduction: (04 Hours)

    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 based on surveying instruments

2. Chain surveying: (07 Hours)

2.1. Purpose and principles of Chain Surveying
2.2 Introduction, advantages and disadvantages
2.3 Direct and indirect ranging, offsets and recording of field notes
2.4 Obstacles in Chain Surveying
2.5 Errors in Chain Surveying and their correction.

3. Compass surveying: (11 Hours)

3.1 Purpose of compass surveying. Use of prismatic compass: Setting and taking observations

3.2 Concept of following with simple numerical problems:
a) Meridian - Magnetic and true, Arbitrary
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 (Simple Numerical Problems)

4. Levelling: (14 Hours)

4.1 Purpose of levelling, 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 use of Dumpy level, Engineer' level, Auto level: advantages and disadvantages, use of auto 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 and permanent adjustment of dumpy level by two peg method.

4.6 Concept of back sight, foresight, intermediate sight, 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, permissible limits, reciprocal leveling. Numerical problems.

4.9 Computations of Areas of regular figures and irregular figures. Simpson's rule: prismatic formula and graphical method use of planimeter for computation of areas, numerical problems

5. Plane Table Surveying (12 Hours)

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 Concept of Two point and Three point problems (Concept only)

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

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 various levels
c) Taking staff readings on different stations from the single setting and finding differences of level between them

ii) a) 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 and 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)

V. Layout of Buildings (from given drawing of two room residential building) by use of surveying instruments.

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. Technical visit to Survey of India, Northern Region and Great Trignometrical Survey(GTS), Dehradun.

MEANS OF ASSESSMENT

- Assignments and quiz/class tests,
- Mid-term and end-term written tests
- Laboratory and practical work
- Report Writing
- Drawing
- Viva-Voce

RECOMMENDED BOOKS

1. A Text Book of Surveying by Kochar, CL; Katson Publishing House, Ludhiana,
2. "Surveying and Leveling" by Kanetkar,TP and Kulkarni, SV; AVG Parkashan, Poona
3. "Surveying –I by Mahajan, Sanjay; Tech. Publication, Delhi
4. "Surveying and Leveling" by Punmia, BC; Standard Publishers Distributors, Delhi.
5. e-books/e-tools/relevant software to be used as recommended by AICTE/HSBTE/NITTTR.

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SUGGESTED DISTRIBUTION OF MARKS

Topic No.	**Time Allotted (**Hours**)**	**Marks Allotted (%)**
1	04	08
2	07	12
3	11	20
4	14	32
5	12	28
Total	**48**	**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.

LEARNING OUTCOMES

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

- Classify rocks and identify particular type of stones
- Classify different types of bricks and tiles
- Perform laboratory tests of cement to determine properties of cement, bricks, tiles.
- Identify types of defects of timber
- Select paints/varnishes for various types of surfaces
- Identify and use different types of metals/alloys
- Select different materials used for wall paneling and false ceiling, such PVC, POP etc.
- Select other materials commonly used for contemporary buildings.

DETAILED CONTENTS

1. Building Stones: (05 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, 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 Identification of common building stones

1.5 Various uses of stones in construction

1.6 Quarrying of stones by blasting and its effect on environment

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 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, soundness

2.6 Tiles

2.6.1 Building tiles; Types of tiles-wall, ceiling, roofing and flooring tiles

2.6.2 Ceramic, terrazo and PVC tiles, : their properties and uses,

2.6.3 Vitrified tiles, Paver blocks, interlocking tiles

2.7 Stacking of bricks and tiles at site

3. Cement: (08 Hrs)

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

3.2 Various types of Cements, their uses and testing: Ordinary portland cement, rapid hardening cement, low heat cement, white and coloured cement, portland pozzolana cement

3.3 Properties of cement

4. Timber and Wood Based Products: (08 Hrs)

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

** 4.2 Market forms of converted timber as per BIS Code

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

4.4 Properties of timber and specifications of structural timber

4.5 Defects in timber, decay in timber

4.6 Preservation of timber and methods of treatment as per BIS

4.7 Other wood based products, their brief description of manufacture and uses: laminated board, gypsum board, block board, fibre board, hard board, sunmica, plywood, veneers, nu-wood and study of the brand name and cost of the wood based products available in the market, Cement Panel Board, Moulded Doors.

5. Paints and Varnishes: (05 Hrs)

5.1 Introduction, purpose and use of paints

5.2 Types, ingredients, properties and uses of oil paints, water paints and cement paints**

5.3 Covering capacity of various paints

5.4 Types, properties and uses of varnishes

5.5 Trade name of different products.

6. Metals: (03 Hrs)

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

6.2 Commercial forms of ferrous, metals.

6.3 Aluminium & Stainless Steel.

7. Miscellaneous Materials: (09 Hrs)

7.1 Plastics – Introduction and uses of various plastic products in buildings such as doors, water tanks and PVC pipes

7.2 Fibre Sheets and their size and uses

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

7.4 Construction chemicals like water proofing compound, epoxies, polymers

7.5 Water proofing, termite proofing and fire resistance materials – types and uses

7.6 Materials used in interior decoration works like POP, methods of doing POP, PVC paneling

7.7. Eco friendly materials for construction of buildings.

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

PRACTICAL EXERCISES:

i) To identify the stones used in building works by visual examination

ii) To determine the crushing strength of bricks

iii) To determine the water absorption of bricks and efflorescence of bricks

iv) To identify various types of timbers such as: Teak, Sal, Chir, Shisham, Deodar, Kail & Hollock by visual examination only

v) The students should submit a report work on the construction materials, covering water proofing material, cements, steel, paints and timber products available in the local

market. They will also show the competitive study based upon the cost, brand name, sizes available in the local market.

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.

MEANS OF ASSESSMENT

- Assignments and quiz/class tests
- Mid-term and end-term written tests,
- Laboratory and practical work,
- Report Writing
- Viva-voce

RECOMMENDED BOOKS

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

Websites for Reference:

http://swayam.gov.in

SUGGESTED DISTRIBUTION OF MARKS

Topic No.	**Time Allotted (**Hours**)**	**Marks Allotted (%)**
1	05	12
2	10	21
3	08	16
4	08	16
5	05	10
6	03	09
7	09	16
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.

LEARNING OUTCOMES

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

- Define the different components and classification of building
- Select a foundation for particular type of building
- Explain different types of walls, scaffolding, shoring, underpinning and their constructional methodology
- Carry out the construction of brick wall.
- Supervise rubble and ashlar types of stone masonry construction
- Demonstrate the construction details of lintels and arches at appropriate level in building
- Select different types of doors, windows, floors and stairs cases in building
- Recognise different parts of roof trusses and drainage system of roofs
- Identify and select application procedure for different types of surfaces finishes in building i.e. plastering, pointing, painting, white washing and distempering
- Evaluate the possible reason of dampness at various level in building and remedial means
- Demonstrate how to carry out different types of possible anti termite treatments in building

DETAILED CONTENTS

1. Introduction: (03 Hours)

    1.1 Definition of a building, classification of buildings based on occupancy
    1.2 Different parts of a building

2. Foundations: (05 Hours)

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, min. depth criteria, thumb rules for depth and width of foundation and thickness of concrete block, stepped foundation for masonry pillars and concrete columns
2.2.2 Introduction to deep foundation and their types

2.3 Earthwork

2.3.1 Layout/setting out for surface excavation, cutting and filling
2.3.2 Excavation of foundation, trenches, shoring, timbering and de- watering

3. Walls: (05 Hours)

3.1 Purpose of walls
3.2 Classification of walls - load bearing, non-load bearing, dwarf wall, retaining, breast walls and partition walls
3.3 Classification of walls as per materials of construction: brick, stone, reinforced brick, reinforced concrete, precast, hollow and solid concrete block and composite masonry walls
3.4 Partition walls: Constructional details, suitability and uses of brick and wooden partition walls
3.5 Scaffolding, construction details and suitability of mason's brick layers and tubular scaffolding, shoring, underpinning

4. Masonry (08 Hours)

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 of bonds
4.1.2 Construction of brick walls –methods of laying bricks in walls, precautions observed in the construction of walls, methods of bonding new brick work with old (toothing, raking, back and block bonding), Expansion and contraction joints
4.1.3 Mortars: types, selection of mortar and its preparation

4.2 Stone Masonry

4.2.1 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

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: (06 Hours)

5.1 Meaning and use of arches and lintels:

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

5.3 Arches:

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

5.3.2 Stone arches and their construction

5.3.3 Brick arches and their construction

5.4 Lintels

5.4.1 Purpose of lintel

5.4.2 Materials used for lintels

5.4.3 Cast-in-situ and pre-cast lintels

5.4.4 Lintel along with sun-shade or chhajja

**6. Doors, Windows and Ventilators: (06 Hours)

6.1 Glossary of terms with neat sketches

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

6.3 Window – Panel window, glazed windows (fixed and openable) ventilators, sky light window, Louveres shutters, plastic and aluminium windows.

6.4 Door and window frames – materials and sections, fixtures and fasteners, hold fasts

*7. Damp Proofing and Water Proofing (06 Hours)

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

7.2 Sources of dampness - moisture penetrating the building from outside e.g. rainwater, surface water, ground moisture. Moisture entrapped during

construction i.e. moisture in concrete, masonry construction and plastering work etc. Moisture which originates in the building itself i.e. water in kitchen and bathrooms etc.

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

7.4. Damp proofing of basement, Ground floors, plinth and walls, water storage tank, kitchen, W.C., roof.

**8. Floors (05 Hours)

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

8.2 Types of floor finishes - concrete flooring, ceramic tile flooring, stone (marble and kota) flooring. Wooden flooring

8.3 Special emphasis on level/slope/reverse slope in bathrooms, toilets, kitchen, balcony and staircase

9. Roofs (05 Hours)

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

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

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

10. Stairs (06 Hours)

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 (06 Hours)

11.1 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, techniques of plastering and curing

11.2 Pointing - different types of pointing and their methods

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

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

11.5 Selection of appropriate paints/finishes for interior and exterior surfaces

11.6 Importance of preparation of surfaces such as hacking, grooving etc before application of surface finishes

12 Anti Termite Measures as per IS 6.313-I-III (03 Hours)

12.1 Anti Termite Treatment to Foundation, Masonary, RCC, Floors, Junction of walls and Floors.

12.2 Treatment to wooden joinery

12.3 Treatment to existing building

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

1. Demonstration of tools and plants used in building construction
2. To prepare Layout of a building: two rooms building with front verandah
3. 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
4. Demonstration of following items of work at construction site by:
   a) Timbering of excavated trenching
   b) Laying damp proof courses
   c) Construction of masonry walls
   d) Laying of tile flooring on an already prepared lime concrete base
   e) Plastering and pointing exercise
   f) Constructing RCC work
   g) Pre-construction and post construction termite treatment of building and woodwork
   h) Interlocking tiles

Note: (A report of these activities will be submitted by the students)

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

MEANS OF ASSESSMENT

- Assignments and quiz/class tests,
- Mid-term and end-term written tests
- Laboratory and practical work
- Report writing
- Viva-voce

RECOMMENDED BOOKS

1. "Building Construction" by Rangwala, SC; Charotar Book Stall, Anand
2. "A Text Book of Building Construction" by Kulkarni, GJ; Ahmedabad Book Depot
3. "A Text Book of Building Construction" by Arora, SP and Bindra, SP; Dhanpat Rai and Sons, New Delhi.
4. "Building Construction" by Sushil Kumar; Standard Publishers Distributors, Delhi
5 SP – 62 Hand Book of BIS
6 B.I.S. – 6313 Part 1, 2, 3
7 National Building Code
8. Handbook of Civil Engineering by PN Khanna
9. Video films on Damp proofing, water proofing, surface finishes
10. e-books/e-tools/relevant software to be used as recommended by AICTE/HSBTE/NITTTR.

Websites for Reference:

http://swayam.gov.in

SUGGESTED DISTRIBUTION OF MARKS

Topic No.	Time Allotted (Hours)	Marks Allotted (%)
1	03	05
2	05	08
3	05	08
4	08	12
5	06	9
6	06	9
7	06	10
8	05	08
9	05	08
10	06	9
11	06	9
12	03	05
Total	**64**	**100**

3.6 BUILDING DRAWING

L	T	P
-	-	3

RATIONALE

Drawing is the language of engineers. Engineering is 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.

LEARNING OUTCOME

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

- Read and interpret building drawings
- Explain the drawing to craftsman
- Layout foundation plan of different types of foundations
- Prepare drawings of small buildings, developing different sections of building
- Guide and supervise carpenters in various carpentry works related to doors, windows etc.
- Prepare details of brick courses in joints
- Draw the sketches of various joints of carpentry
- Demonstrate circular arch and segmental arches

DETAILED CONTENTS

Section-I

Drawing No. 1 (2 sheets)

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

Drawing No. 2 (one sheet)

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

Drawing No. 3 (one sheet)

Drawing plan, elevation of arches: circular arch, segmental arch (one sheet)

Drawing No. 4 (2 sheets)

Elevation, sectional plan and sectional side elevation of flush door, glazed door, panelled door with wire gauge shutter.

Section-II

Drawing No. 5 (2 sheet)
Drawing plan, elevation of a small building by measurement and foundation detail and sectional elevation.

Drawing No. 6: (2 sheets)

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

Drawing No. 7 (one sheet)

Drawings of following floors

Cement concrete floors on ground and at first floor

i) Wooden flooring
ii) Bonded cement concrete flooring
iii) Ceramic/vitrified tile flooring

Drawing No. 8 (one sheet)

Drawing of flat roof, showing the heat/thermal insulation provisions.

Section-III

Drawing No. 9 (one sheet)

Drawing details of damp proofing arrangement of roofs and walls as per BIS Code. Show the rain water drainage arrangement also.

Drawing No 10 (one sheet)
Drawing Damp Proofing details in basement of buildings**.**

Drawing No.11 (one sheet)
Drawing Damp proofing details in water/soil retaining structures**.**

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
c) Some practice should be done to prepare drawings on AutoCAD.

MEANS OF ASSESSMENT

- Assignments and quiz/class tests
- Mid-term and end-term written tests
- Laboratory and practical work
- Drawing
- Viva-Voce

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. Drawing and Design of Residential and Commercial Buildings by Zaidi, SKA and Siddiqui, Suhail; Standard Publishers and Distributors, Delhi.
8. SP : 20
9. National Building Code
10. Building Drawing by Mamta Kataria; North Publication, Jalandhar.
11. e-books/e-tools/relevant software to be used as recommended by AICTE/HSBTE/NITTTR.

Websites for Reference:

http://swayam.gov.in

SOFT SKILLS – I

L	T	P
-	-	2

RATIONALE

The present day world requires professionals who are not only well qualified and competent but also possess good communication skills. The diploma students not only need to possess subject related knowledge but also soft skills to get good jobs or to rise steadily at their work place. The objective of this subject is to prepare students for employability in job market.

LEARNING OUTCOMES

After undergoing this course, the students will be able to:

- Identify components of effective verbal communication
- Prepare a report
- Learn the techniques of enhancing memory
- Set goals for overall personality development
- Understand the concept of quality and its implementation in an organisation.

DETAILED CONTENTS

- Soft Skills - Concept and Importance
- Communication Skills- Improving verbal communication
- Report Writing
- Method to enhance memory and concentration
- Component of overall personality- Dressing sense/etiquettes/body language etc.

In addition, the students must participate in the following activities to be organized in the institute.

- Sports
- NCC/NSS
- Camp – Blood donation
- Cultural Event

Note: Extension Lectures by experts may be organized. There will be no examination for this subject.

FOURTH SEMESTER

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.

LEARNING OUTCOMES

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

- Evaluate physical properties of cement concrete as per IS codes
- Conduct various tests on aggregate in laboratory to evaluate their characteristics
- Interpret the grading charts of different aggregates and evaluate fineness modulus of aggregates
- Evaluate workability and strength of concrete
- Recognise bleeding, segregation, harshness defects in fresh concrete
- Explain hydration process of cement, water to cement (w/s) ratio and analyze relationship between compressive strength and w/c ratio
- Conduct various destructive and non-destructive (NDT) test
- Design mix of concrete as per IS code
- Describe the use of different admixture to enhance the properties of concrete
- Explain the feature of special concretes
- Demonstrate how to carry out various concreting operation

DETAILED CONTENTS

Introduction: Definition of concrete, properties of concrete, uses of concrete in comparison to other building materials. Advantages and disadvantages of concrete. (03 Hours)

2. Ingredients of Concrete: (08 Hours)

2.1 Cement: physical properties of cement; different types of cement as per IS Codes

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: Water Quality requirements as per IS:456-2000

3. Water Cement Ratio: (03 Hours)

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. Properties of Concrete: (11 Hours)

4.1 Properties in plastic state: Workability, Segregation, Bleeding and Harshness

4.1.1 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

4.2 Properties in hardened state: Strength, Durability, Impermeability, Dimensional changes;

5. Concrete Mix Design (10 Hours)

5.1 Objectives of mix design, introduction to various grades as per IS:456-2000; proportioning for nominal mix design as prescribed by IS 456-2000

5.2 Adjustment on site for: Bulking of fine aggregate, water absorption of aggregate, workability

5.3 Difference between nominal and controlled concrete

5.4. Introduction to IS-10262-2009-Code for controlled mix design.

6. Introduction to Admixtures (chemicals and minerals) for improving performance of concrete (03 Hours)

7. Special Concretes (only features) (07Hours)

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

7.1.1 Cold weather concreting

7.1.2 Under water concreting

7.1.3 Hot weather concreting

7.2 Ready mix concrete

7.3 Fibre reinforced concrete

7.4 Polymer Concrete

7.5 Fly ash concrete

7.6 Silica fume concrete

8. Concreting Operations: (16 Hours)

**8.1 Storing of Cement:

8.1.1 Storing of cement in a warehouse

8.1.2 Storing of cement at site

8.1.3 Effect of storage on strength of cement

8.1.4 Determination of warehouse capacity for storage of Cement

**8.2 Storing of Aggregate: Storing of aggregate at site

8.3 Batching (to be shown during site visit)

8.3.1 Batching of Cement

8.3.2 Batching of aggregate by:

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

8.3.2.2 Weight spring balances and batching machines

8.3.3 Measurement of water

** 8.4 Mixing:

8.4.1 Hand mixing

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

8.4.3 Maintenance and care of mixers

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

8.6 Placement of concrete:

Checking of form work, shuttering and precautions to be taken during placement

** 8.7 Compaction:

8.7.1 Hand compaction

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

8.7.3 Selection of suitable vibrators for different situations

8.8 Finishing concrete slabs - screeding, floating and trowelling

8.9 Curing:

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

8.9.2 Duration for curing and removal of form work

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

8.11 Defects in concrete: Identification of defects and methods of removing defects

9. Importance and methods of non-destructive tests (introduction only) (3 Hours)

9.1. Rebound Hammer Test
9.2. Pulse Velocity method

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

PRACTICAL EXERCISES:

1. To determine the physical properties of cement such as fineness, consistency, setting time, soundness and compressive strength of cement as per IS Codes
2. To determine flakiness at elongation Index of coarse aggregate
3. To determine silt content in fine aggregate
4. Determination of specific gravity and water absorption of aggregates
5. Determination of bulk density and voids of aggregates
6. Determination of particle size distribution of fine, coarse and all-in-aggregate by sieve analysis (grading of aggregate)

7. To determine bulking of fine aggregates
8. To determine workability by slump test and to verify the effect of water, fine aggregate/coarse aggregate ratio and aggregate/Cement ratio on slump
9. Compaction factor test for workability

10. Non destructive test on concrete by:
    a) Rebound Hammer Test
    b) Ultrasonic Pulse Velocity Test
11. To determine compressive strength of concrete cubes for different grades of concrete
12. To determine flexural strength of concrete beam

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. The experiments may also be demonstrated to students tPeriodsough video programmes developed in the field of 'concrete technology' by NITTTR, Chandigarh.

MEANS OF ASSESSMENT

- Assignments and quiz/class tests
- Mid-term and end-term written tests
- Laboratory and practical work,
- Report writing
- Viva-Voce

RECOMMENDED BOOKS

1. "Concrete Technology by Krishnamurthy, KT Rao, A Kasundra and Khandekar, AA; Dhanpat Rai and Sons, Delhi
2. "Text Book of Concrete Technology" by Gupta BL and Gupta Amit; Standard Publishers Distributors, Delhi.
3. "Concrete Tecnology" by Handoo, BL, Puri, LD and Mahajan Sanjay; Satya Prakashan, New Delhi.
4. "Laboratory Manual on Concrete Technology" by Sood, Hemant, Mittal LN and Kulkarni PD; CBS Publishers, New Delhi
5. "Concrete Technology" by Birinder Singh; Kaption Publications, Ludhiana,
6. Module on "Special Concretes by Dr. Hemant Sood; NITTTR Chandigarh
7. Video programme on different experiments in 'Concrete Technology' developed by NITTTR, Chandigarh.

8. e-books/e-tools/relevant software to be used as recommended by AICTE/HSBTE/NITTTR.

Websites for Reference:

http://swayam.gov.in

SUGGESTED DISTRIBUTION OF MARKS

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2	08	13
3	03	04
4	11	17
5	10	16
6	03	04
7	07	12
8	16	26
9	03	04
Total	**64**	**100**

4.2 WATER SUPPLY AND WASTE WATER ENGINEERING

L	T	P
4	-	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 supplemented 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.

LEARNING OUTCOMES

After undergoing the subject, students will be able to:

- Calculate the water requirement for a particular population
- Check and improve the quality of water by giving required treatment to water
- Calculate the size of different pipes to carry water
- Lay the network of pipes for water supply as well as sewerage in a building
- Draw the location of different appurtenances
- Carry out the disposal of sewage
- Supervise the water supply and waste water schemes

DETAILED CONTENTS

A. WATER SUPPLY

1. Introduction (02 Hours)

    1.1 Necessity and brief description of water supply system.
    1.2 Sources of water – surface/sub-surface sources

Quantity of Water (06 Hours)

    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 Population Forecasting

3. Quality of Water (03 Hours)

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
3.4 Maintenance of purity of water

4. Water Treatment (brief introduction) (09 Hours)

**4.1 Sedimentation - purpose, types of sedimentation tanks
**4.2 Coagulation/floculation - 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) Areation fountain (ii) mixer (iii) floculator, (iv) classifier, (v) slow and rapid sand filters (vi) chlorination chamber.

5. Conveyance of Water (07 Hours)

**5.1 Different types of pipes - cast iron, PVC, steel, asbestos cement, concrete and lead pipes. Their suitability and uses, types of joints in different types of pipes.
5.2 Appurtenances: Sluice, air, reflux valves, relief valves, scour valves, bib cocks, stop cocks, fire hydrants, water meters their working and uses

6. Laying of Pipes (04 Hours)

6.1 Setting out alignment of pipes
6.2 Excavation for laying of pipes and precautions to be taken
6.3 Handling, lowering and jointing of pipes
6.4 Testing of pipe lines
6.5 Back filling

7. Building Water Supply (02 Hours)

7.1 Connections to water main (practical aspect only)
**7.2 Water supply fittings (with sketches) and terminology related to plumbing

B. WASTE WATER ENGINEERING

8. Introduction (04 Hours)

8.1 Purpose of sanitation
8.2 Necessity of systematic collection and disposal of waste
8.3 Definition of terms in sanitary engineering
8.4 Collection and conveyance of sewage
8.5 Conservancy and water carriage systems, their advantages and Disadvantages
8.6 (a) Surface drains (only sketches) : various types, suitability
(b) Types of sewage: Domestic, industrial, storm water and its seasonal variation

9. Sewerage System (04 Hours)

9.1 Types of sewerage systems, materials for sewers, their sizes and joints
9.2 Appurtenance: Location, function and construction features. Manholes, drop manholes, tank hole, catch basin, inverted siphon, flushing tanks grease and oil traps, storm regulators, ventilating shafts

10. Laying and Construction of Sewers: (05 Hours)

10.1 Setting out/alignment of sewers
10.2 Excavations, checking the gradient with boning rods preparation of bedding, handling and jointing testing and back filling of sewers/pipes.
10.3 Construction of surface drains and different sections required

11 Sewage Characteristics: (03 Hours)

11.1 Properties of sewage and IS standards for analysis of sewage
11.2 Physical, chemical and bacteriological parameters

12. Natural Methods of Sewerage Disposal (04 Hours)

12.1 General composition of sewage and disposal methods
12.2 Disposal by dilution
12.3 Self purification of stream
12.4 Disposal by land treatment
12.5 Nuisance due to disposal

13. Sewage Treatment (08 Hours)

13.1 Meaning and principle of primary and secondary treatment and activated sludge process their flow diagrams
13.2 Introduction and uses of screens, grit chambers, detritus tanks, skimming tanks, plainsedimentation tanks, primary clarifers, secondary clarifers, filters, control beds, intermittent sand filters, trickling filters, sludge treatment and disposal, oxidation ponds (Visit to a sewage treatment plant)

14. Building Drainage (03 Hours)

14.1 Aims of building drainage and its requirements
**14.2 Different sanitary fittings and installations
14.3 Traps

** 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 BOD of given sample
6) To determine residual chlorine in water
7) To determine conductivity of water and total dissolved solids
8) To study the installation of following:
   a) Water meter
   b) Connection of water supply of building with main
   c) Pipe valves and bends
   d) Water supply and sanitary fittings
9) To study and demonstrate the joining/tPeriodseading of GI Pipes, CI Pipes, SWG pipes, PVC pipes and copper pipes.
10) To demonstrate the laying of SWG pipes for sewers
11) Study of water purifying process by visiting a field lab.
12) Demonstration of plumbing tools.

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.

MEANS OF ASSESSMENT

- Assignments and quiz/class tests
- Mid-term and end-term written tests
- Laboratory and practical work,
- Report writing of field visit
- Viva-Voce

RECOMMENDED BOOKS

1. "Elements of Public Health Engineering" by Duggal, KN; S. Chand and Co. New Delhi
2. "Water Supply and Sanitary Engineering" by Rangwala, SC; Charotar Book Stall, Anand
3. "Water Supply Engineering" by Kshirsagar, SR; Roorkee Publishing House, Roorkee
4. "Sewage and Sewage Tratement" by Kshirsagar, SR; Roorkee Publishing House, Roorkee
5. "Water Supply and Sanitary Engineering" by Birdie, GS; Dhanpat Rai and Sons, Delhi
6. "Water Supply Engineering" by Garg, Santosh Kumar; Khanna Publishers, Delhi
7. "Sewage and Waste Water Disposal Engineering" by Garg, Santosh Kumar; Khanna Publishers, Delhi
8 "A Laboratory Manual in Public Health Engineering" by Duggal, Ajay K and Sharma, Sanjay; Galgotia Publications, 2006, New Delhi
9 e-books/e-tools/relevant software to be used as recommended by AICTE/HSBTE/NITTTR.

Websites for Reference:

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9	04	06
10	05	08
11	03	05
12	04	06
13	08	12
14	03	05
Total	**64**	**100**

4.3 IRRIGATION ENGINEERING

L	T	P
3	-	-

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.

LEARNING OUTCOMES

After undergoing the subject, students will be able to:

- Explain concept of necessity of irrigation in India
- Recognise different crops and their water requirements
- Define rainfall and runoff
- Measure rainfall and read rain gauges and hydrographs
- Monitor construction and maintenance work of canal and canal linings
- Monitor installation of tubewells and water harvesting techniques
- Supervise maintenance and construction work of canal head works and cross regulators
- Supervise construction of various river training works
- Carry out desilting operation of canals

DETAILED CONTENTS

THEORY

1. Introduction: (02 Hours)

    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

2. Water Requirement of Crops (04 Hours)

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 commanded area (GCA), culturable commanded area (CCA), Intensity of Irrigation, Irrigable area

3. Hydrological Cycle Catchment Area and Run-off (04 Hours)

Rainfall , definition rain-gauges – automatic and non-automatic, methods of estimating average rainfall (Arithmatic system); catchment area runoff, factors affecting runoff, hydrograph, basic concept of unit hydrograph.

4. Methods of Irrigation (05 Hours)

4.1 Flow irrigation - its advantages and limitations

4.2 Lift Irrigation – Tubewell, submersible and well irrigation advantages and disadvantages

4.3 Sprinkler irrigation conditions favourable and essential requirements for sprinkler irrigation, sprinkler system – classification and component parts

4.4 Drip irrigation, suitability of drip irrigation, layout, component parts, advantages

5. Canals (05 Hours)

5.1 Classification, apurtenancs of a canal and their functions, sketches of different canal cross-sections

5.2 Various types of canal lining - their related advantages and disadvantages, sketches of different lined canal x-sections

5.3 Breaches and their control

5.4 Maintenance of lined and unlined canals

6. Tube Well Irrigation (07 Hours)

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 and methods of determining yield of well

6.3 Types of tube wells and their choice-cavity, strainer and slotted type;

6.4 Method of boring, installation of well assembly, development of well, pump selection and installation and maintenance

6.5 Water Harvesting Techniques: Need and requirement of various methods, Run-off from roof top and ground surface, construction of recharge pits and recharge wells and their maintenance.

7. Dams (05 Hours)

7.1 Classification of dams; earth dams - types, causes of failure; cross-section of zoned earth dam, method of construction, gravity dams – types, cross-sections of a dam, method of construction

7.2 Concept of small and micro dams

7.3 Concept of spillways and energy dissipators

8. Canal Head Works and Regulatory Works (04 Hours)

Definition, object, general layout, functions of different parts of head works. Difference between weir and barrage

9. Cross Drainage Works (04 Hours)

9.1 Functions and necessity of the following types: aqueduct, super passage, level crossing, inlet and outlet

9.2 Sketches of the above cross drainage works

10. Definitions of following Hydraulic Structures with Sketches (02 Hours)

10.1 Falls

10.2 Cross and head regulators

10.3 Outlets

10.4 Canal Escapes

11. River Training Works (03 Hours)

Methods of river training, guide banks, retired (levees) embankments, groynes and spurs, pitched island, cut-off

12. Water Logging and Drainage and Ground Water Re-charge (03 Hours)

12.1 Definition of water logging – its 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

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 and interpret drawings of various irrigation works.

MEANS OF ASSESSMENT

- Assignments and quiz/class tests
- Mid-term and end-term written tests
- Viva-Voce

RECOMMENDED BOOKS

1. Irrigation Engineering and Hydraulics Structures by Garg, Santosh Kumar; Khanna Publishers, Delhi,

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

3 "Irrigation Engineering and Hydraulic Structures" by Saharsabudhe SR

4 BIS Codes

5. Central Ground Water Board and Central Water Commission Guidelines and Reference Books.

6. e-books/e-tools/relevant software to be used as recommended by AICTE/HSBTE/NITTTR.

Websites for Reference:

http://swayam.gov.in

SUGGESTED DISTRIBUTION OF MARKS

Topic No.	Time Allotted (Hours)	Marks Allotted (%)
1	02	05
2	04	08
3	04	08
4	05	10
5	05	10
6	07	15
7	05	10
8	04	08
9	04	08
10	02	04
11	03	08
12	03	06
Total	**48**	**100**

4.4 SURVEYING – II

L	T	P
3	-	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 surverying, 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.

LEARNING OUTCOMES

After undergoing the subject, students will be able to:

- Interpolate contours on a given sheet of paper
- Align a proposed road
- Draw a contour plan of an area
- Calculate earth work for a road from a contour map
- Prolong a line with theodolite
- Conduct closed traversing
- Measure horizontal and vertical angles
- Set out simple circular curve
- Read Total Station, EDM and Auto level

DETAILED CONTENTS

1. Contouring: (08 Hours)

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

2. Theodolite Surveying: (12 Hours)

2.1 concept of transiting, swinging, face left, face right and changing face;
2.2 axes of a theodolite and their relation; temporary adjustments of a transit theodolite; Working of a transit vernier theodolite,
2.3 measurement of horizontal and vertical angles.
2.4 Prolonging a line (forward and backward)
2.5 measurement of bearing of a line;
2.6 traversing by included angles and deflection angle method; traversing by stadia measurement, theodolite triangulation, plotting a traverse;
2.7 concept of coordinate and solution of omitted measurements (one side affected),
2.8 errors in theodolite survey and precautions taken to minimize them; limits of precision in theodolite traversing.
2.9 Height of objects – accessible and non-accessible bases

3. Tacho-metric surveying (08 Hours)

3.1 Tachometry, Instruments to be used in tachometry,
3.2 methods of tachometry, stadia system of tachometry,
3.3 general principles of stadia tachometry, examples of stadia tachometry and Numerical problems.

4. Curves: (15 Hours)

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 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. Introduction to the use of Modern Surveying equipment and techniques such as: (05 Hours)

a) EDM or Distomat
b) Planimeter (Digital)
c) Total station
d) Introduction to remote sensing and GPS
e) Auto level
f) Digital theodolite

NOTE: 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 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, 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

vii) Height of objects with and without accessible bases

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

IV. Minor instruments:

i) Demonstration and use of minor instruments like Ceylon Ghat Tracer, Tangent Clinometer, Pantagraph, Abney level etc.

ii) Use of planimeter for computing areas

V. Demonstration of digital instruments Periodic field visits to Survey of India and other government agencies.

VI. To plot an area with he help of Total Station

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

MEANS OF ASSESSMENT

- Assignments and quiz/class tests
- Mid-term and end-term written tests
- Laboratory and practical work,
- Report writing
- Drawing
- Viva-Voce

RECOMMENDED BOOKS

1. "A Text Book of Surveying" by Kocher, CL; Katson Publishing House Ludhiana,
2. "Surveying and Leveling" by Kanetkar,TP and Kulkarni, SV; AVG Parkashan, Pune
3. "Surveying and Leveling-Vol.2" by Kanetkar, TP and Kulkarni, SV; AVG Prakashan, Pune
4. "Surveying and Leveling " by Punima, BC; Standard Publishers Distributors, Delhi
5. “Surveying-II” by Mahajan, Sanjay; Satya Prakashan, Delhi
6. e-books/e-tools/relevant software to be used as recommended by AICTE/HSBTE/NITTTR.

Websites for Reference:

http://swayam.gov.in

SUGGESTED DISTRIBUTION OF MARKS

Topic No.	Time Allotted (Hours)	Marks Allotted (%)
1	08	17
2	12	27
3	08	15
4	15	31
5	05	10
Total	**48**	**100**

4.5 SOIL MECHANICS AND FOUNDATION 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 and Foundation 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.

LEARNING OUTCOMES

After undergoing the subject, students will be able to:

- Identify and classify various types of soils
- Select particular type of foundation according to loading of structure
- Determine shear strength of soil
- Carry out compaction of soils as per density
- Calculate bearing capacity of soil
- Calculate liquid limit and plastic limit of soil
- Calculate maximum dry density of soil and optimum moisture content of soil
- Perform various tests of the soil

DETAILED CONTENTS

1. Introduction: (03 Hours)

    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 Punjab, dunes and loess, glacial deposits, black cotton soils, 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: (04 Hours)

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, bulk density/bulk unit weight, dry unit weight, saturated unit weight and submerged 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 (04 Hours)

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 cohesionless soils

3.4 Behaviour of cohesive soils with change in water content, 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: (04 Hours)

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) (04 Hours)

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 (04 Hours)

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.

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. Shear Strength of Soil: (09 Hours)

7.1. Concept and Significance of shear strength

7.2 Factors contributing to shear strength of cohesive and cohesion less soils, Coulomb's law

7.3 Determination of shearing strength by direct shear test, unconfined compression test and vane shear test. 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

7.6 Numerical problems

8. Compaction: (4 Hours)

8.1 Definition and necessity of compaction

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:

(8 Hours)

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, resetting, sealing and preservation of samples.

9.4 Presentation of soil investigation results

10 Bearing Capacity of soil

(10 Hours)

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

10.5 Concept of vertical stress distribution in soils due to foundation loads, pressure bulb

10.6 Applications of SPT, unconfined compression test and direct shear test in estimation of bearing capacity

10.7 Plate load test (no procedure details) and its limitations

10.8 Improvement of bearing capacity by sand drain method, compaction, use of geo-synthetics.

11. Foundation Engineering: (10 Hours)

Concept of shallow and deep foundation; types of shallow foundations: combined, isolated, strip, mat, and their suitability. Factors affecting the depth of shallow foundations, deep foundations, type of piles and their suitability; pile classification on the basis of material, pile group and pile cap.

PRACTICAL EXERCISES

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

2. 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

3. Extraction of Disturbed and Undistrubed Samples

   a) Extracting a block sample
   b) Extracting a tube sample
   c) Extracting a disturbed samples for mechanical analysis.
   d) Field identification of samples

4. 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

5. 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

6. 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

7 Laboratory Compaction Tests (Standard Proctor test)

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 and maximum dry density

8. Direct Shear Test

9. Permeability Test

10. Demonstration of Unconfined Compression Test

a) Specimen preparation
b) Conducting the test
c) Plotting the graph
d) Interpretation of results and finding/bearing capacity

11. Demonstration of Vane shear Test

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.

MEANS OF ASSESSMENT

- Assignments and quiz/class tests
- Mid-term and end-term written tests
- Laboratory and Practical work
- Report Writing
- Viva-voce

RECOMMENDED BOOKS

1. "Soil Mechanics and Foundations" by Punmia, BC; Standard Publishers, Delhi
2. "Soil Mechanics and Foundations Engineering" by Bharat Singh and Shamsher Prakash; Nem Chand and Bros, Roorkee,
3. "Soil Sampling and Testing - A Laboratory Manual by Duggal, AK., Ramana, TR.,Krishnamurthy, S; Galgotia Publications, Delhi
4. BIS Codes IS 6403 (latest edition) and IS 1498 (latest edition)
5. "Shallow Foundations" by NITTTR, Chandigarh
6. Video films on Geo-technical Laboratory Practices by Vinod Kumar; NITTTR, Chandigarh
7. e-books/e-tools/relevant software to be used as recommended by AICTE/HSBTE/NITTTR.

Websites for Reference:

http://swayam.gov.in

SUGGESTED DISTRIBUTION OF MARKS

Topic No.	Time Allotted (Hours)	Marks Allotted (%)
1	03	05
2	04	06
3	04	06
4	04	06
5	04	06
6	04	06
7	09	14
8	04	06
9	08	16
10	10	12
11	10	17
Total	**64**	**100**

4.6 WATER SUPPLY & WASTE WATER ENGINEERING AND IRRIGATION ENGINEERING DRAWING

L	T	P
-	-	3

RATIONALE

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

LEARNING OUTCOMES

After undergoing the subject, students will be able to:

- Draw the drawings of traps, manholes and inspection chambers
- Draw the drawing of water supply plan of building
- Draw the sewerage plan of buildings
- Draw the drawing of channel (L-section and cross-section)
- Draw and demonstrate cross-section of an earthen dams
- Draw layout plan of a canal head works
- Read and interpret the Public Health and Irrigation Engineering Drawings

DETAILED CONTENTS

Drawings Exercises

PART A :

WATER SUPPLY AND WASTE WATER ENGINEERING DRAWING

(10 WEEKS)

1. Drains and Sewers

    1.1 Cross section of standard types of open drains (circular, V-shaped and U-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 with soak pit for 5-10 users

4. Bath room and W.C connections:

4.1 Cross-section tPeriodsough the external wall of lavatories at ground and first floor showing the one and two pipe system and the connections of the lavatory to inspection chamber

4.2. Plan of a batPeriodsoom showing positions of lavatory, bath tub, wash-basin, taps and showers

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

6. Practice of reading water supply and sanitary engineering working drawings (PWD/urban Development agencies) including hot water and cold water supply system of a two room set.

PART B

B) IRRIGATION ENGINEERING DRAWING: (06 WEEKS)

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.

Layout plan of a canal head works

Draw the typical L-section of a weir

4. Draw the X-section of an Earthen Dam
   i) Homogeneous
   ii) Zoned type
   iii) DiapPeriodsagm type

Cross section of a tube well

6 Layout and cross section of rain water harvesting system.

Important Note: **i) Use of BIS: 456-2000 is permitted in the examination**
ii) Paper should be set from Part A of 60 marks and Part B of 40 marks

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 for industrial unit at different intervals of time. Reading and interpreting actual field drawings should also be practiced so as to develop necessary competency in the students.

MEANS OF ASSESSMENT

- Assignments and quiz/class tests
- Mid-term and end-term written tests
- Laboratory and practical work
- Drawing
- Viva-Voce

RECOMMENDED BOOKS

1. "Civil Engineering Drawing" by Layal JS ; Satya Parkashan, New Delhi
2. " Civil Engineering Drawings" by Chandel RP
3. " Civil Engineering Drawing by Kumar NS; IPH, New Delhi
4. "Civil Engineering Drawing" by Malik RS and Meo GA ; Asian Publishing House, New Delhi
5. "Civil Engineering Drawing" by S.K. Garg; Khanna Publishers.
6. e-books/e-tools/relevant software to be used as recommended by AICTE/HSBTE/NITTTR.

Websites for Reference:

http://swayam.gov.in

SOFT SKILLS – II

L	T	P
-	-	2

RATIONALE

The present day world requires professionals who are not only well qualified and competent but also possess good communication skills. The diploma students not only need to possess subject related knowledge but also soft skills to get good jobs or to rise steadily at their work place. The objective of this subject is to prepare students for employability in job market.

LEARNING OUTCOMES

After undergoing this course, the students will be able to:

- Develop Communication Skills
- Work in a team
- Learn to resolve conflict by appropriate method
- Identify leadership traits and learn self motivation
- Follow ethics

DETAILED CONTENTS

- Concept of team building, behavior in a team
- Developing Interpersonal Relations- empathy, sympathy
- Communication skills-improving non-verbal communication
- Conflict Management
- Motivation
- Leadership
- Professional Ethics and Values
- Health, Hygiene, Cleanliness and Safety

In addition, the students must participate in the following activities to be organized in the institute

- Sports
- NCC/NSS
- Camp – Environment awareness
- Cultural Event

Note : Extension Lectures by experts may be organized. There will be no examination for this subject.

INDUSTRIAL TRAINING

Industrial training 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.

For this purpose, students at the end of fourth semester need to be sent for industrial training for a minimum of 6 weeks upto 8 weeks duration to be organized during the semester break starting 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 teacher may guide a group of 4-5 students. 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 100 and external assessment of 100 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 behavior, 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. The components of evaluation will include the following.

a)	Punctuality and regularity	15%
b)	Initiative in learning new things	15%
c)	Relationship with workers	15%
d)	Industrial training report	55%

FIFTH SEMESTER

5.1 HIGHWAY ENGINEERING

L	T	P
4	-	2

RATIONALE

Construction of roads is one of the major areas in which diploma holders in Civil Engineering may get very good opportunities for employment. The diploma holders are responsible for construction and maintenance of highways and airports. 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.

LEARNING OUTCOMES

After undergoing the subject, students will be able to:

- classify the roads as per IRC types and geometrics
- explain various components of a flexible/rigid pavement
- select various highway materials and test them for different quality parameters
- supervise construction of a highway in plain areas and hilly areas
- supervise repair and maintenance of roads
- supervise preparation of bituminous mix in the hot mix plants
- describe the use various road construction equipment
- Describe basic terminology of various components of an airport.

DETAILED CONTENTS

1. Introduction (02 Hours)

    1.1 Importance of Highway engineering

    1.2 Functions of IRC, CRRI, MoRT&H, NHAI

    1.3 Classification of roads

2. Road Geometrics (06 Hours)

    2.1 Glossary of terms used in road 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 Average running speed, stopping and overtaking sight distance

2.3 Necessity of curves, horizontal and vertical curves including transition curves. Super elevation and 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 Alignment (04 Hours)

3.1 Basic considerations governing alignment for a road in plain and hilly area

3.2 Highway location, marking of alignment on ground, setting out alignment of road, setting out bench marks, control pegs for embankment and cutting

4. Road Materials (08 Hours)

4.1 Different types of road materials in use; soil, aggregate and binders

4.2 Introduction to California Bearing Ratio, method of finding CBR value and its significance. Aggregate : Source and types, important properties, strength, durability

4.3 Binders: Common binders; bitumen, properties as per BIS specifications, penetration, softening point, ductility and viscosity test of bitumen, procedures and significance, cut back and emulsion and their uses, Bitumen modifiers (CRMB, PMB)

5. Road Pavements (14 Hours)

5.1 Road pavement: Flexible and rigid pavement, their merits and demerits, typical cross-sections, functions of various components

5.2 Sub-grade preparation:
Borrow pits, making profiles of embankment, construction of embankment, compaction, preparation of subgrade, methods of checking camber, gradient and alignment as per recommendations of IRC, equipment used for subgrade preparation.

5.3 Stabilization of subgrade. Types of stabilization mechanical stabilization, lime stabilization, cement stabilization, fly ash stabilization etc.(introduction only)

5.4 Base Course:
Granular base course:

(a) Water Bound Macadam (WBM)
(b) Wet Mix Macadam (WMM)

Bitumen Courses:
(a) Bituminous Macadam
(b) Dense Bituminous Macadam (DBM)

*Methods of construction as per MoRT&H

5.5 Surfacing:
* Types of surfacing

a) Prime coat and tack coat
b) Surface dressing with seal coat
c) Open graded premix carpet
d) Mix seal surfacing
e) Semi dense bituminous concrete
f) Bituminous Concrete

* Methods of constructions as per MORT&H specifications and quality control; equipments used for above.

5.6 Rigid Pavements:

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

6. Hill Roads: (06 Hours)

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

6.2 Special problems of hill areas
6.2.1 Landslides: Causes, prevention and control measures, use of geogrids, geoflexbiles, geo synthetics
6.2.2 Drainage
6.2.3 Soil erosion
6.2.4 Snow: Snow clearance, snow avalanches, frost
6.2.5 Land Subsidence

7. Road Drainage: (04 Hours)

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: (06 Hours)

8.1 Common types of road failures of flexible pavements: Pot hole, cracks, rutting, alligator, cracking, upheaval - their causes and remedies (brief description)

8.2 Maintenance of bituminous road such as crack sealing, patch-work and resurfacing.

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

9. Road Construction Equipment: (08 Hours)

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

9.5 Paver finisher

10 Airport Engineering :- (06 Hours)

10.1 Necessity of study of airport engineering, aviation transport scenario in India.
10.2 Factors to be considered while selecting a site for an airport with respect to zoning laws.
10.3 Introduction to Runways, Taxiways, Apron and Hanger

* An expert may be invited from field/industry for extension lecture on this topic.

PRACTICAL EXERCISES

1. Determination of penetration value of bitumen
2. Determination of softening point of bitumen

3. Determination of ductility of bitumen
4. Determination of impact value of the road aggregate
5. Determination of abrasion value (Los Angeles') of road aggregate
6. Determination of crushing strength of aggregate
7. Determination of flakiness and elongation index of aggregate
8. Determination of the California bearing ratio (CBR) for the sub-grade soil
9. Demonstration of working of hot mix plant through a field visit
10. Visit to highway construction site for demonstration of operation of: Tipper, tractors (wheel and crawler), scraper, bulldozer, dumpers, shovels, grader, roller, dragline, road pavers, JCB
11. Demonstration of working of mixing and spraying equipment through a field visit

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.

MEANS OF ASSESSMENT

- Assignments and quiz/class tests
- Mid-term and end-term written tests
- Laboratory and practical work
- Report Writing
- Viva-voce

RECOMMENDED BOOKS

1. "Highway Engineering" by Khanna, SK and Justo, CEG; Nem Chand and Bros., Roorkee
2. "A Text Book on Highway Engineering and Airport" by Sehgal, SB; and Bhanot, KL; S Chand and Co, Delhi
3. "A Course on Highway Engineering" by Bindra, SP; Dhanpat Rai and Sons, New Delhi
4. "Laboratory Manual in Highway Engineering" by Duggal AK, Puri VP; New Age Publishers (P) Ltd, Delhi,
5. "Laboratory Manual in Highway Engineering", by NITTTR, Chandigarh
6. "Maintenance of Highway – a Reader by Duggal AK; NITTTR, Chandigarh
7. "Types of Highway Construction" by Duggal AK; NITTTR Chandigarh
8. e-books/e-tools/relevant software to be used as recommended by AICTE/HSBTE/NITTTR.

Websites for Reference:

http://swayam.gov.in

IRC Publications

i) MoRTH Specifications for Road and Bridge Works (Fifth Revision)
ii) MoRTH Pocket book for Highway Engineers, 2001
iii) MoRTH Manual for Maintenance of Roads, 1983

SUGGESTED DISTRIBUTION OF MARKS

Topic No.	Time Allotted (Hours)	Marks Allotted (%)
1	02	03
2	06	10
3	04	06
4	08	12
5	14	22
6	06	10
7	04	06
8	06	10
9	08	12
10	06	10
Total	**64**	**100**

5.2 REINFORCED CEMENT CONCRETE DESIGN AND DRAWINGS

L	T	P
5	-	3

RATIONALE

This subject is an applied engineering subject. Diploma holders in Civil Engineering will be required to supervise RC Construction and fabrication. He may also be required to design simple structural elements, make changes in design depending upon availability of materials (bars of different diameters). This subject thus deals with elementary design principles as per IS:456-2000 and Thus one should be able to read and interpret drawings of RC structures. The competence to read and interpret structural drawings is best learnt by being able to draw these drawings. Hence there is a need to have a subject devoted to preparation of structural drawings.

LEARNING OUTCOMES

After undergoing the subject, students will be able to:

- Explain methods of RCC design i.e.
  - Working stress methods
  - Limit state methods
- Design singly, doubly reinforced rectangular and T&L beams as per IS Code
- Design one way and two way slab
- Design axially loaded column and their isolated footing
- Draw the reinforcement details for various structural elements from the given data
- Calculate reinforcement details from the given drawings
- Draw bar bending schedule from drawing
- Read and interpret R.C.C. drawings

DETAILED CONTENTS

1. Introduction (02 Hours)

   1.1 Concept of Reinforced Cement Concrete (RCC)
   1.2 Reinforcement Materials:
   - Suitability of steel as reinforcing material
   - Properties of mild steel and HYSD steel
   1.3. Loading on structures as per IS: 875

2. Introduction to following methods of RCC design (02 Hours)

2.1 Working stress method: Definition and basic assumptions
2.2 Limit state method: Definition and basic assumptions

3. Shear and Development Length (05 Hours)

Shear as per IS:456-2000 by working stress method
i) Shear strength of concrete without shear reinforcement
ii) Maximum shear stress
iii) Shear reinforcement

4. Concept of Limit State Method (07 Hours)

4.1. Definitions and assumptions made in limit state of collapse (flexure)
4.2. Partial factor of safety for materials
4.3. Partial factor of safetyfor loads
4.4. Design loads
4.5. Stress block, parameters

5. Singly Reinforced beam (11Hours)

Theory and design of singly reinforced beam by Limit State Method

6. Doubly Reinforced Beams (11 Hours)

Theory and design of simply supported doubly reinforced rectangular beam by Limit State Method

7. Behaviour of T beam, inverted T beam, isolated T beam and 'L' beams (No Numericals) (05 Hours)

8. One Way Slab (12 Hours)

Theory and design of simply supported one way slab including sketches showing reinforcement details (plan and section) by Limit State Method..

9. Two Way Slab (12 Hours)

Theory and design of two-way simply supported slab with corners free to lift, no provisions for torsional reinforcement by Limit State Method including sketches showing reinforcement details (plan and two sections)

10. Axially Loaded Column (10 Hours)

10.1 Definition and classification of columns

10.2. Effective length of column,

10.3. Specifications for longitudinal and lateral reinforcement

10.4. Design of axially loaded square, rectangular and circular short columns by Limit State Method including sketching of reinforcement(sectional elevation and plan)

11 Pre-stressed Concrete (03 Hours)

11.1 Concept of pre-stressed concrete
11.2 Methods of pre-stressing : pre-tensioning and post-tensioning
11.3 Advantages and disadvantages of pre-stressing
11.4 Losses in pre-stress

DETAILED CONTENTS

1. RCC Drawing:

Reinforcement details from the given data for the following structural elements with bar bending schedules

(i) Drawing No. 1: RC Slabs - One way slab, Two way slab and Cantilever Slab.

(ii) Drawing No.2 : Beams - Singly and doubly reinforced rectangular beams and Cantilever beam (All beams with vertical stirrups)

(iii) Drawing No.3 : Columns and Footings – Square, Rectangular and Circular Columns with lateral ties and their isolated sloped column footings.

(iv) Drawing No. 4 : Portal Frame – Three bay two storey RC portal frame with blow up of column beam junctions.

(v) Drawing No. 5 : Draw atleast one sheet using AutoCAD software

Important Note: Use of BIS:456-2000 is permitted in the examination.

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. Commentary on BIS:456 may be referred along with code for relevant clauses.

MEANS OF ASSESSMENT

- Assignments and quiz/class tests

- Mid-term and end-term written tests
- Laboratory and practical work
- Software installation and operation
- Drawing
- Viva-Voce

RECOMMENDED BOOKS

1. "Reinforced Concrete Structure Vol I" by Punmia, BC; Standard Publishers, Delhi
2. "Design and Testing of Reinforced Structures" by Ramamurtham, S; Dhanpat Rai and Sons, Delhi
3. "RCC Design and Drawing" by Singh, Birinder ; Kaption Publishing House, New Delhi
4 e-books/e-tools/relevant software to be used as recommended by AICTE/HSBTE/NITTTR.

RCC DRAWING:

7. "Civil Engineering Drawing" by Layal JS; Satya Parkashan, New Delhi
8. "Civil Engineering Drawing by Kumar NS; IPH, New Delhi
9. "RCC Design and Drawing" by Singh, Birinder; Kaption Publishing House, New Delhi.
4. "Steel Structures Design and Drawing by Singh, Birinder; Kaption Publishing House, New Delhi
5. e-books/e-tools/relevant software to be used as recommended by AICTE/HSBTE/NITTTR.

Websites for Reference:

http://swayam.gov.in

SUGGESTED DISTRIBUTION OF MARKS

Topic No.	Time Allotted (Periods)	Marks Allotted (%)
1	02	03
2	02	04
3	05	06
4	07	09
5	11	14

6	11	14
7	05	06
8	12	15
9	12	15
10	10	09
11	03	04
	RCC Drawing*	50
Total	**80**	**150**

* Examiner have to set 03 questions from RCC Drawing of 25 marks each and out of which the examinee can attempt any 02 questions.

5.3 SURVEY CAMP

10 Days Duration

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 to the students to develop team spirit
f. To train the students for self management

LEARNING OUTCOME

After undergoing the survey camp, students will be able to:

- Interpret the contours
- Work in a teamwork
- Mark a road alignment of a given gradient connecting any two stations on the map
- Calculate the earth work
- Prepare a topographical plan of a given area

Task:

Preparation of topographical plan of a given area. The survey camp will be organized for a duration of 10 days time span.

The students may be assigned an undulated area of about 1.5 to 2.00 sq.km. with level difference of 15m consisting of good number of physical features such as buildings, roads, bridges, culverts, railway tracks, electric lines etc. They are required to prepare the topographic map of above areas showing various features along with contours using a suitable contour intervals. They will mark a road alignment of given gradient connecting any two stations on the map consisting some horizontal and vertical curves and will prepare estimate of earthwork and submit the detailed technical report indicating therein practical difficulties faced during surveying for the features like ridge, line, valley lines, saddle cliffs etc.

The students should be divided in the groups consisting of 10-15 in numbers. They are required to submit the Report of work done, during survey camp, which will be dully examined, while awarding the internal assessment.

MEANS OF ASSESSMENT

- Practical work
- Report Writing
- Presentation
- Drawing
- Viva-voce

5.4 COMPUTER APPLICATIONS IN CIVIL ENGINEERING

L	T	P
-	-	6

RATIONALE

Computer applications play a very vital role in present day life, more so, in the professional life of engineer. In order to enable the students use the computers effectively in problem solving, this course offers applications of various computer software's in Civil Engineering.

LEARNING OUTCOMES

After undergoing the subject, students will be able to:

- Draw 2D drawings on AutoCAD viz. plan, section and elevation of a residential building
- Use various Civil Engineering software

DETAILED CONTENTS

PRACTICAL EXERCISES

1. Introduction and use of AutoCAD for making 2D Drawings and develop plan, section and elevation of a residential building

2. Demonstration of various Civil Engineering softwares like STAAD-Pro, Revit or Primavera Project Planner, Auto CIVIL & Mx Road, Build Superfast, BIM, ArcGIS or any other equivalent software

Note:

i) Polytechnics may use any other software available with them for performing these exercises

ii) If the above softwares are not available in the institution, demonstration of the above said software should be arranged outside the institute.

MEANS OF ASSESSMENT

- Assignments and quiz/class tests
- Mid-term and end-term written tests
- Laboratory and practical work
- Software installation and operation
- Report Writing
- Drawing
- Viva-voce

5.5 RAILWAYS, BRIDGES AND TUNNELS

L	T	P
5	-	-

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

LEARNING OUTCOMES

After undergoing the subject, students will be able to:

- Describe different component parts of permanent way such as rails, sleepers and ballest
- Distinguish different types of rail gauges used in India
- Use of different types of rail fastenings and fixtures
- Classify bridges and select suitable type of bridge for a particular purpose
- Describe essential components of a ROB and RUB
- Supervise construction of a tunnel
- Carry out ventilation, drainage and lightening of tunnels

DETAILED CONTENTS

PART – I: RAILWAYS (35 Hours)

1. Introduction to Indian Railways

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

3 Classification of permanent way describing its component parts

4 Rail Gauge: Definition, types, practice in India

5 Rails – types of rails

6 Rail Fastenings: Rail joints, types of rail joints, fastenings for rails, fish plates, bearing plates

7 Sleepers: Functions of sleepers, types of sleepers, requirements of an ideal material for sleepers.

8 Ballast: Function of ballast, requirements of an ideal material for ballast

9 Crossings and signalling: Brief description regarding different types of crossings/ signalling

10 Maintenance of track: Necessity, maintenance of track, inspection of soil, track and fixtures; maintenance and boxing of ballast maintenance gauges, tools

11 Earth work and drainage: Features of rail road, bed level, width of formation, side slopes, drains, methods of construction, requirement of drainage system

12 Station and yards: purpose and types of stations and yards

PART-II: BRIDGES (35 Hours)

13. Introduction

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

14. Classification of Bridges

Their structural elements and suitability:

14.1 According to life-permanent and temporary

14.2 According to deck level – Deck, through and semi-through

14.3 According to material –timber, masonry, steel, RCC, pre-stressed

14.4 According to structural form;

- Grade Seperators-Railway Road Over Bridges (ROB), Road Under Bridge (RUB)
- Beam type –RCC, T-Beam, steel girder bridges, plate girder and box girder, balanced cantilever, Trussed bridges.
- Arch type – open spandrel and filled spandrel barrel and rib type
- Suspension type – unstiffened and stiffened and table (its description with sketches)
- According to the position of highest flood level submersible and non submersible

14.5 IRC classification

14.6 Concept of Railway ROB and RUB – Precast components of ROB, drainage problems and solutions of RUB

15. Bridge Foundations: Introduction to open foundation, pile foundation, well foundation

16. Piers, Abutments and Wingwalls

16.1 Piers-definition, parts; types –solid (masonry and RCC), open

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

17. Bridge bearings

Purpose of bearings; types of bearings – fixed plate, rocker and roller, Elastomaric bearings.

18. Maintenance of Bridges

18.1 Inspection of bridges

18.2 Routine maintenance

PART - III: TUNNELS (10 **Hours**)

19. Definition and necessity of tunnels

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

21. Ventilation –necessity and methods of ventilation, by blowing, exhaust and combination of blowing and exhaust

22. Drainage method of draining water in tunnels

23. Lighting of tunnels

Notes: i) Field visits may be organized to Bridge construction site or a Bridge/Tunnel construction site/Railways tracks to explain the various components and a field visit report shall be prepared by the students, as teamwork

ii) Examiners should set questions from all the parts

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 construction of railway track, bridges and tunnel.

MEANS OF ASSESSMENT

- Assignments and quiz/class tests
- Mid-term and end-term written tests
- Viva-voce

RECOMMENDED BOOKS

1. "Railway Engineering" by Vaswani, NK; Publishing House, Roorkee
2. "Railway Engineering" by Rangwala, SC; Anand, Charotar Book Stall
3. "A Text Book of Railway Engineering" by Deshpande, R; Poonam United Book Corporation
4. "Bridge Engineering" by Algia, JS; Charotar Book Stall, Anand
5. "Essentials of Bridge Engineering" by Victor Johnson; Oxford and IBH, Delhi
6. "Bridge Engineering" by Rangwala S.C; Charotar Book Stall, Anand
7. IRC Bridge Codes
8. MoRTH drawings for various types of bridges
9. MoRTH pocket books for bridge Engineers, 2000 (First Revision)
10. "Tunnel Engineering" by Subhash C Saxena; Dhanpat Rai and Sons, Delhi
11. e-books/e-tools/relevant software to be used as recommended by AICTE/HSBTE/NITTTR.

Websites for Reference:

http://swayam.gov.in

SUGGESTED DISTRIBUTION OF MARKS

Topic No.	Time Allotted (Periods)	Marks Allotted (%)
1	35	44
2	35	44
3	10	12
Total	**80**	**100**

5.6 PLUMBING SERVICES

L	T	P
3	-	2

RATIONALE

Plumbing is said to be the system of pipes, tanks, fittings, and other apparatus required for water supply, heating, and sanitation in a building. Plumbers install, repair, and maintain piping systems in residential, commercial and industrial buildings. These systems traditionally included water distribution and wastewater disposal, but because of new technology that combines water and gas pipes, plumbers can work with vent, residential fire, irrigation, and chemical systems as well. The duties of a plumber include: installing, repairing and maintaining pipes, fixtures, and other plumbing equipment; opening walls and floors to accommodate pipes and pipe fittings; welding, connecting, and testing pipes for leaks; preparing cost estimates; interpreting blueprints and designs. Plumbers must also be aware of safety procedures and follow them at all times.

Diploma holders in Civil Engineering who normally work in supervisory positions, must not only be well versed with plumbing procedures, processes, equipment, safety requirements etc. but also be able to demonstrate all practical aspects of plumbing to as to effectively lead team of plumbers and ensure execution of quality work and excellent end results.

This subject is therefore, aimed at instilling theoretical and practical knowledge among students studying civil engineering at diploma level.

LEARNING OUTCOMES

After undergoing this course, the students will be able to:

- Identify and select proper tools and use them for the given plumbing work
- Select appropriate pipes and carry out pipe fitting after carrying out operations like cutting, bending, threading, joining, aligning and other necessary operations
- Erect simple water supply system. Trace leakage and repair water supply system
- Plan, prepare and inspect domestic drainage system
- Select and install sanitary appliances
- Install heating appliances like geyser, etc.

DETAILED CONTENTS

1. **Plumber's Tools** (05 Hours)
   Selection, use and care of tools required for plumbing work, such as threading die, bit brace, ratchet brace, pipe wrench, spanner set, pipe cutter, pipe vice, hacksaw, chisel, files and other common hand tools, bench drilling machine, soldering iron

2. **Pipes and Pipe Fitting** (10 Hours)
   Selection and use of different pipes like GI Pipes, Plastic pipes, PVC pipes, HDPE pipes, Cast iron pipes, Plumbing symbols; Bends, Elbows, Sockets, Tees, Unions, Pipe cutting, Pipe bending, Pipe Threading, Pipe joints, Pipe fitting, Alignment of pipes, Branching of pipes, Safety precautions
3. **Water Supply System** (09 Hours)
   Sources of water; Rainwater harvesting; Water supply systems in a town; Water distribution systems; Distribution reservoirs; Pumps; Valves; Fire hydrants; Storage of water in buildings; Types of tanks; Laying water supply pipe lines

4. **Domestic Drainage** (10 Hours)
   Drainage system (two pipe, one pipe, single stack and other systems), Trap, Cesspool, Sceptic tank, Cleaning blocked pipes and drains, Laying sanitary and sewer pipes, Manholes, Inspection and testing (pressure & leakage test, testing straightness of pipes, ball test etc.); Fixing accessories, Problems in drainage and their solution

5. **Sanitary Appliances** (08 Hours)
   Flush toilet, Squat toilet, Wash basin, Sink, Floor traps, Urinal, Bathtub, Shower, Bidet, Mixing tap, Popup waste

6. **Heating System** (06 Hours)
   Heat transfer, Water heater, Geyser, Domestic hot water supply system, Central heating, Solar water heater

LIST OF PRACTCALS

1. Carry out simple job requiring cutting mild steel plate, filing, drilling and tapping holes etc.
2. Practice cutting, threading and bending of metal pipes; cutting and shaping of PVC pipes
3. Carry out simple pipe connections requiring use of bends, tees, elbows etc.
4. Erect simple water supply system
5. Test drainage lines by using different testing methods
6. Practice fixing of different valves
7. Install sanitary fittings like washbasin, Sink, Floor traps, Urinal, Bathtub and heating appliance like geyser

INSTRUCTIONAL STRATEGY

During instructions, teacher should explain the use of various plumbing tools and demonstrate how to handle them properly. Liberal use of audio-visual aids may be made. Students may be asked to prepare models of different piping systems. Visit may be arranged for students to see how town water supply is arranged and managed. Detailed explanation with the help of actual sanitary appliances may be given about their use and method of installing them.

MEANS OF ASSESSMENT

- Assignments and quiz/class tests
- Mid-term and end-term written tests
- Laboratory and Practical work
- Drawing
- Report Writing
- Viva-voce

RECOMMENDED BOOKS

- Plumber by G. S. Sethi; Computech Publications Ltd, New Delhi (Available in English and Hindi)
- e-books/e-tools/relevant software to be used as recommended by AICTE/HSBTE/NITTTR.

Websites for Reference:

http://swayam.gov.in

SUGGESTED DISTRIBUTION OF MARKS

Topic No.	Time Allotted (Hours)	Marks Allotted (%)
1	05	10
2	10	21
3	09	19
4	10	21
5	08	17
6	06	12
Total	**48**	**100**

ELECTIVE
5.7.1 PRE- STRESSED CONCRETE

L	T	P
3	-	-

RATIONALE

This is an applied technology subject. In this subject, knowledge regarding precast and pre stressed concreting operations and piles has been given.

LEARNING OUTCOME

After undergoing the subject, student will be able to:

- Supervise prestressed concrete construction
- Use various methods of pile driving

DETAILED CONTENTS

1. Precast and Prestressed Concrete Construction (32 Hours)

    1.1 Introduction of prestressed concrete, general theory. Linear post tensioning – general, post tensioning advantages to the design engineer and the contractor

    1.2 Linear post tensioning system, high strength post tensioned stands, parallel lay wire, high strength alloy steel bars

    1.3 Techniques of post tensioning – general, special requirements for forming and false work, ducts or tendons, concreting, stressing procedure, grouting, protecting anchorage from corrosion

    1.4 Pretensioning - general, pretensioning yards set up, forms for pretensioned structural elements, special techniques of pretensioning

    1.5 Materials of prestressing – cement, aggregates concrete, admixtures, vibration, curing, light weight aggregates, high strength steel bars, high strength stand, stress relaxation, galvanization. Codes specifications and inspection, manufacturers of prestressing equipment, specifications, sizes and costs

2. Piles (16 hours)

    Piles; basic piling methods for various types of piles, methods of pile driving, non – displacement piles, problems in pile construction, pile testing

INSTRUCTIONAL STRATEGY

The subject shall consist of visits by the students to various construction sites. They shall also contact the representatives of the manufacturers of various construction equipment and collect information from practical demonstration, discussions and technical information received from the firms.

MEANS OF ASSESSMENT

- Assignments and quiz/class tests
- Mid-term and end-term written tests
- Viva-voce

RECOMMENDED BOOKS

1. "A Text Book of Building Construction" by Gupta, Sushil Kumar, Singla, DR. and Juneja BM; Katson Publishing House, Ludhiana
2. "A Text Book of Building Construction'' by Deshpande, RS and Vartak, GV; United Book Corporation, Poona.
3. "A Text Book of Building Construction" by Kulkarni, GJ; Ahmedabad Book Depot.
4. "A Text Book of Building Construction" by Arora, SP and Bindra, SP; Dhanpat Rai and Son, Delhi.
5. "A Text Book of Building Construction" by Sharma, SK and Kaul, BK; S. Chand and Corporation, Delhi
6. "Building Construction" by Sushil Kumar; Standard Publishers Distributors.Delhi.
7. e-books/e-tools/relevant software to be used as recommended by AICTE/HSBTE/NITTTR.

Websites for Reference:

http://swayam.gov.in

SUGGESTED DISTRIBUTION OF MARKS

Topic No.	Time Allotted (Periods)	Marks Allotted (%)
1	32	65
2	16	35
Total	**48**	**100**

ELECTIVE

5.7.2 REPAIR AND MAINTENANCE OF BUILDINGS

L	T	P
3	-	-

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 in proper perspective has arisen making students aware of importance of maintenance of buildings.

LEARNING OUTCOMES

After undergoing the subject, students will be able to:

- State various factors causing deterioration to buildings
- Investigate/diagnose various defects in buildings
- Explain main causes of defects in buildings
- Select the materials for repair and maintenance of buildings
- Carry out repairs for various types of building defects

DETAILED CONTENTS

1. Need for Maintenance (06 Hours)

    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) (06 Hours)

    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, stones

3. Investigation and Diagnosis of Defects (06 Hours)

3.1 Systematic approach/procedure of investigation

3.2 Sequence of detailed steps for diagnosis of building defects/problems

3.3 List non-destructive and others tests on structural elements and materials to evaluate the condition of the building and study of three most commonly used tests

4. Defects and their root causes (06 Hours)

4.1 Define defects in buildings

4.2 Classification of defects

4.3 Main causes of building defects in various building elements
- 4.3.1 Foundations, basements and DPC
- 4.3.2 Walls
- 4.3.3 Column and Beams
- 4.3.4 Roof and Terraces
- 4.3.5 Joinery
- 4.3.6 Decorative and protective finishes
- 4.3.7 Services
- 4.3.8 Defects caused by dampness

5. Materials for Repair, maintenance and protection (06 Hours)

5.1 Compatibility aspects of repair materials

5.2 State application of following materials in repairs:
- 5.2.1 Anti corrosion coatings
- 5.2.2 Adhesives/bonding aids
- 5.2.3 Repair mortars
- 5.2.4 Curing compounds
- 5.2.5 Joints sealants
- 5.2.6 Waterproofing systems for roofs
- 5.2.7 Protective coatings

6. Remedial Measures for Building Defects (18 Hours)

6.1 Preventive maintenance considerations

6.2 Surface preparation techniques for repair

6.3 Crack repair methods
- 6.3.1 Epoxy injection
- 6.3.2 Grooving and sealing
- 6.3.3 Stitching
- 6.3.4 Adding reinforcement and grouting
- 6.3.5 Flexible sealing by sealant

6.4 Repair of surface defects of concrete
- 6.4.1 Bug holes
- 6.4.2 Form tie holes
- 6.4.3 Honey comb and larger voids

6.5 Repair of corrosion in RCC elements
- 6.5.1 Steps in repairing
- 6.5.2 Prevention of corrosion in reinforcement

6.6 Material placement techniques with sketches
- 6.6.1 Pneumatically applied (The gunite techniques)
- 6.6.2 Open top placement
- 6.6.3 Pouring from the top to repair bottom face
- 6.6.4 Birds mouth
- 6.6.5 Dry packing
- 6.6.6 Form and pump
- 6.6.7 Preplaced – aggregate concrete
- 6.6.8 Trowel applied method

6.7 Repair of DPC against Rising Dampness
- 6.7.1 Physical methods
- 6.7.2 Electrical methods
- 6.7.3 Chemical methods

6.8 Repair of walls
- 6.8.1 Repair of mortar joints against leakage
- 6.8.2 Efflorescence removal

6.9 Waterproofing of wet areas and roofs
- 6.9.1 Water proofing of wet areas
- 6.9.2 Water proofing of flat RCC roofs
- 6.9.3 Various water proofing systems and their characteristics

6.10 Repair of joints in buildings
- 6.10.1 Types of sealing joints with different types of sealants
- 6.10.2 Techniques for repair of joints
- 6.10.3 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. The students will also prepare a project report based upon the available water proofing materials, sealant, special concrete for repair and adhesives and other repair material available in the market.

MEANS OF ASSESSMENT

- Assignments and quiz/class tests
- Mid-term and end-term written tests
- Report Writing
- Viva-voce

RECOMMENDED BOOKS

1. "Building Defects and Maintenance Management" by Gahlot P.S. and Sanjay Sharma; CBS Publishers, New Delhi

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

3. "Building Failures - Diagnosis and Avoidance" by Ransom; WH Publishing

4 e-books/e-tools/relevant software to be used as recommended by AICTE/HSBTE/NITTTR.

Websites for Reference:

http://swayam.gov.in

SUGGESTED DISTRIBUTION OF MARKS

Topic No.	Time Allotted (Hours)	Marks Allotted (%)
1	06	13
2	06	13
3	06	13
4	06	13
5	06	13
6	18	35
Total	**48**	**100**

SOFT SKILLS – III

L	T	P
-	-	2

RATIONALE

The present day world requires professionals who are not only well qualified and competent but also possess good communication skills. The diploma students not only need to possess subject related knowledge but also soft skills to get good jobs or to rise steadily at their work place. The objective of this subject is to prepare students for employability in job market.

LEARNING OUTCOMES

After undergoing this course, the students will be able to:

- Develop communication skills.
- Learn how to speak without fear and get rid of hesitation
- Use effective presentation techniques
- Understand entrepreneurial traits
- Exhibit attitudinal changes

DETAILED CONTENTS

- Communication Skills – Handling fear and phobia
- Resume Writing
- Applying for job through email/job portal
- Interview preparation : Mock Interview, Group Discussions and Extempore
- Presentation Techniques
- Developing attitude towards safety. Disaster management.

In addition, the students must participate in the following activities to be organized in the institute

- Sports
- NCC/NSS
- Camp – Entrepreneurial awareness
- Cultural Event

Note : Extension Lectures by experts may be organized. There will be no examination for this subject.

SIXTH SEMESTER

6.1 STEEL STRUCTURES DESIGN AND DRAWING

L	T	P
4	-	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. This subject thus deals with elementary design principles as per BIS code of practice IS: 800. Thus one should be able to read and interpret structural drawings of steel structures. The competence to read and interpret structural drawings is best learnt by being able to draw these drawings. Hence there is a need to have a subject devoted to preparation of structural drawings.

LEARNING OUTCOMES

After undergoing the subject, students will be able to:

- Explain structural properties of steel and its designation as per Indian Standards
- Select different types of bolted and welded joints
- Analyze and design single and double angle section struts and I section compression members
- Explain different types of trusses, their different components and usability
- Analyze and design of simply supported steel beams
- Select various types of plate girders
- Supervise fabrication and erection of steel structure like trusses, columns and girders
- Read and interpret steel structural drawing
- Prepare the detailed drawings of toe joint, ridge joint, details of purlins and roof sheets
- Prepare and draw slab base connection, gusseted base connection grillage base connection for single section steel columns
- Draw column beam connections
- Prepare drawings of plate girder from given design data
- Prepare the drawing and demonstrate steel roof truss
- Draw the structural drawing sheets using CAD Software

DETAILED CONTENTS

1. Structural Steel and Sections: (02 Hours)

    1.1 Properties of structural steel as per IS Code
    1.2 Designation of structural steel sections as per IS handbook and IS:800

2. Riveted Connections (04 Hours)

Types of Rivet, Permissible stresses in rivets, types of riveted joints, specifications as per IS800, Failure of riveted joint, strength and efficiency of riveted joint, Design of Riveted Connection only axially loaded number (No staggered rivetting)

3. Bolt Connections: (04 Hours)

Types of bolt, permissible stresses in bolt, types of bolted joints, specifications for bolted joints as per IS 800. Failure of a bolted joint. Assumptions in the theory of bolted joints. Strength and efficiency of a bolted joint. Design of bolted joints for axially loaded members (No Staggered bolts).

4. Welded connections: (04 Hours)

Types of welds and welded joints, advantages and disadvantages of welded joints design of fillet and butt weld for axially loaded members

5. Tension Members (14 Hours)

Analysis and design of single and double section tension members and their rivetted and welded connections with gusset plate as per IS:800-2007

6. Compression Members (14 Hours)

Analysis and design of single and double angle sections compression members subjected to axial load

7. Roof Trusses (05 Hours)

Form of trusses, pitch of roof truss, spacing of trusses, spacing of purlins, connection between purlin and roof covering. Connection between purlin and principal rafter (no design, only concept)

8. Column Bases: (07 Hours)

Types of column bases i.e. slab base, gusseted base.Concept of buckling, effective length, slenderness ratio, Analysis and Design of axially loaded single section column.

9. Beams (08 Hours)

Analysis and design of single section simply supported laterally restrained steel beams. Introduction to plate girder and functions of various elements of a plate girder

10. Fabrication and erection of steel structures like trusses, columns and girders

(02 Hours)

Steel Structures Drawings:

Structural drawing from given data for following steel structural elements.

(i) Drawing No. 1: Roof Truss – Drawing of Fink Roof Truss with details of joints, fixing details of purlins and roof sheets.

(ii) Drawing No.2 : Column and Column Bases - Drawing of splicing of steel columns. Drawings of slab base, gusseted base and grillage base for single section steel columns.

(iii) Drawing No.3 : Column Beam Connections

(a) Sealed and Framed Beam to Beam Connections
(b) Sealed and Framed Beam o Column Connections

(iv) Drawing No. 4 : Plate Girder (Bolted)

Plan and Elevation of Plate Girder with details at supports and connection of stiffness, flange angles and cover plate with web highlighting curtailment of plates.

(v) Drawing No. 5 : Draw atleast one sheet using CAD software

Important Note:

Use of IS: 800 and Steel Tables are permitted in examination.

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. IS:800 may be referred along with code for relevant clauses

MEANS OF ASSESSMENT

- Assignments and quiz/class tests
- Mid-term and end-term written tests
- Laboratory and Practical work
- Drawing
- Software installation and operation
- Viva-voce
-

RECOMMENDED BOOKS

1. "Design of Steel Structures" by Duggal SK; Standard Publishers, Delhi
2. "Steel Structures Design and Drawing" by Birinder Singh; Kaption Publishing House, Ludhiana
3. "Design of Steel Structures" by Ram Chandra; Standard Publishers,Delhi
4. "Design of Steel Structures" by S Ramamurthan
5 e-books/e-tools/relevant software to be used as recommended by AICTE/HSBTE/NITTTR.

Steel Structures Drawings:

10. "Civil Engineering Drawing" by Layal JS; Satya Parkashan, New Delhi
11. " Civil Engineering Drawings" by Chandel RP
12. " Civil Engineering Drawing by Kumar; NS; IPH, New Delhi
13. "Civil Engineering Drawing" by Malik RS and Meo GA; Asian Publishing House, New Delhi
5. "Steel Structures Design and Drawing" by Singh, Birinder; Kaption Publishing House, New Delhi

6 e-books/e-tools/relevant software to be used as recommended by AICTE/HSBTE/NITTTR.

Websites for Reference:

http://swayam.gov.in

SUGGESTED DISTRIBUTION OF MARKS

Topic No.	Time Allotted (Hours)	Marks Allotted (%)
1	02	03
2	04	06
3	04	06
4	04	06
5	14	22
6	14	22
7	05	08
8	07	10
9	08	14
10	02	03
	SS Drawing*	50
Total	**64**	**150**

* Examiner have to set 03 questions from SS Drawing of 25 marks each and out of which the examinee can attempt any 02 questions.

6.2 EARTHQUAKE RESISTANT BUILDING CONSTRUCTION

L	T	P
3	-	-

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

LEARNING OUTCOMES

After undergoing the subject, students will be able to:

- Classify the earthquakes
- Explain seismic behavior of traditionally built constructions
- Supervise construction of earthquake resistant buildings
- Monitor reinforcement detailing in earthquake resistant structures
- Manage all rescue operation caused due to earthquake

DETAILED CONTENTS

1. Elements of Engineering Seismology (08 Hours)

General features of tectonic of seismic regions. Causes of earthquakes, Seismic waves, earthquake size (magnitude and intensity), Epicentre, Seismograph, Classification of earthquakes, Seismic zoning map of India, Static and Dynamic Loading, Fundamental period.

2. Seismic Behaviour of Traditionally-Built Constructions of India (07 Hours)

Performance of building during earthquakes and Mode of failure (Out-of-plane failure, in-plane failure, Diaphragm failure, Connection failure, Non-structural components failure)

3. Special construction method, tips and precautions to be observed while planning, designing and construction of earthquake resistant building. (08 Hours)

4. Introduction to seismic zone of India and factors related to IS:1893 and IS: 13920 (latest edition) (05 Hours)

5. Seismic provision of strengthening and retrofitting measures for traditionally-built constructions (08 Hours)

6. Provision of reinforcement detailing in masonry and RCC constructions (06 Hours)

7. Disaster Management: Disaster rescue, psychology of rescue, rescue workers, rescue plan, rescue by steps, rescue equipment, safety in rescue operations, debris clearance and casuality management. (06 Hours)

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.

MEANS OF ASSESSMENT

- Assignments and quiz/class tests
- Mid-term and end-term written tests
- Viva-voce

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 / IIT Kanpur

4. IS 13920, IS: 13827, IS: 13828, IS 1893-2002, IS 4326 (latest edition)

5. Dynamics of Structure by AK Chopra; Prentice Hall Inc. New Delhi

6. Earthquake Resistant Building Construction by Neelam Sharma

7 e-books/e-tools/relevant software to be used as recommended by AICTE/HSBTE/NITTTR.

Websites for Reference:

http://swayam.gov.in

SUGGESTED DISTRIBUTION OF MARKS

Topic No.	Time Allotted (Hours)	Marks Allotted (%)
1	08	19
2	07	15
3	08	17
4	05	10
5	08	19
6	06	08
7	06	12
Total	**48**	**100**

6.3 QUANTITY SURVEYING & VALUATION

L	T	P
4	-	2

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.

LEARNING OUTCOMES

After undergoing the subject, students will be able to:

- Explain different units of measurement for different items
- Calculating quantities of materials and prepare the material chart
- Prepare detailed and abstract of estimates from drawings
- Prepare tender document of different civil engineering items by using C.S.R. rates with premium
- Use principles of valuation for valuation of a building

DETAILED CONTENTS

1. Introduction to quantity surveying and its importance. Duties of quantity surveyor (02 Hours)

2. Types of estimates (02 Hours)

   2.1 Preliminary estimates
   - Plinth area estimate
   - Cubic content estimate

   2.2 Detailed estimates
   - Definition
   - Stages of preparation – details of measurement and calculation of quantities and abstract

3. Measurement (07 Hours)

   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 by following CSR rates for: (20 Hours)

4.1 A small residential building with a flat roof comprising of
- Two rooms with W.C., bath, kitchen and verandah

4.2 Earthwork for unlined channel
4.3 WBM road and pre-mix carpeting
4.4 Single span RCC slab culvert
4.5 Earthwork for plain and hill roads
4.6 RCC work in beams, slab, column and lintel, foundations
4.7 10 users septic tank

5. Calculation of quantities of materials for (05 Hours)

5.1 Cement mortars of different proportion
5.2 Cement concrete of different proportion
5.3 Brick/stone masonry in cement mortar of different proportion
5.4 Plastering, pointing and painting
5.5 D.P.C. and flooring

6. Analysis of Rates (08 Hours)

6.1 Steps involved in the analysis of rates. Requirement of material, labour, sundries, 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 in hard/ordinary soil and filling with a concept of lead and lift
- RCC in roof slab/beam/lintels/columns
- Brick masonry in cement mortar
- Cement Plaster
- White washing, painting

7 Contractorship (05 Hours)

- Meaning of contract
- 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
- Classification and types of contracting firms/construction companies

8 Preparation of Tender Document based on Common Schedule Rates (CSR) (10 Hours)

- Introduction to CSR and calculation of cost based on premium on CSR
- Exercises on writing detailed 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) Construction of a small house as per given drawing
c) RCC works
d) Pointing, plastering and flooring
e) White-washing, distempering and painting
f) Wood work including polishing
g) Sanitary and water supply installations
h) False ceiling, aluminum (glazed) partitioning
i) Tile flooring including base course
j) Preparation of comparative statement for item rate contract.

9. Valuation (05 Hours)

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

LIST OF PRACTICAL'S

- Prepare the list of items to be executed with units for detailed estimate of a given structure from the given drawing.
- Prepare a report on market rates for given material, labour wages, hire charges of tools & equipments required to construct the given structure as mentioned in at Serial number 1 above.
- Study of items with specification given in the HSR (for any ten items)
- Recording in Measurement Book (MB) for any four items
- Prepare bill of quantities of given item from actual measurements (any four items).

- Calculate the reinforcement quantities from the given set of drawings for a room size of 3 m X 4 m with bar bending schedule (footing, column, beam, lintel with chajja, slab)
- Calculate the quantity of items of work from the given set of drawings using standard measurement sheet for load bearing residential structure using description of item from DSR (1BHK Building with staircase).
- Use the relevant software to prepare detailed estimate of a residential building.

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 and use of relevant software for preparing estimates. Teachers should conceptualize making analysis of rates for different items of works. It will be advantageous if students are given valuation reports for reading.

MEANS OF ASSESSMENT

- Assignments and quiz/class tests
- Mid-term and end-term written tests
- Report Writing
- Viva-voce

RECOMMENDED BOOKS

1. "Estimating, Costing and Valuation (Civil)" by Pasrija, HD, Arora, CL and S. Inderjit Singh; New Asian Publishers, Delhi,
2. " Estimating and Costing" by Rangwala, S.C ; Charotar Book Stall, Anand
3. "Estimating and Costing by Dutta, BN
4. "Estimating and Costing" by Mahajan Sanjay; Satya Parkashan, Delhi
5. e-books/e-tools/relevant software to be used as recommended by AICTE/HSBTE/NITTTR.

Websites for Reference:

http://swayam.gov.in

SUGGESTED DISTRIBUTION OF MARKS

Topic No.	Time Allotted (Periods)	Marks Allotted (%)
1	02	03
2	02	04
3	07	10
4	20	30
5	05	08
6	08	13
7	05	08
8	10	16
9	05	08
Total	**64**	**100**

6.4 CONSTRUCTION MANAGEMENT AND ACCOUNTS

L	T	P
5	-	-

RATIONALE

This is an applied civil 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 & safety and accounts.

LEARNING OUTCOME

After undergoing the subject, students will be able to:

- State functions of various aspects of controlling construction job/project
- Explain pre-tender stage and contract stage
- Prepare bar charts for simple construction work
- Prepare scheduling techniques i.e. PERT and CPM
- Prepare job layout of building
- Comply with various labour laws
- Analyze and support in effective functioning of organization
- Inspect quality at various stages of the construction
- Control accidents and safety concerns
- Prepare measurement books and bill of quantities

DETAILED CONTENTS

THEORY

CONSTRUCTION MANAGEMENT:

1. Introduction: (06 Hours)

    1.1 Significance of construction management
    1.2 Main objectives of construction management and overview of the subject
    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, architect and contractors, their functions and inter-relationship

2. Construction Planning: (12 Hours)

2.1 Importance of construction planning
Stages of construction planning

- Pre-tender stage
- Contract stage

2.2 Scheduling construction works by bar charts

- Definition of activity, identification of activities though
- Preparation of bar charts for simple construction work
- Preparation of schedules for labour, materials, machinery and finances for small works
- Limitations of bar charts

2.3 Scheduling by network techniques

- Introduction to network techniques; PERT and CPM, differences between PERT and CPM terminology

3. Organization: (06 Hours)

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

4. Site Organization: (06 Hours)

4.1 Principle of storing and stacking materials at site
4.2 Location of equipment
4.3 Preparation of actual job layout for a building
4.4 Organizing labour at site

5. Construction Labour: (06 Hours)

5.1 Conditions of construction workers in India, wages paid to workers
5.2 Important provisions of the following Acts:

- Labour Welfare Fund Act 1936 (as amended)
- Payment of Wages Act 1936 (as amended)
- Minimum Wages Act 1948 (as amended)
- Acts relating to Labour Safety

6. Control of Progress: (05 Hours)

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: (09 Hours)

7.1 Need for inspection and quality control
7.2 Principles of inspection
7.3 Stages of inspection and quality control for
- Earth work
- Masonry
- RCC
- Sanitary and water supply services

8. Accidents and Safety in Construction: (08 Hours)

8.1 Accidents – causes and remedies
8.2 Safety measures for
- Excavation work
- Drilling and blasting
- Hot bituminous works
- Scaffolding, ladders, form work
- Demolitions

8.3 Safety campaign and safety devices, safety training

ACCOUNTS

9. Public Work Accounts: (22 Hours)

9.1 Introduction, technical sanction, allotment of funds, re-appropriation of funds bill, contractor ledger, measurement book running and final account bills complete, preparation of bill of quantities (BOQ), completion certificate & report, hand receipt, aquittance roll. Muster Roll labour, casual labour roll-duties and responsibility of different cadres, budget-stores, returns, account of stock, misc. P.W. advances T & P – verification, survey report, road metal material charged direct to works, account - expenditure & revenue head, remittance and deposit head, definition of cash, precaution in custody of cash book, imprest account, temporary advance, treasury challan, preparation of final bills. Students must learn to prepare accounts register.

9.2 Filling of PWD accounts forms

INSTRUCTIONAL STRATEGY

This is highly practice-based course and efforts should be made to relate 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

MEANS OF ASSESSMENT

- Assignments and quiz/class tests
- Mid-term and end-term written tests
- Report Writing
- Viva-voce

RECOMMENDED BOOKS

1. "Civil Engineering Management" by Wakhlo, ON ; Light and Life Publishers, New Delhi
2. "Construction Equipment and its Planning and Application by Verma, Mahesh
3. "Management in Construction Industry" by Dharwadker, PP; Oxford and IBH Publishing Company, New Delhi
4. "Construction Planning and Management" by Gahlot PS; Dhir, BM; Wiley Eastern Limited, New Delhi
5. MS Project – Microsoft USA
6. Primavera Manual by Sh. Vinod Kumar; NITTTR, Chandigarh.
7. e-books/e-tools/relevant software to be used as recommended by AICTE/HSBTE/NITTTR.

Websites for Reference:

http://swayam.gov.in

SUGGESTED DISTRIBUTION OF MARKS

Topic No.	Time Allotted (Hours)	Marks Allotted (%)
1	06	8
2	12	15
3	06	8
4	06	8
5	06	8
6	05	6
7	09	12
8	08	10
9	22	25
Total	**80**	**100**

6.5 PROJECT WORK

L	T	P
-	-	12

RATIONALE

Project Work aims at developing innovative skills in the students whereby they apply in totality the knowledge and skills gained through the course work in the solution of particular problem or by undertaking a project. In addition, the project work is intended to place students for project oriented practical training in actual work situation for the stipulated period.

LEARNING OUTCOMES

After undergoing the project work, students will be able to:

Apply in totality the knowledge and skills gained through the course work in the solution of particular problem or by undertaking a project. In addition, the project work is intended to place the learner for project oriented practical training in actual work situation for the stipulated period with a view to:

- 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
- Develop understanding of subject based knowledge given in the classroom in the context of its application at work places.
- 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 related to the world of work.
- Develop abilities like interpersonal skills, communication skills, positive attitudes and values etc.

General Guidelines

The individual students have different aptitudes and strengths. Project work, therefore, should match the strengths of students. For this purpose, students should be asked to identify the type of project work, they would like to execute. The activity of problem identification should begin well in advance (say at the end of second year). Students should be allotted a problem of interest to him/her as a major project work. It is also essential that the faculty of the respective department may have a brainstorming session to identify suitable project assignments for their students. The project assignment can be individual assignment or a group assignment. There should not be more than 3 students if the project work is given to a group. The project work identified in collaboration with industry should be preferred.

This practical training cum project work **should not be considered** as merely conventional industrial training in which students are sent at work places with either minimal or no supervision. This experience is required to be planned in advance and supervised on regular basis by the polytechnic faculty. For the fulfillment of above objectives, polytechnics may establish close linkage with 8-10 relevant organization for providing such an experience to students. It is necessary that each organization is visited well in advance and activities to be performed by students are well defined. The chosen activities should be such that it matches with the curricular interest to students and of professional value to industrial/ field organizations. Each teacher is expected to supervise and guide 5-6 students.

Some of the projects are listed below for the benefit of the students:

1. Study and detailed estimate of different component of modern residential and commercial building
2. Preparation of detailed estimate for low cost two room set residential building
3. Analysis of green building
4. Design of rain water harvesting for a given building
5. Analysis of accidents prone area in your city and remedial measure for them
6. Case study of safety practices in a multi-storied buildings under constructions
7. Concrete Mix Design
8. Case study of repair and maintenance of a given building
9. Preparation of DNIT of a given building for Civil Engineering works
10. Detailed estimate for installing plumbing fixtures
11. Preparing a standard measurement book of a given building
12. Construction of concrete road by using latest techniques
13. Water supply scheme for a govt approved colony
14. Construction estimates of shopping complex
15. Analysis and design of Effluent Treatment Plant (ETP) for an industry
16. Design of soak pit with septic tank for 100 users
17. Design and estimate of two room set building
18. Design of concrete mix by using flyash
19. Setting up of an interlocking pavers fabrication plant

20. Preparation of different Civil Engineering models e.g. beam, one way, two way slab, column etc.
21. Reinforcement detailing as per IS:4326
22. Design of car parking in your polytechnic
23. Design of acoustics for an auditorium
24. To prepare analysis of rates for non -schedule items e.g. aluminium door, windows, work stations etc.
25. Study of retrofitting of a given Civil Engineering works.
26. Survey of your polytechnic by using total station.
27. Traffic volume study and analysis on different roads in a city
28. Case study of a flyover with regard to its various construction components
29. Study and preparation of detailed project report of ready mix concrete (RMC) unit
30. Study and preparation of detailed project report of prefabricated/prestressed concrete components unit
31. 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 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
32. Water Supply system for a locality
    - Surveying
    - Design of water requirements and water distribution system
    - Preparation of drawing of overhead tank
    - Material estimating and costing
    - Specifications

- Technical report writing

33. Construction of shopping complex by detailing of RCC drawings, estimating and costing of material
34. Design and construction of septic tank with soak pit for 100 users
35. 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

There is no binding to take up the above projects as it is only a suggestive list of projects.

A suggestive criterion for assessing student performance by the external (person from industry) and internal (teacher) examiner is given in table below:

Sr. No.	**Performance Criteria**	**Max.** Marks**	**Rating Scale**				
			Excellent	**Very Good**	**Good**	**Fair**	**Poor**
1.	Selection of project assignment	10%	10	8	6	4	2
2.	Planning and execution of considerations	10%	10	8	6	4	2
3.	Quality of performance	20%	20	16	12	8	4
4.	Providing solution of the problems or production of final product	20%	20	16	12	8	4
5.	Sense of responsibility	10%	10	8	6	4	2
6.	Self expression/ communication skills	5%	5	4	3	2	1
7.	Interpersonal skills/human relations	5%	5	4	3	2	1
8.	Report writing skills	10%	10	8	6	4	2
9	Viva voce	10%	10	8	6	4	2
Total marks		**100**	**100**	**80**	**60**	**40**	**20**

The overall grading of the practical training shall be made as per following table.

In order to qualify for the diploma, students must get "Overall Good grade" failing which the students may be given one more chance to improve and re-evaluate before being disqualified and declared "not eligible to receive diploma ". It is also important to note that the students must get more than six "goods" or above "good" grade in different performance criteria items in order to get "Overall Good" grade.

	Range of maximum marks	**Overall grade**
i)	More than 80	Excellent
ii)	79 <> 65	Very good
iii)	64 <> 50	Good
iv)	49 <> 40	Fair
v)	Less than 40	Poor

Important Notes

1. **This criteria must be followed by the internal and external examiner and they should see the daily, weekly and monthly reports while awarding marks as per the above criteria.**

2. **The criteria for evaluation of the students have been worked out for 200 maximum marks. The internal and external examiners will evaluate students separately and give marks as per the study and evaluation scheme of examination.**

3. **The external examiner, preferably, a person from industry/organization, who has been associated with the project-oriented professional training of the students, should evaluate the students performance as per the above criteria.**

4. **It is also proposed that two students or two projects which are rated best be given merit certificate at the time of annual day of the institute. It would be better if specific nearby industries are approached for instituting such awards.**

The teachers are free to evolve other criteria of assessment, depending upon the type of project work.

It is proposed that the institute may organize an annual exhibition of the project work

SOFT SKILLS – IV

L	T	P
-	-	2

RATIONALE

The present day world requires professionals who are not only well qualified and competent but also possess good communication skills. The diploma students not only need to possess subject related knowledge but also soft skills to get good jobs or to rise steadily at their work place. The objective of this subject is to prepare students for employability in job market.

LEARNING OUTCOMES

After undergoing this course, the students will be able to:

- Communicate effectively.
- Apply techniques of effective time management
- Develop habits to overcome stress
- Face problems with confidence
- Exhibit attributes required to appear for an interview
- Learn about current and future career opportunities
- Exhibit entrepreneurial skills
- Use QC/QT tools

DETAILED CONTENTS

- Communication Skills - Presentation
- Time management
- Stress Management
- Problem solving
- Career opportunities-Current and future
- Entrepreneurial Skills
- Quality and Quality tools used in industry

In addition, the students must participate in the following activities to be organized in the institute

- Sports
- NCC/NSS
- Cultural Event

Note : Extension Lectures by experts may be organized. There will be no examination for this subject.