

Approved by : AICTE Ministry of HRD, Govt. of India, Affiliated to : U.P.B.T.E., Lucknow

DEPARTMENT OF CIVIL ENGINEERING
FIRST SEMESTER

1.1	Mathematics-I	6-7
1.2	Applied Physics-I	8-11
1.3	Applied Chemistry	12-16
1.4	Communication Skills in English	17-20
1.5	Engineering Graphics	21-23
1.6	Sports & Yoga	24-26

SECOND SEMESTER

2.1	Mathematics-II	27-29
2.2	Applied Physics-II	30-32
2.3	Introduction to IT Systems	33-36
2.4	Fundamentals of Electrical & Electronics Engineering	37-40
2.5	Engineering Mechanics	41-43
2.6	Engineering Workshop Practice	44-45
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**TECHNICAL EDUCATION DEPARTMENT (DIPLOMA SECTOR)
UTTAR PRADESH**

CURRICULUM FOR FIRST AND SECOND SEMESTER

COMMON FOR ALL ENGINEERING DIPLOMA COURSES^

=====
Semester System
=====



EFFECTIVE FROM YEAR -----

Prepared By

INSTITUTE OF RESEARCH DEVELOPMENT & TRAINING, U.P., KANPUR

^Curriculum of First and Second Semester for the following Engineering Branches

Sr. No.	Name of Diploma Programme	Duration
1	Diploma in Mechanical Engineering	3 Years
2	Diploma in Mechanical Engineering (Repair & Maintenance)	3 Years
3	Diploma in Mechanical Engineering(Computer Aided Design)	3 Years
4	Diploma in Mechanical Engineering (Refrigeration & Air conditioning)	3 Years
5	Diploma in Mechanical Engineering (Automobile)	3 Years
6	Diploma in Mechanical Engineering(Production)	3 Years
7	Diploma in Electronics Engineering	3 Years
8	Diploma in Electronics Engineering (Advanced Microprocessor & Interface)	3 Years
9	Diploma in Electronics Engineering (Modern Consumer Electronics Appliances)	3 Years
10	Diploma in Electronics Engineering (Micro Electronics)	3 Years
11	Diploma in Electrical Engineering	3 Years
12	Diploma in Electrical Engineering (Industrial Control)	3 Years
13	Diploma in Electrical & Electronics Engineering	3 Years
14	Diploma in Electronics & Communication Engineering	3 Years
15	Diploma in Chemical Engineering	3 Years
16	Diploma in Chemical Technology (Rubber & Plastic)	3 Years
17	Diploma in Chemical Technology (Fertilizer)	3 Years
18	Diploma in Chemical Engineering (Petro Chemical)	3 Years
19	Diploma in Paint Technology	3 Years
20	Diploma in Civil Engineering	3 Years
21	Diploma in Computer Science & Engineering	3 Years
22	Diploma in Information Technology	3 Years
23	Diploma in Instrumentation & Control Engineering	3 Years
24	Diploma in Civil Engineering (Environmental Pollution & control)	3 Years

25	Diploma in Agricultural Engineering	3 Years
26	Diploma in Plastic Mould Technology	3 Years
27	Diploma in Glass & Ceramics	3 Years
28	Diploma in Dairy Engineering	3 Years
29	Diploma in Leather Technology (Tanning)	3 Years
30	Diploma in Leather Technology Footwear (Computer Aided Shoe Design)	3 Years
31	Diploma in Textile Technology	3 Years
32	Diploma in Textile Chemistry	3 Years
33	Diploma in Textile Engineering	3 Years
34	Diploma in Printing Technology	3 Years
35	Diploma in Food Technology	3 Years
36	Diploma in Paper & Pulp Technology	3 Years
37	Diploma in Carpet Technology	3 Years
38	Diploma in Mining Engineering	3 Years
39	Renewable Energy	3 Years
40	Communication and Computer Networking	3 Years
41	Civil and Environment Engineering	3 Years

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SECOND SEMESTER

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PREFACE

An important issue generally debated amongst the planners and educators world over is how technical education can contribute to sustainable development of the societies struggling hard to come in the same bracket as that of the developed nations. The rapid industrialization and globalization has created an environment for free flow of information and technology through fast and efficient means. This has led to shrinking of the world, bringing people from different culture and environment together and giving rise to the concept of world turning into a global village. In India, a shift has taken place from the forgettable years of closed economy to knowledge based and open economy in the last few decades. In order to cope with the challenges of handling new technologies, materials and methods, we have to develop human resources having appropriate professional knowledge, skills and attitude. Technical education system is one of the significant components of the human resource development and has grown phenomenally during all these years. Now it is time to consolidate and infuse quality aspect through developing human resources, in the delivery system. Polytechnics play an important role in meeting the requirements of trained technical manpower for industries and field organizations. The initiatives being taken by the State Board of Technical Education, UP to revise the existing curricula of 42 diploma programmes as per the needs of the industry and making them NEP-2020/AICTE compliant, are laudable.

In order to meet the requirements of future technical manpower, we will have to revamp our existing technical education system and one of the most important requirements is to develop outcome-based curricula of diploma programmes. The curricula for diploma programmes have been revised by adopting time-tested and nationally acclaimed scientific method, laying emphasis on the identification of learning outcomes of diploma programme.

The real success of the diploma programme depends upon its effective implementation. However best the curriculum document is designed, if that is not implemented properly, the output will not be as expected. In addition to acquisition of appropriate physical resources, the availability of motivated, competent and qualified faculty is essential for effective implementation of the curricula.

It is expected of the polytechnics to carry out job market research on a continuous basis to identify the new skill requirements, reduce or remove outdated and redundant courses, develop innovative methods of course offering and thereby infuse the much needed dynamism in the system.

Director
Institute of Research Development & Training

ACKNOWLEDGEMENTS

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1. Sh. M. Devraj, IAS, Principal Secretary Govt. of UP, Technical Education Department, Secretariat Lucknow.
2. Sh. Annavi Dinesh Kumar, IAS, Special Secretary /Director, Technical Education, UP for taking keen interest in the review of this curriculum.
3. Sh. F.R. Khan, Director, I.R.D.T., Kanpur for entrusting this project of Curriculum revision.
4. All the participants from industry/field organizations, engineering colleges, polytechnics, and other technical institutions for their professional inputs during curriculum workshops.
5. Faculty /Subject Experts from U.P. Government polytechnics.

CDC Officer
IRDT Kanpur

1. SALIENT FEATURES OF DIPLOMA PROGRAMME FOR ENGINEERING & TECHNOLOGY BRANCHES

- 1) Duration of the Programme : Three years (Six Semesters)
- 2) Entry Qualification : Matriculation or equivalent as Prescribed by State Board of Technical Education, UP
- 3) Intake : 60 (or as prescribed by the Board)
- 4) Pattern of the Programme : Semester Pattern

5) **Student Centred Activities:**

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

6) **Project work**

A project work has been included in the curriculum to enable the student get familiarize with the practices and procedures being followed in the industries and provide an opportunity to work on some live projects in the industry.

7) **Industrial Training**

Industrial Training (Summer Internship –I) of 4 Weeks duration to be organized after II-semester exam. Evaluation will be completed in III-Semester.

STUDY AND EVALUATION SCHEME FOR ALL ENGINEERING AND TECHNOLOGY BRANCHES (Listed in Annexure -1)

FIRST SEMESTER

Sr. No.	SUBJECTS	STUDY SCHEME Periods/Week			Credits	MARKS IN EVALUATION SCHEME									Total Marks of Internal & External
		L	T	P		INTERNAL ASSESSMENT			EXTERNAL ASSESSMENT						
						Th	Pr	Tot	Th	Hrs	Pr	Hrs	Tot		
1.1	Mathematics-I	2	1	-	3	40	-	40	60	3	-	-	60	100	
1.2	Applied Physics-I	3	-	2	4	40	60	100	60	3	40	3	100	200	
1.3	Applied Chemistry OR Introduction to IT Systems	3	-	2	4	40	60	100	60	3	40	3	100	200	
	2	-	4												
1.4	Communication Skills in English OR Fundamentals of Electrical & Electronics Engineering	3	-	2	4	40	60	100	60	3	40	3	100	200	
1.5	Engineering Graphics OR Engineering Workshop Practice	-	-	4	2	-	40	40	60	3	-	-	60	100	
	-					60	60	-	-	40	3	40			
1.6	Sports & Yoga	-	-	2	1	-	50	50	-	-	-	-	-	50	
# Student Centered Activities (SCA)		-	-	10	-	-	50	50	-	-	-	-	-	50	
TOTAL					18									900	

Note :-The Institutional authority may select alternative subjects, as indicated at Sr. No. 1.3, 1.4 and 1.5 based on the need of the respective branches offered at their institute.

The alternative subjects once selected in first semester will not be selected in second semester.

Students centered activities will comprise of co-curricular activities like extension lecture, games, hobby, clubs, e.g., photography etc., seminars, declamation contents, education field visit, library, NCC,NSS, Cultural Activities and self-study etc. The Lecture allotted to SCA can also be utilized for the course completion of other subjects.

1-Each Period will be 60 minutes duration.

2-Each Session will be 16 weeks.

3- Effective teaching will be at least 14 weeks.

STUDY AND EVALUATION SCHEME FOR ALL ENGINEERING AND TECHNOLOGY BRANCHES (Listed in Annexure -1)

SECOND SEMESTER:

Sr. No.	SUBJECTS	STUDY SCHEME			Credits	MARKS IN EVALUATION SCHEME								Total Marks of Internal & External
		Periods/Week				INTERNAL ASSESSMENT			EXTERNAL ASSESSMENT					
		L	T	P		Th	Pr	Tot	Th	Hrs	Pr	Hrs	Tot	
2.1	Mathematics-II	3	1	-	4	40	-	40	60	3	-	-	60	100
2.2	Applied Physics-II	3	-	2	4	40	60	100	60	3	40	3	100	200
2.3	Applied Chemistry OR	3	-	2	4	40	60	100	60	3	40	3	100	200
	Introduction to IT Systems	2	-	4										
2.4	Fundamentals of Electrical & Electronics Engineering OR Communication Skills in English	3	-	2	4	40	60	100	60	3	40	3	100	200
2.5	Engineering Mechanics	2	1	2	4	40	60	100	60	3	40	3	100	200
2.6	Engineering Graphics OR			4	2	-	40	40	60	3	-	-	60	100
	Engineering Workshop Practice					-	60	60	-	-	40	3	40	
2.7	(Q) Environmental Sciences	3	-	-	-	-	-	-	60	3	-	-	60	-
# Student Centered Activities (SCA)		-	-	4	-	-	50	50	-	-	-	-	-	50
Total					22									1050

Note :-The Institutional authority may select alternative subjects, as indicated at Sr. No. 2.3, 2.4 and 2.6 based on the need of the respective branches offered at their institute.

The alternative subjects once selected in first semester will not be selected in second semester.

Students centered activities will comprise of co-curricular activities like extension lecture, games, hobby, clubs, e.g., photography etc., seminars, declamation contents, education field visit, library, NCC,NSS, Cultural Activities and self-study etc. The Lecture allotted to SCA can also be utilized for the course completion of other subjects.

(Q) It is compulsory to appear and to pass the examination, but marks will not be included for percentage and division of obtained marks.

1-Each Period will be 60 minutes duration.

2-Each Session will be 16 weeks.

3- Effective teaching will be at least 14 weeks.

1.1 MATHEMATICS - I

L T P
2 1 -

COURSE OBJECTIVES

Contents of this course provide fundamental base for understanding elementary mathematics and their uses in solving engineering problems. Contents of this course will enable students to use basic mathematical function like logarithms, partial fractions, matrices and basic 2D curves in solving various engineering problems of all fields.

COURSE OUTCOMES

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

- Understand and apply angle measurements, T-Ratios, and graph functions.
- Grasp the concepts of limits, differentiation and apply differentiation rules.
- Resolve proper and improper fractions into partial fractions with various factors.
- Solve problems using binomial theorem.
- Understand complex numbers in different forms , perform arithmetic operations and applications of De Moivre's theorem.

COURSE CONTENT

UNIT - I: Trigonometry

(08 Periods)

Concept of angles, measurement of angles in degrees, and radians and their conversions, T-Ratios of Allied angles (without proof), Sum, difference formulae and their applications (without proof). Product formulae (Transformation of product to sum, difference and vice versa). T- Ratios of multiple angles, sub- multiple angles (2A) only. Graphs of $|x|$, $\sin x$, $\cos x$, and e^x .

UNIT-II : Differential Calculus

(10 Periods)

Definition of function, concept of limits. Four standard limits $\lim_{x \rightarrow a} \frac{x^n - a^n}{x - a}$, $\lim_{x \rightarrow 0} \frac{\sin x}{x}$, $\lim_{x \rightarrow 0} \frac{a^x - 1}{x}$, $\lim_{x \rightarrow 0} (1 + x)^{\frac{1}{x}}$.

Differentiation of x^n , $\sin x$, $\cos x$, $\tan x$, e^x , $\log_e x$ by definition. Differentiation of sum, product and quotient of functions. Differentiation of function of a function. Differentiation of trigonometric, functions, logarithmic differentiation, exponential functions.

UNIT - III: Partial fractions:

(08 Periods)

Definition of polynomial fraction, proper & improper fractions and definition of partial fractions. To resolve proper fraction and improper fraction into partial fraction with denominator containing non-repeated linear factors, repeated linear factors.

UNIT- IV : Binomial theorem

(06 Periods)

Value of ${}^n P_r$, ${}^n C_r$.

Binomial theorem (without proof) for positive integral index (expansion and general form); applications of Binomial theorem (General term, middle term, independent terms only).

UNIT-V : Complex Numbers:**(10 Periods)**

Definition, real and imaginary parts of a complex number, polar and Cartesian representation of a complex number and its conversion from one form to other, conjugate of a complex number, modulus and amplitude of a complex number. Addition, subtraction, multiplication and division of complex numbers. De Moivre's theorem and its simple applications.

INSTRUCTIONAL STRATEGY

The basic instructional strategy to teach basic mathematics, binomial theorem, trigonometry, differential calculus etc. should be conceptual with real world applications of relevant branch. More numerical and theory examples can be used for clear understanding of the content.

MEANS OF ASSESSMENT

- Assignments and Quiz/Class Tests
- Mid-term and End-term Written Tests
- Model/Prototype Making

RECOMMENDED BOOKS

1. B.S. Grewal, Higher Engineering Mathematics, Khanna Publishers, New Delhi, 40th Edition, 2007.
2. G. B. Thomas, R. L. Finney, Calculus and Analytic Geometry, Addison Wesley, 9th Edition, 1995.
3. Reena Garg, Engineering Mathematics, Khanna Publishing House, New Delhi (Revised Ed. 2018)
4. V. Sundaram, R. Balasubramanian, K.A. Lakshminarayanan, Engineering Mathematics, 6/e., Vikas Publishing House.
5. Reena Garg & Chandrika Prasad, Advanced Engineering Mathematics, Khanna Publishing House, New Delhi

SUGGESTED DISTRIBUTION OF MARKS

Topic	Time Allotted (Periods)	Marks Allotted (%)
1.	08	20
2.	10	25
3.	08	20
4	06	10
5	10	25
Total	42	100

1.2 APPLIED PHYSICS – I

L T P
3 - 2

COURSE OBJECTIVES

Applied physics includes the study of a diversified topics related to 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 behave. Concrete knowledge of physical laws, analysis and applications in various fields of engineering and technology are given prominence in this 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 learn and appreciate these concepts and principles. In all contents, SI units should be followed.

COURSE OUTCOMES

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

- Identify the use of S.I. system of measurement and how it is used in engineering
- Represent physical quantities as scalars and vectors, applying the physical laws and concepts of linear and circular motion in everyday life.
- Analyse banking of roads/railway tracks and apply conservation of momentum principle to Explain recoil of gun etc.
- Derive work, power and energy relationship and solve problems about work and power.
- Define work, energy and power and their units.
- Describe conservation of energy and its applications
- Understand the concept of rotational motion of a rigid body and its applications
- Apply the physical laws and concepts of gravity, its variation with height and depth
- Understand the concept of elasticity, surface tension, pressure and the laws governing movement of fluids.
- Express physical work in term of heat and temperature; Measure temperature in various processes on different scales (Celsius, Kelvin, Fahrenheit etc.)
- Distinguish between conduction, convection and radiation and uses in daily life.

COURSE CONTENTS

1. Units and Dimensions

(6 Periods)

- 1.1 Need of Measurement in engineering and science, unit of physical quantities - fundamental and derived units, systems of units (FPS, CGS and SI units)
- 1.2 Dimensions and dimensional formulae of physical quantities.
- 1.3 Principle of homogeneity of dimensions
- 1.4 Dimensional equations and their applications, conversion of numerical values of physical quantities from one system of units into another, checking the correctness of physical equations and deriving relations among various physical quantities
- 1.5 Limitations of dimensional analysis.

2. Force and Motion

(6 periods)

- 2.1 Scalar and vector quantities – examples, representation of vector
- 2.2 Addition and Subtraction of Vectors, Triangle and Parallelogram law (Statement only), Scalar and Vector Product.
- 2.3 Resolution of Vectors.
- 2.4 Force, Momentum, Statement of Conservation of linear momentum, its applications such as recoil of gun.
- 2.5 Gravitational force, Acceleration due to gravity (g) and its variation with depth and height from earth surface.

3. Work, Power and Energy

(6 periods)

- 3.1 Work: and its units, examples of zero work, positive work and negative work.
- 3.2 Friction: modern concept, static, limiting and dynamic friction, Coefficient of friction.
- 3.3 Energy and its units, Kinetic energy, potential energy and Mechanical energy with examples.
- 3.4 Work Energy Theorem (statement only), Conservation of mechanical energy for freely falling bodies.
- 3.5 Power and its units, calculation of power in numerical problems.

4. Circular motion

(6 periods)

- 4.1 Circular motion, Definition of Uniform and Non-uniform Circular motion
- 4.2 Definition of angular displacement, angular velocity, angular acceleration, frequency, time period.
- 4.3 Relation between linear and angular velocity, linear acceleration and angular acceleration
- 4.4 Centripetal acceleration (Definition and formula only)
- 4.5 Centripetal force with examples such as banking of roads and bending of cyclist. Definition of Centrifugal force.

5. Rotational Motion of a rigid body

(6 periods)

- 5.1 Definition of rigid body, Rotational Motion of rigid body, Definition of torque with examples
- 5.2 Moment of inertia and its physical significance, radius of gyration for rigid body, Theorems of parallel and perpendicular axes (statements only)
- 5.3 Moment of inertia of rod, disc, ring and sphere (hollow and solid) (Formulae only).
- 5.4 Rotational kinetic energy
- 5.5 Angular momentum, Conservation of angular momentum and its examples

6. Properties of Matter

(6 periods)

- 6.1 Elasticity: definition of stress and strain, Hooke's law (Definition and formula only).
- 6.2 Pressure: definition, its units.
- 6.3 Surface tension: concept, its units, cohesive and adhesive forces, angle of contact, Capillary action ascent formula (without derivation), applications of surface tension, effect of temperature on surface tension
- 6.4 Viscous force, Velocity gradient and its unit, coefficient of viscosity, Stoke's law and effect of temperature on viscosity.
- 6.5 Stream line flow of fluid motion, Equation of continuity, Bernoulli's Theorem (without derivation) and their applications to Torricelli's formula [$v=(2gh)^{1/2}$].

7. Heat and Thermometry

(6 periods)

- 7.1 Concept of Heat and Temperature.
- 7.2 Different scales of temperature and their relationship
- 7.3 Modes of transfer of heat (Conduction, convection and radiation with examples)
- 7.4 Expansion of solids: coefficient of linear, surface and cubical expansions and relation amongst them
- 7.5 Concept of Mercury Thermometer

LIST OF PRACTICALS (To perform any Six Practicals)

1. To measure length, radius of a given cylindrical body using a vernier calipers and find its volume.
2. To determine diameter of a wire using a screw gauge and find its volume.
3. To determine the Radius of curvature of (i) convex mirror, (ii) concave mirror by spherometer.
4. To determine value of acceleration due to gravity (g) using simple pendulum.
5. To verify parallelogram law of forces.
6. To find the coefficient of friction between wood and glass using a horizontal board.
7. To determine the viscosity of glycerine by Stoke's method.
8. To verify law of conservation of mechanical energy (PE to KE).
9. To measure room temperature and temperature of hot bath using mercury thermometer and convert it into different scales.
10. To determine force constant of spring using Hooks law.

INSTRUCTIONAL STRATEGY

Teacher may use various teaching aids like live models, charts, graphs and experimental kits etc. for imparting effective instructions in the subject. The teacher should explain about field applications before teaching the basics to develop proper understanding of the physical phenomenon. Use of demonstration and animations can make the subject interesting and may develop scientific temper in the students. Teacher must plan a tour of Science Park/planetarium available in nearby areas in order to enhance the interest in this course.

MEANS OF ASSESSMENTS

- Assignment & Quiz,
- Mid-Term and End-Term written test,
- Model Making,
- Actual Lab & Practical Work,
- Viva Voice

RECOMMENDED BOOKS

1. Text Book of Physics for Class XI (Part-I, Part-II); N.C.E.R.T., Delhi
2. Concepts in Physics by HC Verma, Vol. I & II, Bharti Bhawan Ltd. New Delhi
3. Comprehensive Practical Physics, Vol, I & II, JN Jaiswal, Laxmi Publications (P) Ltd., New Delhi
4. B.Sc. Practical Physics by C L Arora, S. Chand Publication..
5. Engineering Physics by PV Naik, Pearson Education Pvt. Ltd, New Delhi
6. Engineering Physics by DK Bhattacharya& Poonam Tandan; Oxford University Press, New Delhi
7. Modern Engineering Physics by SL Gupta, Sanjeev Gupta, Dhanpat Rai Publications
8. V. Rajendran, physics-I, Tata McGraw-Hill raw Hill publication, New Delhi
9. Arthur Beiser, Applied Physics, Tata McGraw-Hill raw Hill publication, New Delhi
10. Physics Volume 1, 5th edition, Haliday Resnick and Krane, Wiley publication

SUGGESTED DISTRIBUTION OF MARKS

Topic No.	Time Allotted (Periods)	Marks Allotted (%)
1	06	14
2	06	14
3	06	15
4	06	15
5	06	14
6	06	14
7	06	14
Total	42	100

1.3 APPLIED CHEMISTRY

L	T	P
3	-	2

COURSE OBJECTIVES

There are numerous number materials are used in fabricating and manufacturing devices for the comfort of life. The selection, characterization and suitability assessment of natural raw materials essentially requires principles and concepts of Applied Chemistry for technicians. On successful completion of this course content will enable technicians to understand, ascertain and analyses and properties of natural raw materials require for producing economical and eco-friendly finished products.

COURSE OUTCOMES

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

- Solve various engineering problems applying the basic knowledge of atomic structure and chemical bonding.
- Use relevant water treatment method to solve domestic and industrial problems.
- Solve the engineering problems using knowledge of engineering materials and properties.
- Use relevant fuel and lubricants for domestic and industrial applications
- Solve the engineering problems using concept of electrochemistry and corrosion.

COURSE CONTENT

Unit 1: Atomic Structure, Chemical Bonding and Solutions

(08 periods)

Rutherford model of atom, Bohr's theory (expression of energy and radius to be omitted), Heisenberg uncertainty principle, Quantum number. Shapes of s, p and d orbitals, Pauli's exclusion principle, Hund's rule of maximum multiplicity Aufbau rule, electronic configuration.

Concept of chemical bonding – cause of chemical bonding, types of bonds: ionic bond (NaCl), covalent bond (H_2 , F_2 , HF), coordination bond (NH_4)⁺. Hybridization in $BeCl_2$, BF_3 , CH_4 , NH_3 , H_2O . Anomalous properties of NH_3 , H_2O due to hydrogen bonding, metallic bonding.

Solution – idea of solute, solvent and solution, methods to express the concentration of solution molarity (M = mole per liter), Molality, Normality, ppm, mass percentage, volume percentage and mole fraction.

Unit 2: Water

(08 periods)

Classification of soft and hard water based on soap test, salts causing water hardness, unit of hardness and simple numerical on water hardness.

Cause of poor lathering of soap in hard water, problems caused by the use of hard water in boiler (scale and sludge, foaming and priming, corrosion etc), and total dissolved solids (TDS).

- i). Water softening techniques – soda lime process, zeolite process and ion exchange process.
- ii). Municipal water treatment (in brief only) – sedimentation, coagulation, filtration, sterilization.

Unit 3: Engineering Materials

(08 periods)

Natural occurrence of metals – minerals, ores of iron, aluminium and copper, gangue (matrix), flux, slag, brief account of general principles of metallurgy.

Extraction of - Aluminum from bauxite ore.

Alloys – definition, purposes of alloying, ferrous alloys and non-ferrous with suitable examples, properties and applications.

General chemical composition, composition based applications (elementary idea only, details omitted): Port land cement and hardening, Composite materials (Wood, Glass fiber reinforced composites).

Polymers – monomer, homo and co polymers, degree of polymerization, simple reactions involved in preparation and their application of thermoplastics and thermosetting plastics (using PVC, PS, PTFE, nylon – 6, nylon-6,6 and Bakelite), rubber and vulcanization of rubber.

Unit 4: Chemistry of Fuels and Lubricants

(09 periods)

Definition of fuel and combustion of fuel, classification of fuels, calorific values (HCV and LCV), calculation of HCV and LCV using Dulong's formula.

Fuel rating (octane and cetane numbers).

Chemical composition, calorific values and applications of LPG, CNG, water gas, coal gas, producer gas and biogas.

Lubrication – function and characteristic properties of good lubricant, classification with examples. Physical properties (viscosity and viscosity index, oiliness, flash and fire point, cloud and pour point only) and chemical properties (coke number, total acid number saponification value) of lubricants.

Unit 5: Electro Chemistry

(09 periods)

Electronic concept of oxidation, reduction and redox reactions.

Definition of terms: electrolytes, non-electrolytes with suitable examples, Faradays laws of Electrolysis and simple numerical problems. Industrial Application of Electrolysis –

- Electrometallurgy
- Electroplating
- Electrolytic refining.

Application of redox reactions in electrochemical cells –

- Primary cells – dry cell,
- Secondary cell - commercially used lead storage battery, fuel and Solar cells.

Introduction to Corrosion of metals –

Definition, types of corrosion (chemical and electrochemical), factors affecting rate of corrosion.

- Internal corrosion preventive measures –Purification, alloying and heat treatment
- External corrosion preventive measures: a) metal (anodic, cathodic) coatings, b) organic Inhibitors.

INSTRUCTIONAL STRATEGY

Unit 1: Atomic Structure, Chemical Bonding and Solutions

Assignments: Writing electronic configuration of elements up to atomic number 30 ($Z= 30$). Numerical on molarity, ppm, mass percentage, volume percentage and mole fraction of given solution.

Seminar: 1. Quantum numbers,

2. Discuss the metallic properties such as malleability, ductility, hardness, high melting point, conductance of heat and electricity, magnetic properties of metals. Projects: Model of molecules BeCl_2 , BF_3 , CH_4 , NH_3 , H_2O .

Unit 2: Water

Assignments: Simple problems on hardness calculation.

Seminar: 1. Quality and quantity requirement of water in house and industry.

2. Quality of control measures of effluents (BOD & COD).

Projects: Collect water samples from different water sources and measure of hardness of water.

Unit 3: Engineering Materials

Assignments: Preparation of table showing different ores of iron, copper and aluminum metals along with their chemical compositions and classify in to oxide sulphide halide ores.

Seminar: Discuss the chemical reactions taking place in blast furnace in extraction of Fe, Cu and Al metals.

Projects: Make table showing place of availability of different ores in India and show places on India map.

Unit 4: Chemistry of Fuels and Lubricants

Assignments: Calculation of HCV and LCV of fuel using fuel composition in Dulong's formula.

Seminar: Chemical structure of fuel components influence on fuel rating.

Projects: Mapping of energy recourses in India. Collection of data of various lubricants available in the market.

Unit 5: Electro Chemistry

Assignments: Simple problems on Faradays laws of electrolysis. Seminar:

1. Corrosion rate and units.
2. Corrosion preventions.

Projects: Mapping of area in India prone to corrosion. Collection of data of various electrochemical cells batteries used in equipment and devices and available in market. Visit to sites such as Railway station to watch corrosion area in railways and research establishment in and around the institution.

LIST OF PRACTICALS:

Perform any Ten Laboratory Practicals.

Volumetric and Gravimetric analysis:

1. Preparation of standard solution of oxalic acid or potassium permanganate.
2. To determine strength of given sodium hydroxide solution by titrating against standard oxalic acid solution using phenolphthalein indicator.
3. Standardization of KMnO_4 solution using standard oxalic acid and determine the percentage of iron present in given Hematite ore by KMnO_4 solution.
4. Iodometric estimation of copper in the copper pyrite ore.
5. Volumetric estimation of total acid number (TAN) of given oil.
6. Volumetric estimation of:
 - a) Total hardness of given water sample using standard EDTA solution.
 - b) Alkalinity of given water sample using 0.01M sulphuric acid.
7. Proximate analysis of coal:
 - a) Gravimetric estimation of moisture in given coal sample.
 - b) Gravimetric estimation of ash in given coal sample.

Instrumental analysis:

8. Determine the conductivity of given water sample.
9. Determination of the iron content in given cement sample using colorimeter.
10. Determination of calorific value of solid or liquid fuel using bomb calorimeter.
11. Determination of viscosity of lubricating oil using Redwood viscometer.
12. Determination of flash and fire point of lubricating oil using Abel's flash point apparatus.
13. To verify the first law of electrolysis of copper sulfate using copper electrode.
14. Construction and measurement of emf of electrochemical cell (Daniel cell).
15. To study the effect of dissimilar metal combination.

(a) Open source software and website address:

- 1 www.chemguide.co.uk/atommenu.html (Atomic structure and chemical bonding)
- 2 www.visionlearning.com (Atomic structure and chemical bonding)
- 3 www.chem1.com (Atomic structure and chemical bonding)
- 4 <https://www.wastewaterlearning.com/elearning/> (Water Treatment)
- 5 www.capital-refractories.com (Metals, Alloys, Cement, and Refractory Materials)
- 6 www.em-ea.org/guide%20books/book-2/2.1%20fuels%20and%20combustion.pdf (Fuel and Combustion)
- 7 www.chemcollective.org (Metals, Alloys)
- 8 www.wqa.org (Water Treatment)

References/Suggested Learning Resources:**(b) Books :**

1. Text Book of Chemistry for Class XI& XII (Part-I, Part-II); N.C.E.R.T., Delhi, 2017-18.
2. Agarwal, & Shikha, Engineering Chemistry, Cambridge University Press; New Delhi, 2015.
3. C.N. R. Rao, Understanding Chemistry, Universities Press (India) Pvt. Ltd., 2011.
4. Dara, S. S. & Dr.S.S.Umare, Engineering Chemistry, S.Chand. Publication, New Delhi, New Del-hi, 2015.
5. Jain & Jain, Engineering Chemistry, Dhanpat Rai and Sons; New Delhi, 2015.
6. Dr. Vairam, S., Engineering Chemistry, Wiley India Pvt.Ltd., New Delhi, 2013.
7. Dr. G. H. Hugar & Prof A. N. Pathak, Applied Chemistry Laboratory Practices, Vol. I and Vol. II, NITTTR, Chandigarh, Publications, 2013-14.
8. Agnihotri, Rajesh, Chemistry for Engineers, Wiley India Pvt.Ltd., 2014.

SUGGESTED DISTRIBUTION OF MARKS

Topic No.	Time Allotted (Periods)	Marks Allotted (%)
1	08	20
2	08	20
3	08	20
4	09	20
5	09	20
Total	42	100

1.4 COMMUNICATION SKILLS IN ENGLISH

COURSE OBJECTIVES

L T P
3 - 2

Communication Skills play an important role in career development. This lab course aims at actively involving students in various activities to improve their communication skills with an emphasis on developing personality of the students.

COURSE OUTCOMES

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

1. Develop listening skills for enhancing communications.
2. Develop speaking skills with a focus on correct pronunciation and fluency.
3. Introduce the need for personality development - Focus will be on developing certain qualities which will aid students in handling personal and career challenges, leadership skills etc., for that purpose group discussion extempore and other activities should be conducted during lab classes.

COURSE CONTENTS

Unit -1 Communication: Theory and Practice (08 Periods)

- 1.1 Basics of Communication, Definition Process of Communication
- 1.2 Types of communication (formal and informal, verbal and non-verbal), 7 C's of Communication
- 1.3 Barriers to communication and ways to overcome them
- 1.4 Tools or devices of Communication

Unit – 2 Soft Skills for Professional Excellence (04 Periods)

- 2.1 Introduction to Soft skills and hard skills
- 2.2 Importance of soft skills
- 2.3 Applying soft skills across cultures

Unit – 3 Reading Comprehension: English for Communication (08 Periods)

- On Communication
- 3.1 Professional Development of Technicians
 - 3.2 Leadership and Supervision
 - 3.3 The Romance of Reading
 - 3.4 Sir C V Raman

Unit: 4 Professional Writing (14 Periods)

CV Writing, Covering Letter, Resume, Notices, Precis -Writing, Official Letters (Memo, Circular, Office Orders, Agenda, Minutes of Meeting, Report Writing, E-mail Drafting)

Unit: 5 Vocabulary and Grammar

(08 Periods)

5.1 Sentence and its Types

5.2 Parts of Speech

5.3 Tenses

5.4 Active and Passive Voice

5.5 Punctuation

5.6 One Word Substitution, Idioms and Phrases

LIST OF PRACTICALS

Unit-1 Listening skills

1.1 Introduction to listening process and practice

1.2 Listening to recorded lectures/speeches/poems/interviews and Dialogues

Unit 2 Introduction to phonetics

2.1 Sounds: consonants, vowels (Monophthongs and Diphthongs)

2.2 Transcription of words (IPA) syllable division and word stress

Unit 3 Speaking skills

3.1 Self and Peer introduction

3.2 Extempore-Just a minute session

3.3 Greeting and starting conversation

3.4 Leave taking

3.5 Wishing well

3.6 Talking about likes and dislikes

3.7 Asking questions-polite responses

3.8 Apologizing/forgiving

3.9 Complaining/Warning

4.0 Asking and giving information

4.1 Getting and giving Permission

4.2 Asking for and giving Opinion

4.3 Delivering formal speeches

4.4 Mock Interviews

4.5 Presentation

4.6 Conversation practices in various situations such as -asking address, enquiries at places like retail shop, service center, bank, customer care etc.

Unit 4 Building Vocabulary

4.1 Word Formation

4.2 Phrasal Verbs, Foreign Phrases, Jargons

4.3 Word Games such as crosswords, scrabble, quiz spell it etc. (To enhance self-expression and vocabulary of participants.)

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-semester and end-semester written tests
- Actual practical work, exercises and viva-voce
- Presentation and viva-voce

RECOMMENDED BOOKS

1. Communicating Effectively in English, Book-I by RevathiSrinivas; Abhishek Publications, Chandigarh.
2. Communication Techniques and Skills by R. K. Chadha; DhanpatRai Publications, New Delhi.
3. High School English Grammar and Composition by Wren & Martin; S. Chand & Company Ltd., Delhi.
4. Excellent General English-R.B.Varshnay, R.K. Bansal, Mittal Book Depot, Malhotra
5. The Functional aspects of Communication Skills – Dr. P. Prasad, S.K. Katria& Sons, New Delhi
6. Q. Skills for success – Level & Margaret Books, Oxford University Press.
7. E-books/e-tools/relevant software to be used as recommended by AICTE/UPBTE/NITTTR.
8. English for Communication (text Book Published by IRDT, Kanpur 1998).

Websites for Reference:

1. [http://www.mindtools.com/ page 8.html](http://www.mindtools.com/page 8.html) – 99k
2. <http://www.letstalk.com.in>
3. <http://www.englishlearning.com>
4. <http://learnenglish.britishcouncil.org/en/>
5. <http://swayam.gov.in>

SUGGESTED DISTRIBUTION OF MARKS

Unit No.	Time Allotted (Periods)	Marks Allotted (%)
1	8	20
2	4	10
3	8	20
4	14	30
5	8	20
Total	42	100

1.5 Engineering Graphics

L T P
- - 4

COURSE OBJECTIVES

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.

COURSE 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
- To make projections of Solid
- 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 basic commands of AutoCAD.

COURSE CONTENT

Unit – I Basic elements of Drawing

Introduction to drawing instruments, materials, layout and sizes of drawing sheets and drawing boards. Different types of lines as per BIS specifications Practice of vertical, horizontal and inclined lines, geometrical figures such as triangles, rectangles, circles, ellipses and curves, hexagonal, pentagon with the help of drawing instruments.

Common symbols and conventions of materials used in engineering.

Free hand and instrumental lettering (Alphabet and numerals) – Capital Letter, single stroke, vertical and inclined, series of 5, 8, 12 mm in the ratio of 7:4.

Dimensioning-

Necessity, method and principles, Dimensioning of overall sizes, circles, threaded holes, chamfered surfaces, angles, tapered surfaces, holes, equally spaced on P.C.D., counter sunk holes, counter bored holes, cylindrical parts, narrow spaces and gaps, radii, curves and arches Scales.

Scales –Needs & importance (theory), R.F., type of scales, and length of scale, drawing of plain and diagonal scales.

Unit – II Orthographic projections

Introduction, Projection of Points in different quadrant, Projection of Straight Line- parallel to both planes, perpendicular and inclined to reference plane, Projection of Plane – Different lamina like square, rectangular, triangular and circle inclined to one plane, parallel and perpendicular to another plane in 1st angle only, Three views of orthographic projection of different objects. Identification of surfaces.

Unit – III Projection of Solid and Sections

Definition and types of Solids, To make projections, sources, Top view, Front view and Side view of various types of Solid, Importance and salient features.

Drawing of full section, half section, partial or broken out sections, Off-set sections, revolved sections and removed sections, Convention sectional representation of various materials, conventional breaks for shafts, pipes, rectangular, square, angle, channel, rolled sections.

Unit – IV Isometric Projections

Introduction, Isometric scale and Natural scale, Isometric view and isometric projection, Illustrative problems related to objects containing lines, circles and arcs shape only.

Conversion of orthographic views into isometric view /projection.

Unit-V Introduction to Auto CAD

Basic introduction and operational instructions of various commands in AutoCAD. At least two sheets on AutoCAD of cube, cuboid, cone, pyramid, truncated cone and pyramid, sphere and combination of above solids.

Auto CAD drawing will be evaluated internally by sessional marks and not by final theory paper.

INSTRUCTIONAL STRATEGY

Teacher should show model of the component/part whose drawing is to be made. Emphasis should be given on cleanliness, dimensioning and layout of sheet. Focus should be on proper selection of drawing instruments and their proper use. The institute should procure AutoCAD or other engineering graphics software for practice in engineering drawings.

Teachers should undergo training in AutoCAD/Engineering Graphic. Separate labs for practice on AutoCAD should be established.

MEANS OF ASSESSMENT

- Sketches
- Drawing
- Use of software

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.

1.6 SPORTS AND YOGA

L T P

- - 2

COURSE OBJECTIVES

To make the students understand the importance of sound health and fitness principles as they relate to better health. To expose the students to a variety of physical and yogic activities aimed at stimulating their continued inquiry about Yoga, physical education, health and fitness. To create a safe, progressive, methodical and efficient activity based plan to enhance improvement and minimize risk of injury .To develop among students an appreciation of physical activity as a lifetime pursuit and a means to better health.

COURSE OUTCOMES:

On successful completion of the course the students will be able to:

- Practice Physical activities and Hatha Yoga focusing on yoga for strength, flexibility, and relaxation.
- Learn techniques for increasing concentration and decreasing anxiety which leads to stronger academic performance.
- Learn breathing exercises and healthy fitness activities
- Understand basic skills associated with yoga and physical activities including strength and flexibility, balance and coordination.
- Perform yoga movements in various combination and forms.
- Assess current personal fitness levels.
- Identify opportunities for participation in yoga and sports activities.
- Develop understanding of health-related fitness components: cardiorespiratory endurance, flexibility and body composition etc.
- Improve personal fitness through participation in sports and yogic activities.
- Develop understanding of psychological problems associated with the age and lifestyle.
- Demonstrate an understanding of sound nutritional practices as related to health and physical performance.
- Assess yoga activities in terms of fitness value.
- Identify and apply injury prevention principles related to yoga and physical fitness activities.
- Understand and correctly apply biomechanical and physiological principles related to exercise and training

COURSE CONTENT

1 Introduction to Physical Education

- Meaning & definition of Physical Education
- Aims & Objectives of Physical Education

2 Yoga

- Meaning & Importance of Yoga
- Elements of Yoga- Gyan Yoga, Bhakti Yoga, Karm Yoga, Hathyoga, Astang Yoga .

- Introduction - Asans, Pranayama, Meditation & Bandh , Mudra and shat Karm .
- Meaning of Practice of various Yogic Sukhasan, Vyayams
- Practice of Asans and Benefits – Sidhasana, Padmasana, Vajrasana, Shasakasan, Singhasan, Gomukhasan, Virasan, Dhanurasan, Matsnyendrasan, Gorakhasan, Paschimottansan, Mayurasan, Garunasan, Pawanmuktasan, Kurmasan, Mandukasan, Shalabhasan, Makrasan, Bhujangasan, Naukasan, Shavasan, Sharvangasans, Halasan.
- Practice and Benefits of Pranayamas – Anulom- Vilom, Surya Bhedhi, Ujjayi, Sheetkari, Bhastrika, Bharamri, Murchha, kewali etc .
- Practice of Meditation – Meaning of Meditation, Types , Techniques, Benefits .

3 Olympic Movement

- Olympic Symbols, Ideals, Objectives & Values
- Awards and Honours in the field of Sports in India (Dronacharya Award, Arjuna Award,
- Dhayanchand Award, Rajiv Gandhi Khel Ratna Award etc.)

4 Physical Fitness, Wellness & Lifestyle

- Meaning & Importance of Physical Fitness & Wellness
- Components of Physical fitness
- Concept of Positive Lifestyle

5 Yoga & Lifestyle

- Ideal life style
- Asans and pranayams a preventive measures
- Yoga and Immunity
- Concept of Yogic diet.
- **Life Style Diseases-** Yoga management of Diseases, Yoga management of Stress, Yoga management of Obesity, Yoga management of High Blood Pressure, Yoga management of Insomnia, Yoga management of Asthma, Yoga management of Joints Pains, Yoga management of Digestive Disorders .

6 Fundamentals of Anatomy & Physiology in Physical Education, Sports and Yoga

- Define Anatomy, Physiology & Its Importance
- Effect of exercise on the functioning of Various Body Systems.
- Circulatory System,
- Respiratory System,

7 Postures

- Meaning and Concept of Postures.
- Causes of Bad Posture.
- Advantages & disadvantages of weight training.

8 Training and Planning in Sports

- Meaning of Training
- Warming up and limbering down

9 Psychology & Sports

- Definition & Importance of Psychology in Physical Edu. & Sports
- Define & Differentiate Between Growth & Development

10 Doping

- Meaning and Concept of Doping

11 Sports Medicine

- First Aid – Definition, Aims & Objectives.
- Sports injuries: Classification, Causes & Prevention.

12 Sports / Games

Following sub topics related to any one Game/Sport of choice of student out of: Athletics, Badminton, Basketball, Chess, Cricket, Kabaddi, Lawn Tennis, Swimming, Table Tennis, Volleyball, Yoga etc.

- History of the Game/Sport.
- Specifications of Play Fields and Related Sports Equipment.
- Important Tournaments and Venues.

References:

1. Modern Trends and Physical Education by Prof. Ajmer Singh.
2. Light On Yoga By B.K.S. Iyengar.
3. Health and Physical Education – NCERT (11th and 12th Classes)

2.1 MATHEMATICS –II

L T P
3 1 -

COURSE OBJECTIVES

This course is designed to give a comprehensive coverage at an introductory level to the subject of matrices, integral calculus, coordinate geometry, basic elements of vector algebra and first order differential equations.

COURSE OUTCOMES

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

- Solve linear equations using determinants and matrix algebra.
- Perform integration techniques, solve area and volume problems.
- Solve first order differential equations and apply numerical methods.
- Form and interpret equations of lines, circles and conics.
- Perform vector operations and solve related engineering problems of relevant branch.

COURSE CONTENTS

UNIT - I: Determinants and Matrices

(10 periods)

Elementary properties of determinants upto 3rd order, consistency of equations, Cramer's rule. Algebra of matrices, inverse of a matrix, matrix inverse method to solve a system of linear equations in three variables.

UNIT - II: Integral Calculus

(12 periods)

Integration as inverse operation of differentiation. Simple integration by substitution, by parts and by partial fractions (for linear factors only). Introduction to definite integration. Use of formulae $\int_0^{\pi/2} \sin^n x dx$, $\int_0^{\pi/2} \cos^n x dx$, $\int_0^{\pi/2} \sin^m x \cos^n x dx$ for solving problems, where m and n are positive integers. Applications of integration for (i). Simple problems on evaluation of area bounded by a curve and axes. (ii). calculation of volume of a solid formed by revolution of an area about axes. (Simple problems).

UNIT-III: Differential Equations & Numerical Methods

(15 periods)

Definition of differential Equations, order and degree of a differential equation, formation of differential equations, solution of first order and first degree differential equations by variable separable method (simple problems). Trapezoidal rule, Simpson's 1/3 and Simpson's 3/8 rule and their applications in simple cases. MATLAB – Simple Introduction.

UNIT - IV: Two dimensional Co-Ordinate Geometry

(10 periods)

Equation of straight line in various standard forms (without proof), intersection of two straightlines, angle between two lines. Parallel and perpendicular lines, perpendicular distance formula.

General equation of a circle and its characteristics. To find the equation of a circle, given:

- i. Centre and radius,
- ii. Three points lying on it and

iii. Co-ordinates of end points of a diameter;

Definition of conics (Parabola, Ellipse, Hyperbola), their standard equations without proof. Problems on conics when their foci, directories or vertices are given.

UNIT - V: Vector Algebra

(9 periods)

Definition notation and rectangular resolution of a vector. Addition and subtraction of vectors. Scalar and vector product of two vectors. Simple problems related to work, moment and angular velocity.

INSTRUCTIONAL STRATEGY

The content of this course is to be taught on conceptual basis with plenty of real world examples. Differential equations and applications of differential equations can be taught with engineering applications of relevant branch.

MEANS OF ASSESSMENT

- Assignments and Quiz/Class Tests
- Mid-term and End-term Written Tests
- Model/Prototype Making

RECOMMENDED BOOKS

1. B.S. Grewal, Higher Engineering Mathematics, Khanna Publishers, New Delhi, 40th Edition, 2007.
2. G. B. Thomas, R. L. Finney, Calculus and Analytic Geometry, Addison Wesley, 9th Edition, 1995.
3. S.S. Sabharwal, Sunita Jain, Eagle Parkashan, Applied Mathematics, Vol. I & II, Jalandhar.
4. Comprehensive Mathematics, Vol. I & II by Laxmi Publications, Delhi.
5. Reena Garg & Chandrika Prasad, Advanced Engineering Mathematics, Khanna Publishing House, New Delhi

SUGGESTED DISTRIBUTION OF MARKS

Topic	Time Allotted (Periods)	Marks Allotted (%)
1.	10	20
2.	12	20
3.	15	25
4	10	20
5	9	15
Total	56	100

2.2 APPLIED PHYSICS – II

L T P
3 - 2

COURSE OBJECTIVES

Applied physics includes the study of a diversified topics related to 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 behave. Concrete knowledge of physical laws, analysis and applications in various fields of engineering and technology are given prominence in this 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 learn and appreciate these concepts and principles. In all contents, SI units should be followed.

COURSE OUTCOMES

After undergoing this subject, the student will be able to;

- Define wave motion its types (Transverse and Longitudinal), Periodic and Simple Harmonic Motion, solve simple problems.
- Define the terms: frequency, amplitude, wavelength, velocity of a wave.
- Explain various Engineering, Medical and Industrial applications of Ultrasonic.
- Define capacitance and its unit. They will be able to explain the function of capacitors in simple circuits, solve simple problems using $C=Q/V$
- Explain the role of free electrons in insulators, conductors and semiconductors, qualitatively the terms: potential, potential difference, electromotive force.
- Explain the concept of electric current, resistance and its measurement.
- List the effects of an electric current and their common applications, State and apply Ohm's law, calculate the equivalent resistance of a variety of resistor combinations.
- Explain Bio-Savart Law, Lorenz Force, Faraday's law.
- State the laws of electromagnetic induction, describe the effect on a current-carrying conductor when placed in a magnetic field
- Apply the knowledge of diodes in various electronic circuits. Apply the concept of light amplification in designing of various LASER based instruments and optical sources.
- Explain total internal reflection and apply this concept for optical fiber and its uses in Medical field and Communication.

COURSE CONTENTS

1. Oscillations and Wave motion

(06 periods)

- 1.1 Harmonic Motion, Oscillation, Definition of Simple Harmonic Motion (SHM),
- 1.2 Displacement equation $y = a \sin \omega t$ (without derivation), velocity, acceleration, time period, frequency in S.H.M., Energy of a body executing S. H. M.
- 1.3 Wave motion, transverse and longitudinal wave motion with examples.
- 1.4 Wave equation, phase, phase difference, wave length, wave velocity.
- 1.5 Ultrasonic – Introduction, properties and applications in engineering and medical applications.

2. Optics

(06 periods)

- 2.1 Basic optical laws - Reflection and Refraction, Refractive Index.
- 2.2 Critical angle, Total internal reflection (TIR) and conditions for total internal reflection,
- 2.3 Application of total internal reflection (List Only).

- 2.4 Dual nature of light (concept only): Wave and particle nature of light
2.5 Examples of Wave and particle nature of light (List Only).

3. Electrostatics

(06 periods)

- 3.1 Concept of charge, Quantization of charge, Coulombs law, Electric field of point charges
3.2 Electric lines of force and their properties, Electric flux, Gauss law of electrostatics (without derivation)
3.3 Electric potential and potential difference.
3.4 Capacitance and its units, Parallel plate Capacitor: Working principle and its Capacitance, Effect of Dielectric on capacitance.
3.5 Series and parallel combination of capacitors (numerical).

4. Current Electricity

(06 periods)

- 4.1 Electric Current and its unit, Ohm's law, Resistance and its units,
4.2 Factors affecting Resistance of a wire, Specific Resistance, Conductance, Specific Conductance,
4.3 Series and Parallel combination of Resistances.
4.4 Kirchhoff's laws (KCL and KVL), Wheatstone bridge: Construction and its balanced condition,
4.5 Measurement of an unknown resistance using Meter Bridge.

5. Electromagnetism

(06 periods)

- 5.1 Biot-Savart law for current carrying wire and Concept of Magnetic field (**B**) and its units.
5.2 Lorentz force (Force on moving charge in magnetic field), Force on current carrying conductor (Formula only).
5.3 Magnetic lines of forces and their properties, magnetic flux and its units.
5.4 Concept of electromagnetic induction, Faraday's Laws and Lenz's law.
5.5 Conversion of galvanometer into ammeter and voltmeter.

6. Semiconductor physics

(06 periods)

- 6.1 Classification of solids on the basis of Energy bands (Definition only): Insulator, Semi-conductor and Conductor.
6.2 Intrinsic and extrinsic semiconductors, P-type and N-type semiconductors.
6.3 PN junction diode and its biasing (Forward and Reverse Biasing).
6.4 Some application of semiconductor diodes (list only)
6.5 Construction of PNP and NPN transistors and some electronic applications (list only)

7. Modern Physics

(06 Periods)

- 7.1 Ground, Excited and Metastable energy levels of atom,
7.2 Spontaneous and stimulated emission, population inversion, pumping, Laser and its characteristics
7.3 Ruby laser and He-Ne laser, Engineering and medical applications of lasers.
7.4 Introduction to optical fibers, light propagation, acceptance angle and numerical aperture (without derivation).
7.5 Applications of optical fibers in telecommunication, medical and sensors.

LIST OF PRACTICALS (To perform minimum six experiments)

1. To determine the velocity of sound with the help of resonance tube.
2. To verify the laws of reflection from a plane mirror / interface.
3. To verify the laws of refraction (Snell's law) using a glass slab.
4. To determine the focal length and magnifying power of a convex lens.
5. To verify laws of resistances in series and parallel combination.

6. To verify ohm's laws by drawing a graph between voltage and current.
7. To measure very low resistance and very high resistances using Slide Wire bridge
8. Conversion of Galvanometer into an Ammeter and Voltmeter of given range.
9. To draw characteristics of a PN junction diode and determine knee and break down voltages.
10. To verify the Kirchoff's Law using electric circuit.
11. To find numerical aperture of an optical fiber.
12. To draw magnetic field lines due to bar magnet using magnetic compass.

INSTRUCTIONAL STRATEGY

Teacher may use various teaching aids like live models, charts, graphs and experimental kits etc. for imparting effective instructions in the subject. The teacher should explain about field applications before teaching the basics to develop proper understanding of the physical phenomenon. Use of demonstration and animations can make the subject interesting and may develop scientific temper in the students. Teacher must plan a tour of Science Park/planetarium available in nearby areas in order to enhance the interest in this course.

MEANS OF ASSESSMENT

- Assignment & Quiz
- Mid-Term and End-Term written test
- Model Making
- Actual Lab & Practical Work
- Viva-Voice

RECOMMENDED BOOKS

1. Text Book of Physics (Part-I, Part-II); N.C.E.R.T., Delhi
2. Concepts in Physics by HC Verma, Vol. I & II, Bharti Bhawan Ltd. New Delhi
3. A Text Book of Optics, Subramanian and Brij Lal, S Chand & Co., New Delhi
4. Practical Physics, by C. L. Arora, S Chand publications
5. Engineering Physics by PV Naik, Pearson Education Pvt. Ltd, New Delhi
6. Modern Engineering Physics by SL Gupta, Sanjeev Gupta, Dhanpat Rai Publications.
7. Physics Volume 2, 5th edition, Haliday Resnick and Krane, Wiley publication
8. Fundamentals of Physics by Haliday, Resnick & Walker 7th edition, Wiley publication

SUGGESTED DISTRIBUTION OF MARKS

Topic No.	Time Allotted (Periods)	Marks Allotted (%)
1	06	15
2	06	14
3	06	15
4	06	14
5	06	14
6	06	14
7	06	14
Total	42	100

2.3 INTRODUCTION TO IT SYSTEMS

L T P
2 - 4

COURSE OBJECTIVES

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., form the broad competency profile of diploma holders. This exposure will enable the students to enter their professions with confidence, live in a harmonious way and contribute to the productivity.

Note:

Explanation of Introductory part should be demonstrated with practical work. Following topics may be explained in the laboratory along with the practical exercises.

COURSE 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, scan, 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.
- Use online office tools (Google suits)

COURSE CONTENTS

1. Introduction to Computers and Peripherals. (05 Periods)

Introduction, Computer Generations, Components of Computer, Types of Computer, CPU, RAM, ROM, Hard disk, USB, Flash drive, Keyboard, Mouse, display devices, Printer, Scanner, Modem, Sound Cards, Speakers, CMOS battery, Sharing of Printers.

1. Operating System and Application Software (06 Periods)

System Software, Application Software, Virtualization Software, Utility Software, MS Office/Open Office/LibreOffice, Working with windows OS, Desktop components, Menu bars, creating shortcut of program. Installation of Application software's, Antivirus and Drivers.

2. Office Tools: MS Office/Open Office/ Libre Office (06 Periods)

Creation of document, spreadsheets and presentation, Google Suits (Google drive, google sheet, google doc, google presentation)

3. Internet (06 Periods)

Network topologies, Basics of Networking,– LAN,MAN, WAN, Connecting Devices(Bridge, Switch, Router, Gateway),Wi-Fi technologies, Concept of IP Address, DNS, Search Engines, e-mail, Web Browsing.

4. Basics of Information Security (05 Periods)

Introduction to security, Security threats: detection and prevention, Indian Cyber laws.

LIST OF PRACTICAL EXERCISES

1. Identify various components, peripherals of computer and list their functions.
2. Installation of operating system. (windows/linux/others)
3. Installation of various application software and peripheral drivers.
4. Creation and Management of files and folders (Rename, delete, search)
5. Installation of Antivirus and remove virus.
6. Scanning and printing documents.
7. Browsing, Downloading, Information using Internet.
8. E-Mail ID creation, composing, sending and receiving e-mail. Attaching a file with e- mail message.
9. Word Processing (MS Office/Open Office) File Management, Editing documents, Mail Merge, Security etc.

10. Spread Sheet Processing (MS Office/Open Office/Libre Office) Addition, deletion, formulation, Security etc.
11. PowerPoint Presentation (MS Office/Open Office/Libre Office) Preparing Slides, customization, animation, Security etc.
12. Google Suite.

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/Libre office/Google Suite in addition to working on internet. The student should be made capable of working on computers independently.

MEANS OF ASSESSMENT

- Class Tests/Quiz
- Software Installation and Use
- Viva-Voce
- Presentation

RECOMMENDED BOOKS

1. Fundamentals of Computer by V Rajaraman; Prentice Hall of India Pvt. Ltd., New Delhi
2. Information Technology for Management by Henery Lucas, Tata McGraw Hills, New Delhi
3. Computers Fundamentals Architecture and Organisation by B Ram, revised Edition, New Age International Publishers, New Delhi
4. Computers Today by SK Basandara, Galgotia publication Pvt Ltd. Daryaganj, New Delhi.
5. Internet for Every One by Alexis Leon and Mathews Leon; Vikas Publishing House Pvt. Ltd., Jungpura, New Delhi.
6. A First Course in Computer by Sanjay Saxena; Vikas Publishing House Pvt. Ltd., Jungpura, New Delhi
7. Computer Fundamentals by PK Sinha; BPB Publication, New Delhi
8. Fundamentals of Information Technology by Leon and Leon; Vikas Publishing House Pvt. Ltd., Jungpura, New Delhi
9. On Your Marks - Net...Set...Go... Surviving in an e-world by Anushka Wirasinha, Prentice Hall of India Pvt. Ltd., New Delhi
10. Fundamentals of Information Technology by Vipin Arora, Eagle Parkashan, Jalandhar

Reference websites

1. www.tutorialspoint.com
2. www.sf.net
3. Gsuite.google.com
4. Spoken-tutorial.org
5. Swayam.gov.in

SUGGESTED DISTRIBUTION OF MARKS

Topic No.	Time Allotted (Periods)	Marks Allotted (%)
1	5	18
2	6	21
3	6	22
4	6	21
5	5	18
Total	28	100

2.4 FUNDAMENTALS OF ELECTRICAL AND ELECTRONICS ENGINEERING

L T P
3 - 2

COURSE OBJECTIVES

To learn basic concepts of various active and passive electronic components, signals, measuring instruments, digital electronics, electric and magnetic circuits, ac circuits, transformer, motors and their applications. To help the students deal with the electrical and electronics engineering principles and applications in industrial processes of different fields.

COURSE OUTCOMES

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

- Understand and identify key electronic components and their applications.
- Use and understand basic electrical measuring instruments.
- Grasp the fundamentals of logic gates, Boolean algebra, and digital circuits.
- Understand basic concepts of electric and magnetic circuits.
- Analyze A.C. circuits and understand phase relationships and power calculations.
- Understand the principles and applications of transformers and electrical machines.

COURSE CONTENTS

UNIT- I Overview of electronic components:

(09 Periods)

Active and Passive components, Resistor, Capacitor, Inductor and their types. Introduction to semi-conductor, Intrinsic and Extrinsic semi-conductors, P-N Junction diode - forward and reverse bias; introduction of Bipolar Junction Transistor; FET and MOSFET (brief idea only).

UNIT- II Basic measuring instruments:

(05 Periods)

Basic concept of Ideal and non-ideal voltage and current sources, ammeter, voltmeter, wattmeter and digital multimeter, CRO (Block diagram, working and its uses).

UNIT –III Overview of Digital Electronics:**(7 Periods)**

Analog and digital signal, advantages of digital system. number system and its conversion (Decimal, binary ,octal ,hexadecimal) , Boolean Algebra, Logic Gates-Truth Table and Symbol of AND, OR, NOT, NAND, NOR, ExOR, ExNOR Gates.

Unit -IV Electric and Magnetic Circuits:**(7 Periods)**

Definitions of basic terms, such as Current, Resistance, EMF, Potential Difference, Power and Energy, Ohm's Law and its limitation, Kirchhoff's laws; M.M.F, magnetic force, flux, permeability, reluctance, BH curve, hysteresis loop; Electromagnetic induction, Faraday's laws of electromagnetic induction, Lenz's law; Dynamically and Statically induced emf; concept of self and mutual inductance.

Unit -V A.C. Circuits:**(7 Periods)**

Cycle, Frequency, Periodic time, Amplitude, Angular velocity, RMS value, Average value, Form Factor Peak Factor, impedance, phase angle, and power factor; Mathematical and phasor representation of alternating emf and current; A.C in pure resistors, pure inductors and pure capacitors; Power in A.C. Circuit, power triangle; Introduction of poly phase system and comparison with single phase system.

Unit -VI Transformers and Machines:**(7 Periods)**

Single phase transformer: General construction, working principle, types, EMF equation, transformation ratio; Brief idea of Auto transformer.

DC machines: Types, EMF equation of motor.

Single Phase Induction Motor: Principle of operation and introduction to methods of starting.

Three Phase Induction Motor: Principle of operation.

INSTRUCTIONAL STRATEGY

The instructional strategy combines lectures, demonstrations, and hands-on labs. Lectures will cover key concepts, while demonstrations will illustrate component functions and instrument operations. Hands-on labs will provide practical experience with electronic components and measuring instruments. Interactive quizzes and problem-solving sessions will reinforce and assess understanding, ensuring practical application of theoretical knowledge.

MEANS OF ASSESSMENT

- Assignment & Quiz
- Lab & Practical Work
- Viva-Voice

List of Practicals:- (8 practical to be performed)

1. Identify various passive and active electronic components in the given circuit.
2. Determine the value of given resistor using digital multi-meter to confirm with color code.
3. Exercise of soldering and de-soldering of components in circuits.
4. To measure frequency, time period and amplitude of a sinusoidal signal using CRO.
5. To measure voltage and current using digital multi-meter.
6. To verify the truth tables for all logic gates – NOT, OR, AND, NAND, NOR, XOR, XNOR
7. Verify the Kirchhoff's laws.
8. Measure voltage, current and power in 1-phase circuit with resistive load.
9. Verify the ohms law.
10. Use of voltmeter, ammeter, and watt-meter.
11. Connect resistors in series and parallel combination on bread board and measure its value using digital multi-meter.
12. Connect capacitors in series and parallel combination on bread board and measure its value using multi-meter.

REFERENCE BOOKS –

1. Ritu Sahdev, Basic Electrical Engineering, Khanna Publishing House.
2. Mittle and Mittal, Basic Electrical Engineering, McGraw Education, New Delhi, 2015, ISBN: 978-0-07-0088572-5.
3. Saxena, S. B. Lal, Fundamentals of Electrical Engineering, Cambridge University Press, latest edition, ISBN: 9781107464353.
4. Theraja, B. L., Electrical Technology Vol – I, S. Chand Publications, New Delhi, 2015, ISBN: 9788121924405.
5. Theraja, B. L., Electrical Technology Vol – II, S. Chand Publications, New Delhi, 2015, ISBN: 9788121924375.
6. Jegathesan, V., Basic Electrical and Electronics Engineering, Wiley India, New Delhi, 2015, ISBN: 97881236529513.
7. Sedha, R.S., A Textbook of Applied Electronics, S. Chand, New Delhi, 2008, ISBN-13: 978-8121927833.
8. Malvino, Albert Paul, David, Electronics Principles, McGraw Hill Education, New Delhi, 2015, ISBN-13: 0070634244-978.
9. Mehta, V.K., Mehta, Rohit, Principles of Electronics, S. Chand and Company, New Delhi, 2014, ISBN-13: 9788121924504.
10. Bell, David, Fundamentals of Electronic Devices and Circuits, Oxford University Press, New Delhi, 2015, ISBN: 9780195425239.

SUGGESTED DISTRIBUTION OF MARKS

Topic No.	Time Allotted (Periods)	Marks Allotted (%)
1	09	20
2	05	10
3	07	15
4	07	18
5	07	18
6	07	19
Total	42	100

2.5 ENGINEERING MECHANICS

L T P
2 1 2

COURSE OBJECTIVES

The course provides a foundational understanding of mechanics, covering force systems, equilibrium, and beam analysis under different loads. It explores friction and its applications, centroids and moments of inertia for various shapes, and the principles and applications of simple lifting machines.

COURSE OUTCOMES

After completing this course, student will be able to:

1. Identify the force systems for given conditions by applying the basics of mechanics.
2. Determine unknown force(s) of different engineering systems.
3. Apply the principles of friction in various conditions for useful purposes.
4. Find the centroid and centre of gravity of various components in engineering systems.
5. Select the relevant simple lifting machine(s) for given purposes.

COURSE CONTENTS

Unit – I Introduction to Engineering Mechanics and Force System : (08 Periods)

Basic Concept and definitions, Law of Mechanics (Newton's Laws), Classification: Statics and Dynamics.

Principle of transmissibility of forces, System of forces and its classification, Moment of Force and couple, Resolution of force- Orthogonal component of force, Varignon's theorem, Composition of forces- Analytical method for determination of resultant for concurrent, non- concurrent and parallel co- planar force systems- Law of triangle, parallelogram and polygon of forces.

Unit– II Equilibrium of Forces and Concept of Beam: (10 Periods)

Condition of equilibrium, free body diagram (FBD), equilibrium of coplanar concurrent and non-concurrent forces, Lami's Theorem- statement and explanation, application for various engineering problems.

Beam- Types of beam, supports (simple, hinged, roller and fixed) and loads acting on beam (Vertical and inclined point load, uniformly distributed load, couple). Beam reaction for cantilever, simply supported beam with or without overhang subjected to combination of point load and uniformly distributed load.

Unit– III Friction :

(06 Periods)

Introduction , types and Laws of friction, Co-efficient of friction, angle of friction, angle of repose, cone of friction, equilibrium of bodies on horizontal surface (force parallel and inclined to the plane) and inclined plane (force parallel to the plane only).

Unit– IV Centroid and Moment of Inertia :

(10 Periods)

Concept, definition and determination of Centroid of plain figures (square, rectangle, triangle, circle, semi-circle, quarter circle) and Centre of gravity of symmetrical solid bodies (Cube, cuboid, cone, cylinder, sphere, hemisphere).

Concept of moment of inertia, Perpendicular axis theorem and Parallel axis theorem. Concept of second moment of area (Rectangle, Triangle and circle) and composite section (L,T &I).

Unit – V Simple Machines :

(08 Periods)

Definition and types, mechanical advantage, velocity ratio. Application and efficiency of simple machines, Law of Machines, Ideal machine, reversible and irreversible machine.

System of pulleys (first, second, third system of pulleys) determination of velocity ratio, mechanical advantage and efficiency. Working Principle and application of : wheel and axel, simple screw jack, Worm and worm wheel, single and double winch Crab.

List of Practical (A minimum of eight practicals must be performed)

1. Verification of parallelogram law of forces.
2. Verification of triangle and polygon law of forces.
3. To find the Resultant of coplanar concurrent forces using force table.
4. Study of forces in various members of jib crane.
5. Determine reaction forces for simply supported beam.
6. Determine the coefficient of friction on horizontal and inclined plane.
7. Study of Ladder friction (analyze condition for equilibrium)
8. Determine the centroid of a composite lamina (Graphical and Analytical methods).
9. Determine moment of inertia of flywheel or physical pendulum or torsional pendulum.
10. To find the mechanical advantage, velocity ratio and efficiency for Screw Jack.
11. To find the mechanical advantage, velocity ratio and efficiency for Wheel and axel.
12. Derive Law of machine using Worm and Worm wheel.

INSTRUCTIONAL STRATEGY

The instructional strategy includes lectures, visual aids, and interactive examples for key mechanics concepts and force systems, along with problem-solving sessions. Equilibrium concepts are taught with practical demonstrations and hands-on beam analysis. Friction is explored through case studies and practical demonstrations, followed by exercises. Centroid and moment of inertia are covered with visual aids and practical tasks. Simple lifting machines are introduced through lectures and demonstrations, with problem-solving on mechanical advantage and efficiency.

MEANS OF ASSESSMENT

- Assignment & Quiz
- Lab & Practical Work
- Viva-Voice

RECOMMENDED BOOKS :

1. D.S. Bedi, Engineering Mechanics, Khanna Publications, New Delhi (2008)
2. Khurmi, R.S., Applied Mechanics, S. Chand & Co. New Delhi.
3. Bansal R K, A text book of Engineering Mechanics, Laxmi Publications.
4. Ramamrutham, Engineering Mechanics, S. Chand & Co. New Delhi.
5. Dhade, Jamadar & Walawelkar, Fundamental of Applied Mechanics, Pune Vidhyarthi Gruh.
6. Ram, H. D.; Chauhan, A. K., Foundations and Applications of Applied Mechanics, Cambridge University Press.
7. Meriam, J. L., Kraige, L.G., Engineering Mechanics- Statics, Vol. I, Wiley Publication, New Delhi.
8. Bhavikatti S.S., Engineering Mechanics, New Age International Publishers

SUGGESTED DISTRIBUTION OF MARKS

Topic No.	Time Allotted (Periods)	Marks Allotted (%)
1	08	20
2	10	25
3	06	10
4	10	25
5	08	20
Total	42	100

2.6 ENGINEERING WORKSHOP PRACTICE

L T P
- - 4

COURSE OBJECTIVES

The course aims to provide hands-on experience and practical skills in various essential workshops, including carpentry, fitting, welding, sheet metal, plumbing, and painting and polishing. Students will gain proficiency in using different tools and machines, understanding and executing various processes and operations, and completing multiple jobs that involve intricate tasks. This practical knowledge will equip students with the necessary skills to handle real-world tasks efficiently, fostering a deeper understanding of the techniques and safety measures required in each shop.

COURSE OUTCOMES

At the end of the course, the student will be able to:

1. Acquire skills in basic engineering practice to identify, select and use various marking, measuring, and holding, striking, and cutting tools & equipment's and machines
2. Explain job drawing and complete jobs as per specifications in allotted time
3. Inspect the job for the desired dimensions and shape
4. Operate, control different machines and equipment's adopting safety practices

DETAILS OF PRACTICAL CONTENTS

1. CARPENTRY SHOP

- 1.1. Demonstration of different wood working tools / machines.
- 1.2. Demonstration of different wood working processes, like planing, marking, chiselling, grooving, turning of wood etc.
- 1.3. Three jobs involving joint like mortise and tenon, dovetail, bridle, and half lap.

2. FITTING SHOP

- 2.1. Demonstration of different fitting tools and drilling machines and power tools
- 2.2. Demonstration of different operations like filing, drilling, tapping, sawing, cutting etc.
- 2.3. Three fitting job involving practice of cutting, chipping, filing, marking, hacksawing, drilling, tapping, etc.

3. WELDING SHOP

- 3.1. Demonstration of different welding tools/machines.
- 3.2. Demonstration on Arc Welding, Gas Welding, MIG welding, gas cutting and rebuilding of broken parts with welding.
- 3.3. Two simple job involving butt and lap joint and T. Joint using electric arc welding.

4. SHEET METAL SHOP

- 4.1. Demonstration of different sheet metal tools/machines.
- 4.2. Demonstration of different sheet metal operations like sheet cutting, bending, edging, end curling, lancing, soldering, brazing, and riveting.
- 4.3. Three simple job involving sheet metal operations, soldering, and riveting.
- 4.4. Jobs
 - 4.4.1. Cutting Practices
 - 4.4.2. Single / Double Seam Joint
 - 4.4.3. Cylinders

5. PLUMBING SHOP

- 5.1. Demonstration of different plumbing tools, accessories, valves and different pipe fittings and joints (GI and PVC).
- 5.2. Demonstration of different plumbing operations like cutting, threading, pipe fitting (GI and PVC).
- 5.3 One simple job involving pipe cutting and external thread cutting on GI pipe.

6. PAINTING AND POLISHING SHOP

- 6.1. Introduction of paints, Varnishes, Reason for Surface preparation, Advantage of painting, other method of surface coating i.e. Electroplating etc.
- 6.2. Jobs
 - 6.2.1. To prepare a wooden surface for painting apply primer on side and to paint in the same side.
 - 6.2.2. To prepare metal surface for painting, apply primer and paint on same side.
 - 6.2.3. To Prepare a metal surface for spray painting. First spray primer and paint the same by spray gun and compressor system.

REFERENCES:

- 1. S.K. Hajara Chaudhary, Workshop Technology, Media Promoters and Publishers, New Delhi, 2015
- 2. B.S. Raghuwanshi, Workshop Technology, Dhanpat Rai and sons, New Delhi 2014
- 3. J.P. Bhati, Engineering Workshop, C.B.H. Publication, Jaipur.
- 4. K. Venkat Reddy, Workshop Practice Manual, BS Publications, Hyderabad 2014
- 5. Kents Mechanical Engineering Hand book, John Wiley and Sons, New York
- 6. Roop Lal and Bharadwaj P. K., Prarambhik KaryashalaTakneeki (Hindi), Vayu Education of India, New Delhi

2.7 ENVIRONMENTAL SCIENCE

L T P

3 - -

COURSE OBJECTIVES:

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. He should know the concept of hazards and disaster management.

COURSE OUTCOMES:

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

- Comprehend the importance of ecosystem and sustainable development.
- Demonstrate interdisciplinary nature of environmental issues
- Identify different types of environmental pollution and control measures.
- Explain environmental legislation acts.
- Demonstrate positive attitude towards judicious use of energy and environmental protection
- Practice energy efficient techniques in day-to-day life and industrial processes.
- Analyze the impact of human activities on the environment
- Understand the basic concept of disaster and hazards.
- Analyze the impact of disaster on various social components.

COURSE CONTENT

1. Introduction (06 Periods)

Basics of ecology, eco system- concept, and sustainable development, Resources renewable and non-renewable. Global Warming, Climate change and its impact, Green House Effect, Acid Rain, Concept of Green Building, Ground water management.

2. Air Pollution and Noise pollution (08 Periods)

Source of air pollution. Effect of air pollution on human health, economy, plant, animals. Air Pollution Control Methods. Introduction to Air Pollution and its Prevention and Control Act 1981 & Environmental Protection Act 1986 and Function of State pollution control board and National Green Tribunal (NGT).

Source of noise pollution, Unit of noise, Effect of noise pollution, Acceptable noise level, Different method of minimize noise pollution.

3. Water Pollution and Soil Pollution (11 Periods)

Impurities in water, Cause of water pollution, Source of water pollution. Effect of water pollution on human health, Turbidity, pH, total suspended solids, total dissolved solids, Concept of dissolved O₂, BOD, COD. Prevention of water pollution. Introduction to Water (Prevention and Control of Pollution) Act 1974. Concept of rain water harvesting system.

Sources of soil pollution, Types of Solid waste- House hold, Hospital, From Agriculture,

Biomedical, Animal waste and human waste, sediments and E-waste, Plastic Waste .
Effect of Solid waste, Disposal of Solid Waste- Solid Waste Management.

4. Disaster Causes and Hazards (6 Periods)

4.1 Introduction

4.2 Classification of Natural Disasters

4.3 Classification of Natural Disasters in India

- Earthquake
- Tsunami
- Flood
- Drought
- Land Slide
- Thunderstorm and Lightning

5 Disaster Management (11 Periods)

5.1 Framework

- Yokohama Strategy for a Safer World (1999)
- The Hyogo Framework for Action (HFA) (2005-2015)
- Sendai Framework for Action (SDGS) (2015-2030)

5.2 Disaster Management, Preparedness and Response in India

- National Disaster Management Authority (NDMA) Guidelines
- National Policy on Disaster Management (2009)
- National Disaster Management Act (2005)
- NDRF (National Disaster Response Force), SDRF (State Disaster Response Force), DDRF (District Disaster Response Force), and Aapda Mitra.
- Case studies of disaster management efforts: COVID-19 Pandemic, Earthquakes, Firefighting, Thunder Storm, and Lightning.

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 DeepPublications, 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 ErachBharucha; University Press (India) Private Ltd., Hyderabad.
7. Environmental Engineering and Management by Suresh K Dhamija; S K Kataria and Sons, New Delhi.
8. E-books/e-tools/relevant software to be used as recommended by AICTE/BTE/NITTTR, Chandigarh.
9. Disaster Management Second Edition AICTE Recommended by S C Sharma, Khanna Publishers
10. Bharat Bhautik Paryavaran Class 11, By NCERT.
11. Apda Avem Apda Prabhandhan | आपदा और आपदा प्रबंधन | Mahesh Kumar Barnwal | Cosmos Publication.
12. S.C. Sharma & M.P. Poonia, Environmental Studies, Khanna publishing House, New Delhi

Websites for Reference:

- <http://swayam.gov.in>
- <https://www.amazon.in/Prabhandhan>
- <https://ncert.nic.in/textbook.php?khgy1=0-6>
- <https://rb.gy/yergl>

SUGGESTED DISTRIBUTION OF MARKS

Topic No.	Time Allotted (Periods)	Marks Allotted (%)
1	6	15
2	8	20
3	11	25
4	6	15
5	11	25
Total	42	100

4- Recourse Requirement

A- LIST OF EQUIPMENT

APPLIED PHYSICS LABORATORY				
Sr. No.	Description	Qty	Approx. Price (Rs)	Total
1.	Vernier calipers Working length 160 mm, Internal and external dia with locking arrangement	12		3,000
2.	Screw Gauges Working length 15 mm, pitch 0.5 mm, least count .005 mm	12		3,000
3.	Spherometers Distance between legs 2.5 mm, pitch 0.5 mm, least count .005 mm.	12		3,000
4.	Mirrors (convex, concave and plane)	5 Each		1,500
5.	Pendulum Setup	03		6,000
6.	Gravesand's Apparatus	02		4,000
7.	Double Inclined Plane Setup	02		4,000
8.	D type Galvanometers Sensitivity: 20 microamperes per scale division,	10		10,000
9.	Resistance boxes (dial type) assorted	03		3,000
10.	Rheostats	02		1,000
11.	Stoke's Apparatus with all accessories	2		10,000
12.	Resonance Tube Apparatus with accessories and Tuning fork set	2		14,000
13.	Ohmic resistance coil	10		5,00
14.	Slide wire bridge with all accessories	2		8,000
15.	PN Junction diode Apparatus kit	2		10,000
16.	Numerical aperture setup	1		25,000
17.	Ohms law setup kit	2		4,000
18.	Series and parallel resistance combination kit	2		4,000
19.	Hooks law setup with pan and weights	2		3,000
20.	Optical bench with all accessories (setup) (with three holder in each setup)	2		7,000
21.	Mercury Thermometer measuring room temperature (range 0°C to 100°C)	5		3,000
22.	Coefficient of friction apparatus setup with pan and weights	2		4400
23.	Kirchhoff's law setup	2		5,000
24.	Miscellaneous (glycerin, glass slab for Snell's law, convex lens, optical fiber, bar magnet, compass needle, carbon composition resistors as per requirement .	LS		25,000
25	Digital Multimeter (AC & DC current & Voltage can be measured, resistance & capacitance can be measured .	05		10,000

APPLIED CHEMISTRY LABORATORY

Sr. No.	Description	Qty	Approx. Per Unit Price (Rs)
1.	Digital Balance	1	85,000
2.	Burette 50ml	30	250
3.	Pipette 25ml	60	200
4.	Beakers 100ml	60	200
5.	Burette stand	30	1,000
6.	Glazed tile	30	30
7.	Conical flask 50ml (Titration flask)	60	200
8.	Standard measuring flask 250/100ml	30	300
9.	Able's Flash Point apparatus	2	8,000
10.	(1/10) ^o C thermometer	06	1,000
11.	Candles	20	5
12.	Crucible with lid	06	700
13.	Muffle furnace	1	25,000
14.	Desiccator	06	3,000
15.	Pair of tongue (small and big)	24 (small) 2 (big)	150 200
16.	Digital hot plate with magnetic stirrer	2	17,000
17.	Conductivity meter with electrode	1	5,000
18.	Photo colorimeter	1	10,000
19.	Bomb calorimeter	1	1,30,000

20.	Ammeter (0-500mA)	5	800
21.	Rheostat (200ohm, 1A)	1	1,000
22.	Cuvette	20	800
23.	Copper electrode	1	6,500
24.	Salt bridge tube	5	800
25.	Zinc rod	1	1,000
26.	Voltmeter (0-12V)	1	700
27.	DC variable voltage source(0-30V)	1	8,000
28.	Chemicals - EDTA-1 kg - Eriochrome Black-T(solochrome black T)-200g - Buffer solution (NH ₃ - 2.5 ltr, NH ₄ Cl – 1 kg) - Zinc sulphate- 1kg - H ₂ SO ₄ - 2.5 ltr - Phenolphthalein indicator (as per requirement) - Methyl orange indicator (as per requirement) - Charcoal (as per requirement) - Kerosene (as per requirement) - KCl & agar-agar - Distilled water (as per requirement) - Cement - Ferrous ammonium sulphate - 40%Ammonium thiocyanate - Fuels(solid & Liquid) - Oxalic acid - Copper sulphate - NaOH - KMnO ₄ , Na ₂ CO ₃ , KOH, 2-Propanol - Hematite ore, copper pyrite ore - Hypo(Na ₂ S ₂ O ₃) , 10% KI, CH ₃ COOH	LS	40,000
29.	Miscellaneous	LS	10,000

COMMUNICATION LAB

Sr. No.	Description	Qty	Approx. Total Price (Rs)
1.	Stools	40	10,000
2.	Display Board/Screen	2	6,000
3.	Sound recording and playing system	1	6,000
4.	Audio cassettes	60	2,000
5.	Overhead Projector	1	5,000
6.	Transparencies slides	100	500
7.	TV, VCR and camera for video recording	1 each	20,000
8.	English spoken course	1	2,000
9.	A Quiz room equipped with two way audio system, back projection system and slide projector	1	30,000
10.	Miscellaneous	LS	1,500

ENGINEERING WORKSHOP PRACTICE

S.No.	Description	Qty.	Approx. Total price (Rs.)
CARPENTRY SHOP			
1.	Work benches fitted with 4 carpenter vices 9"	5	60,000
2.	Circular saw grinder	1	6,000
3.	Wood cutting band saw-vertical	1	10,000
4.	Bench grinder	1	5,000
5.	Bench drilling machine with different drill bits	1	8,500
6.	Wood turning lathe machine	1	40,000
7.	Wood planner	1	20,000
8.	Tool accessories measuring and marking instruments	25	25,000
9.	Band saw blade brazing unit	1	10,000
10.	Miscellaneous	LS	1,500

PAINTING AND POLISHING SHOP			
1	Spray gun 1 Ltr. cup capacity with hose pipe	1	3,000
2	Paint brushes & rollers	20	3,000
3	Paint/varnish	LS	2,000
4	Air compressor with 2 hp motor	1 set	21,000
5	Miscellaneous	LS	2,000
WELDING SHOP			
1.	Electrical welding transformer set with accessories	3	30,000
2.	Gas cutting unit	1	3,000
3.	Work benches with vices	3	5,000
4.	Portable welding machine (220 amp)	1	9,000
5.	Oxy acetylene welding set with accessories	1	7,000
6.	Acetylene generating set	1	6,000
7.	Electric welder tool kit	10	10,000
8.	Projection welding machine	1	15,000
9.	Brazing equipment with accessories	1	10,000
10.	Soldering irons	3	1,000
11.	Pedestal grinder	1	3,000
12.	Angle grinder	1	3,000
13.	Metal spraying gun	1	10,000
14.	Spot welding machine	1	25,000
15.	Tig welding set	1	1,00,000
16.	Mig welding set	1	1,00,000
17.	Welding partition screen	5	2,500
18.	Miscellaneous	LS	3,000

FITTING AND PLUMBING SHOP			
1.	Work benches with vices (4 vices on each bench)	5	60,000
2.	Marking tables with scribes	4	24,000
3.	Surface plates	5	20,000
4.	Accessories like calipers, v blocks, height, gauges steel rules and scribes	25	50,000
5.	Tool kits — taps, dies, drills, number punch, letter punch	25	40,000
6.	Tool kits — chisels, hammers, files, hacksaw	25	25,000
7.	Bench drilling machine 3 phase	1	10,000
8.	Hand drill machine	1	5,000
9.	Pipe vice	2	10,000
10.	Chain wrenches	2	2,000
11.	Bench grinder	1	6,500
12.	Ring spanner set	5	600
13.	Pipe die set 2"	2 set	2,000
14.	Pipe bending device	1	5,000
15.	Various plumbing fittings	LS	2,000
16.	Miscellaneous	LS	1,500
SHEET METAL SHOP			
1.	Hammers	8	3,000
2.	Mallets (hard & soft)	5	2,000
3.	Sheet and wire gauges	2	8,000
4.	Hand shearing machine	1	20,000
5.	Bar folding machine	1	20,000
6.	Burring machine	1	10,000
7.	Various sheet (black plain, galvanized iron)	1 Each	1,000
8.	Hand shears/snippers	4	2,000
9.	Nuts, bolts, rivets, screw	LS	1,000
10.	Miscellaneous	LS	2,000

INTRODUCTION TO IT SYSTEMS LAB /COMPUTER LAB

S.N.	Name of Equipment	No. of Equipment	Approx. Total Price
1	Computer System with latest configuration	30	21,00,000
2	Printer (MFP)	1	25,000
3	Printer (Laser)	1	35,000
4	Antivirus Software	LS	10,000
5	Internet Facility on Computers	LS	2,00,000
6	LCD Projector	1	70,000
7	UPS	30	60,000
8	Software (latest MS Office, Others) A4,A3 Size	1	1,00,000
9	Scanner (A4,A3 Size)	1	10,000

Fundamentals of Electrical and Electronics Engineering Lab

S.N.	Instruments	Quantity	Approx. unit price (Rs.)
1	Voltmeter	6	3000
2	Ammeter	6	3000
3	Wattmeter	6	4000
4	Single Phase Transformer	1	10000
5	Single Phase Variac	1	4000
6	Resistive Load	1	4000
7	Digital Multi-meter	6	10000
8	Variable Choke coil	1	5000
9	Bread board	5	500
10	Soldering stations temperature controlled	1	10500
11	Soldering Set	2	3000
12	PN junction experimental kit	1	3500
13	Digital logic trainer	2	20000
14	Miscellaneous (PN junction diodes, resistors, capacitors, CRO probes, multipurpose PCB, connecting wires, different logic gate ICs, etc.)	LS	7000
15	Decade resistors, capacitors and inductor box	2 each	4500
16	D.C regulated power supply	2	8000
17	CRO	2	30000
18	Function Generator	2	12000

ENGINEERING GRAPHICS

Sr No.	Instruments	Qty	Approx. unit Price in Rs.
1.	Drawing Boards (700 x 500mm)	60	800
2.	Draughtsman Tables	60	3,000
3.	Draughtsman Stools	60	750
4.	Computer Aided Drawing (CAD) Software	30 User	5,00,000
5.	Wooden Model of different solids- cone, cylinder, prism, and polygon.	1set	2,000
6.	Wooden Model of different hollow cut sections- cylinder, cube, and Rectangle.	1set	1,500
7.	Miscellaneous	LS	10,000

Note- This subject will be evaluated as a theory examination.

B - Furniture Requirement

Norms and standards laid down by AICTE -APH (latest) be followed for working out furniture requirement for diploma courses

C- Human Resources:

Weekly work schedule, annual work schedule, student teacher ratio for various group and class size, staffing pattern, work load norms, qualifications, experience and job description of teaching staff workshop staff and other administrative and supporting staff be worked out as per norms and standards laid down by the AICTE.

5- EVALUATION STRATEGY

INTRODUCTION

Evaluation plays an important role in the teaching-learning process. The major objective of any teaching-learning endeavor is to ensure the quality of the product which can be assessed through learner's evaluation.

The purpose of student evaluation is to determine the extent to which the general and the specific objectives of curriculum have been achieved. Student evaluation is also important from the point of view of ascertaining the quality of instructional processes and to get feedback for curriculum improvement. It helps the teachers in determining the level of appropriateness of teaching experiences provided to learners to meet their individual and professional needs. Evaluation also helps in diagnosing learning difficulties of the students. Evaluation is of two types: Formative and Summative (Internal and External Evaluation)

Formative Evaluation

It is an on-going evaluation process. Its purpose is to provide continuous and comprehensive feedback to students and teachers concerning teaching-learning process. It provides corrective steps to be taken to account for curricular as well as co-curricular aspects.

Summative Evaluation

It is carried out at the end of a unit of instruction like topic, subject, semester or year. The main purpose of summative evaluation is to measure achievement for assigning course grades, certification of students and ascertaining accountability of instructional process. The student evaluation has to be done in a comprehensive and

systematic manner since any mistake or lacuna is likely to affect the future of students.

In the present educational scenario in India, where summative evaluation plays an important role in educational process, there is a need to improve the standard of summative evaluation with a view to bring validity and reliability in the end-term examination system for achieving objectivity and efficiency in evaluation.

STUDENTS' EVALUATION AREAS

The student evaluation is carried out for the following areas:

- Theory
- Practical Work (Laboratory, Workshop, Field Exercises)
- Project Work
- Professional Industrial Training

A. Theory

Evaluation in theory aims at assessing students' understanding of concepts, principles and procedures related to a course/subject, and their ability to apply learnt principles and solve problems. The formative evaluation for theory subjects may be caused through sessional /class-tests, home-assignments, tutorial-work, seminars, and group discussions etc. For end-term evaluation of theory, the question paper may comprise of three sections.

Section-I

It should contain objective type items e.g. multiple choice, matching and completion type. Total weightage to Section-1 should be of the order of 20 percent of the total marks and no choice should be given in this section. The objective type items should be used to evaluate students' performance in knowledge, comprehension and at the most application domains only.

Section-II

It should contain short answer/completion items. The weightage to this section should be of the order of 40 percent of the total marks. Again, no choice should be given in section-II

Section-III

It may contain two to three essay type questions. Total weightage to this section should be of the order of 40 percent of the total marks. Some built-in, internal choice of about 50 percent of the questions set, can be given in this section.

Table II : Suggested Weightage to be given to different ability levels

Abilities	Weightage to be assigned
Knowledge	10-30 percent
Comprehension	40-60 percent
Application	20-30 percent
Higher than application i.e. Analysis, Synthesis and Evaluation	Upto 10 percent

B. Practical Work

Evaluation of students performance in practical work (Laboratory experiments, Workshop practicals/field exercises) aims at assessing students ability to apply or practice learnt concepts, principles and procedures, manipulative skills, ability to observe and record, ability to interpret and draw conclusions and work related attitudes. Formative and summative evaluation may comprise of weightages to performance on task, quality of product, general behaviour and it should be followed by viva-voce.

C. Project Work

The purpose of evaluation of project work is to assess students ability to apply, in an integrated manner, learnt knowledge and skills in solving real life problems, manipulative skills, ability to observe, record, creativity and communication skills. The formative and summative evaluation may comprise of weightage to nature of project, quality of product, quality of report and quality of presentation followed by viva-voce.

D. Professional Industrial Training

Evaluation of professional industrial training report and viva-voce/ presentation aims at assessing students' understanding of materials, industrial processes, practices in the industry/field and their ability to engage in activities related to problem-solving in industrial setting as well as understanding of application of learnt knowledge and skills in real life situation. The formative and summative evaluation may comprise of weightages to performance in testing, general behaviour, quality of report and presentation during viva-voce.

6 -RECOMMENDATIONS FOR EFFECTIVE CURRICULUM IMPLEMENTATION

This curriculum document is a Plan of Action and has been prepared based on exhaustive exercise of curriculum planning and design. The representative sample comprising selected senior personnel (lecturers and HODs) from various institutions and experts from industry/field have been involved in curriculum design process.

The document so prepared is now ready for its implementation. It is the faculty of polytechnics who have to play a vital role in planning instructional experiences for the courses in four different environments viz. class-room, laboratory, library and field and execute them in right perspective. It is emphasized that a proper mix of different teaching methods in all these places of instruction only can bring the changes in stipulated student's behavior as in the curriculum document. It is important for the teachers to understand curriculum document holistically and further be aware of intricacies of teaching-learning process (T-L) for achieving curriculum objectives. Given below are certain suggestions which may help the teachers in planning and designing learning experiences effectively. These are indicative in nature and teachers using their creativity can further develop/refine them. The designers of the programme suggest every teacher to read them carefully, comprehend and start using them.

(A) Broad Suggestions:

- 1- Curriculum implementation takes place at programme, course and class-room level respectively and synchronization among them is required for its success. The first step towards achieving synchronization is to read curriculum document holistically and understand its rationale and philosophy.
2. An academic plan needs to be prepared and made available to all polytechnics well in advance. The Principals have a great role to play in its dissemination and, percolation upto grass-root level. Polytechnics, in turn are supposed to prepare institutional academic plan.
3. HOD of every Programme Department along with HODs and in-charge of other departments are required to prepare academic plan at department level referring to institutional academic plan.
4. All lecturers/Senior lecturers are required to prepare course level and class level lesson plans referring departmental academic plan.

(B) Course Level Suggestions

Teachers are educational managers at class room level and their success in achieving course level objectives lies in using course plan and their judicious execution which is very important for the success of programme by achieving its objectives.

Polytechnic teachers are required to plan various instructional experiences viz. theory lecture, expert lectures, lab/workshop practical, guided library exercises, field visits, study tours, camps etc. In addition, they have to carry out progressive assessment of theory, assignments, library, practical and field experiences. Teachers are also required to do all these activities within a stipulated period of time. It is essential for them to use the given time judiciously by planning all above activities properly and ensure execution of the plan effectively.

Following is the gist of suggestions for subject teachers to carry out T-L process effectively:

1. Teachers are required to prepare a course plan, taking into account departmental academic plan, number of weeks available and courses to be taught.
2. Teachers are required to prepare lesson plan for every theory class. This plan may comprise of contents to be covered, learning material for execution of a lesson plan. They may follow steps for preparing lesson plan e.g. drawing attention, state instructional objectives, help in recalling pre-requisite knowledge, deliver planned subject content, check desired learning outcomes and reinforce learning etc.
3. Teachers are required to plan for expert lectures from field/industry. Necessary steps are to plan in advance, identify field experts, make correspondence to invite them, take necessary budgetary approval etc.
4. Teachers are required to plan for guided library exercises by identification of course specific experience requirement, setting time, assessment, etc. The assignments and seminars can be thought of as terminal outcome of library experiences.
5. Concept and content-based field visits may be planned and executed for such content of course which is abstract in nature and no other requisite resources are readily available in institute to impart them effectively.
6. There is a dire need for planning practical experiences in right perspective. These slots in a course are the avenues to use problem-based learning/activity learning/experiential learning approach effectively. The development of lab instruction sheets for the course is a good beginning to provide lab experiences effectively.
7. Planning of progressive assessment encompasses periodical assessment in a semester, preparation of proper quality question paper, assessment of answer sheets immediately and giving constructive feedback to every student

8. The student-centered activities may be used to develop generic skills like task management, problem solving, managing self, collaborating with others etc.
9. Where ever possible, it is essential to use activity-based learning rather than relying on delivery based conventional teaching all the time.
10. Teachers may take initiative in establishing liaison with industries and field organizations for imparting field experiences to their students.
11. Students be made aware about issues related to ecology and environment, safety, concern for wastage of energy and other resources etc.
12. Students may be given relevant and well thought out project assignments, which are purposeful and develop practical skills. This will help students in developing creativity and confidence for their gainful employment.
13. A Project bank may be developed by the concerned department of the polytechnics in consultation with related Industry, research institutes and other relevant field organizations in the state.

7 - List of Experts

Mathematics I & II

1. Shri Pankaj Bhatnagar, Lecturer Mathematics, Govt. Poly. Deeh Sadar Unnao
2. Shri Nilesh Kumar, Lecturer Mathematics, Govt. Poly. Unnao
3. Smt. Pushpa Gautam, Lecturer Mathematics, Govt. Poly. Jamunia Deeh Harak Barabanki
4. Shri Manish Kumar, Lecturer Mathematics, Govt. Poly. Ghatampur Kanpur
5. Smt. Kshama Mishra, Lecturer Mathematics, Govt. Poly. Kanpur
6. Shri Sanjiv Agrawal, Lecturer Mathematics, Govt. Poly. Orai Jalaun

Applied Physics

1. Shri Rakesh Kumar Verma, Lecturer Physics, Govt. Poly. Tirwa Kannauj
2. Smt. Shalini, Lecturer Physics, Govt. Poly. Bindki Fatehpur
3. Dr. Ajay Maurya, Lecturer Physics, Govt. Poly. Kanpur
4. Smt. Monika Tandon, Lecturer Physics, Govt. Poly. Ghatampur Kanpur
5. Smt. Neelam, Lecturer Physics, Govt. Poly. Deeh Sadar Unnao

Applied Chemistry

1. Dr. Jagrati, Lecture Chemistry, Govt. Poly. Bighapur Unnao
2. Dr Tahir Jafar, Lecture Chemistry, Govt. Poly. Sicundra Kanpur Dehat
3. Shri Santosh Kumar Singh, Lecture Chemistry, Govt. Poly. Fatehpur
4. Shri Ravi Rajak, Lecture Chemistry, MMIT, Kanpur Dehat
5. Smt. Manisha Gangwar, Lecture Chemistry, Govt. Poly. Deeh Sadar Unnao
6. Dr Anshu Singh, Lecture Chemistry, Govt. Girls Poly. Lucknow

Communication In Skills In English

1. Mohd. Kamrujjma, Lecture English, Govt. Poly. Deeh Harak Barabanki
2. Dr. Dhruv Shankar, Lecture English, MMIT Kanpur Dehat
3. Smt. Jyotishna Singh, Lecture English, Govt. Poly. Unnao
4. Dr. Rupali, Lecture English, Govt. Poly. Bindki Fatehpur
5. Shri Amit Agnihotri, Lecture English, Govt. Poly. Kanpur

Engineering Graphics

1. Shri Pradeep Kumar, HOD Mechanical, Govt. Poly. Lucknow.
2. Shri Atul Roy, Lecturer Mechanical, Govt. Poly. Kanpur
3. Shri Pankaj Singh, Lecturer Mechanical, MMIT Auraiya
4. Smt. Charu Bajpai, Lecturer Civil, Govt. Poly. Sikandra Kanpur dehat
5. Shri Ram Sajivan, Lecturer Mechanical, MMIT, Kannauj
6. Smt. Ruchi Singh, Lecturer Civil, Govt. Poly. Kanpur
7. Shri Sakib Ali, Lecturer Mechanical, Govt. Poly. Bighapur Unnao

Engineering Workshop Practice

1. Shri. Narendra Kumar, Workshop Superintendent, Govt. Poly. Kanpur
2. Shri Pravin Kumar, Workshop Superintendent, Govt. Girls Poly. Lucknow
3. Shri V. K. Shrivastav, Workshop Superintendent, Govt. Poly. Ayodhya
4. Shri S. K. Saxena, Workshop Superintendent, Govt. Poly. Jhansi
5. Shri A. K. Shrivastav Workshop Superintendent, Govt. Poly. Hardoi

Introduction to IT Systems

1. Shri Madan Mishra, HOD Computer Science & Engg., MMIT Santkabir Nagar.
2. Dr. Jokhu Lal, HOD Computer Science & Engg., Govt. Girls Poly. Lucknow.
3. Shri Janmejai Kumar, Lecturer CSE, Govt. Poly. Jansath Muzaffarnagar.
4. Smt. Roopali Singh, Lecturer CSE, Govt. Poly. Kanpur.
5. Dr. Vikas Yadav, Lecturer CSE, Govt. Poly. Bighapur Unnao.

Fundamental Of Electrical & Electronics Engineering

1. Shri Anand Kumar, Hod Electrical, Govt. Poly. Lucknow
2. Smt. Geeta Gautam, Lecturer Electronics, Govt. Poly. Fatehpur
3. Smt. Priyanka Tiwari, Lecturer Electrical Govt. Poly. Kanpur
4. Shri Santosh Kumar Yadav. Lecturer Electronics Govt. Poly. Kanpur
5. Smt. Garima Singh, Lecturer Electronics Govt. Poly. Kanpur
6. Dr. Preeti Sonkar, Lecturer Electrical, Govt. Poly. Kanpur

Engineering Mechanics

1. Shri Kuldeep Singh, HOD Mechanical, Jamunia Deeh Harak Barabanki
2. Shri Atul Roy, Lecturer Mechanical, Government Polytechnic Kanpur
3. Shri Pranjal Mishra, Lecturer Mechanical, Govt. Poly. Deeh Unnao
4. Smt. Anshita Awasthi, Lecturer Mechanical, Govt. Poly. Deeh Unnao
5. Mohd. Saqib Ali Lecturer Mechanical Govt. Poly. Bighapur Unnao
6. Shri Ram Sajivan, Lecturer Mechanical, MMIT Kannauj

Environmental Science

1. Shri Rakesh Kumar, HOD Chemical, Govt. Poly. Kanpur
2. Shri Ravi Sachan, HOD Civil, Govt. Poly. Lucknow
3. Smt. Charu Bajpai, Lecturer Civil, Govt. Poly. Sikandra Kanpur Dehat
4. Dr. Shashi Bala, Lecture Chemical, Govt. Poly. Kanpur
5. Smt. Ruchi Singh, Lecturer Civil, Govt. Poly. Kanpur
6. Smt. Pratiksha Chaurasiya, Lecturer Plastic and Mold Technology, Govt. Poly. Kanpur.

8- GUIDELINES FOR ASSESSMENT OF STUDENT-CENTRED ACTIVITIES (SCA)

It was discussed and decided that the maximum marks for SCA should be 50 as it involves a lot of subjectivity in the evaluation. The marks may be distributed as follows

- I. 15 Marks for general behaviour and discipline
(by HODs in consultation with all the teachers of the department)
- II. 10 Marks for attendance as per following:
(by HODs in consultation with all the teachers of the department)
 - a) 75 - 80% 06 Marks
 - b) 80 - 85% 08 Marks
 - c) Above 85% 10 Marks
- III. 25 Marks maximum for Sports/NCC/Cultural/Co-curricular/NSS activities as per following:
(by In-charge Sports/NCC/Cultural/Co-curricular/NSS)
 - a) 25 - State/National Level participation
 - b) 20 - Participation in two of above activities
 - c) 15 - Inter-Polytechnic level participation

9 . Evaluation Scheme Guidelines : As Per AICTE

a. For Theory Courses:

(The weightage of Internal assessment is 40% and for End Semester Exam is 60%) The student has to obtain at least 40% marks individually both in internal assessment and end semester exams to pass.

b. For Practical Courses:

(The weightage of Internal assessment is 60% and for End Semester Exam is 40%) The student has to obtain at least 40% marks individually both in internal assessment and end semester exams to pass.

c. For Summer Internship / Projects / Seminar etc.

Evaluation is based on work done, quality of report, performance in viva-voce, presentation etc.

Note: The internal assessment is based on the student's performance in mid semester tests (two best out of three), quizzes, assignments, class performance, attendance, viva-voce in practical, lab record etc.

10- (Annexure –I)**^Curriculum of First and Second Semester for the following Engineering Branches -**

Sr. No.	Name of Diploma Programme	Duration
1	Diploma in Mechanical Engineering	3 Years
2	Diploma in Mechanical Engineering (Repair & Maintenance)	3 Years
3	Diploma in Mechanical Engineering(Computer Aided Design)	3 Years
4	Diploma in Mechanical Engineering (Refrigeration & Air conditioning)	3 Years
5	Diploma in Mechanical Engineering (Automobile)	3 Years
6	Diploma in Mechanical Engineering(Production)	3 Years
7	Diploma in Electronics Engineering	3 Years
8	Diploma in Electronics Engineering (Advanced Microprocessor & Interface)	3 Years
9	Diploma in Electronics Engineering (Modern Consumer Electronics Appliances)	3 Years
10	Diploma in Electronics Engineering (Micro Electronics)	3 Years
11	Diploma in Electrical Engineering	3 Years
12	Diploma in Electrical Engineering (Industrial Control)	3 Years
13	Diploma in Electrical & Electronics Engineering	3 Years
14	Diploma in Electronics & Communication Engineering	3 Years
15	Diploma in Chemical Engineering	3 Years
16	Diploma in Chemical Technology (Rubber & Plastic)	3 Years
17	Diploma in Chemical Technology (Fertilizer)	3 Years
18	Diploma in Chemical Engineering (Petro Chemical)	3 Years
19	Diploma in Paint Technology	3 Years
20	Diploma in Civil Engineering	3 Years
21	Diploma in Computer Science & Engineering	3 Years
22	Diploma in Information Technology	3 Years
23	Diploma in Instrumentation & Control Engineering	3 Years

24	Diploma in Civil Engineering (Environmental Pollution & control)	3 Years
25	Diploma in Agricultural Engineering	3 Years
26	Diploma in Plastic Mould Technology	3 Years
27	Diploma in Glass & Ceramics	3 Years
28	Diploma in Dairy Engineering	3 Years
29	Diploma in Leather Technology (Tanning)	3 Years
30	Diploma in Leather Technology Footwear (Computer Aided Shoe Design)	3 Years
31	Diploma in Textile Technology	3 Years
32	Diploma in Textile Chemistry	3 Years
33	Diploma in Textile Engineering	3 Years
34	Diploma in Printing Technology	3 Years
35	Diploma in Food Technology	3 Years
36	Diploma in Paper & Pulp Technology	3 Years
37	Diploma in Carpet Technology	3 Years
38	Diploma in Mining Engineering	3 Years
39	Renewable Energy	3 Years
40	Communication and Computer Networking	3 Years
41	Civil and Environment Engineering	3 Years

**NEP-2020 Aligned Curriculum for
Three Year (Six Semester) Diploma Programme in**

CIVIL ENGINEERING

(3rd and 4th Semester)

For the State of Uttar Pradesh



Prepared by:

Curriculum Development Centre

Institute of Research Development & Training, U.P. Kanpur

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PREFACE

An important issue generally debated amongst the planners and educators world over is how technical education can contribute to sustainable development of the societies struggling hard to come in the same bracket as that of the developed nations. The rapid industrialization and globalization has created an environment for free flow of information and technology through fast and efficient means. This has led to shrinking of the world, bringing people from different culture and environment together and giving rise to the concept of world turning into a global village. In India, a shift has taken place from the forgettable years of closed economy to knowledge based and opens economy in the last few decades. In order to cope with the challenges of handling new technologies, materials and methods, we have to develop human resources having appropriate professional knowledge, skills and attitude. Technical education system is one of the significant components of the human resource development and has grown phenomenally during all these years. Now it is time to consolidate and infuse quality aspect through developing human resources, in the delivery system. Polytechnics play an important role in meeting the requirements of trained technical manpower for industries and field organizations.

In order to meet the requirements of future technical manpower, we will have to revamp our existing technical education system and one of the most important requirements is to develop outcome-based curricula of diploma programmes. The curricula for diploma programmes have been revised by adopting time-tested and nationally acclaimed scientific method, laying emphasis on the identification of learning outcomes of diploma programme.

The real success of the diploma programme depends upon its effective implementation. However best the curriculum document is designed, if that is not implemented properly, the output will not be as expected. In addition to acquisition of appropriate physical resources, the availability of motivated, competent and qualified faculty is essential for effective implementation of the curricula.

It is expected of the polytechnics to carry out job market research on a continuous basis to identify the new skill requirements, reduce or remove outdated and redundant courses, develop innovative methods of course offering and thereby infuse the much needed dynamism in the system.

Director

Institute of Research Development & Training

ACKNOWLEDGEMENTS

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Vikas Kulshreshtha
Assistant Professor/Course Coordinator
IRDT Kanpur

1. SALIENT FEATURES

- 1) **Name of the Programme** : Diploma Programme in Civil Engineering
- 2) **Duration of the Programme** : Three years (Six Semesters)
- 3) **Entry Qualification** : Matriculation or equivalent NSQF Level as Prescribed by State Board of Technical Education, UP
- 4) **Pattern of the Programme** : Semester Pattern
- 5) **NSQF Level** : Level - 5
- 6) **Ratio between theory and Practical:** 40 : 60 (Approx.)

7) **Industrial Training**

Four and six weeks of industrial training is made mandatory after the II and IV semesters during summer vacation. Total marks allotted to industrial training will be respectively 50 & 100.

In the last (6th Semester) we have made the one semester Industrial training/Internship as optional along with usual classroom training.

8) **Ecology and Environment**

As per Govt. of India directives a subject on Environmental Science has been incorporated in the curriculum.

9) **Entrepreneurship and Start-ups**

A full subject Entrepreneurship & Start-ups has been incorporated in the curriculum.

10) **Student Centred Activities**

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

11) **Project work**

A project work has been included in the curriculum to enable the student get familiarize with the practices and procedures being followed in the industries and provide an opportunity to work on some live projects in the industry.

2. **PROGRAM OUTCOMES (POs)**

PO1: Basics and Discipline specific Knowledge

Assimilate knowledge of basic mathematics, science and engineering fundamentals.

PO2: Problem's Analysis and solution

Identify, analysis and solve problems using standard methods and established techniques.

PO3: Design and Development

Design solutions for technical problems.

Assist in designing components, systems, or processes to meet specific requirements.

PO4: Engineering Tools, Experimentation, and Testing

Use modern engineering tools and appropriate techniques to conduct experiments as per BIS standard.

PO5: Socio/Economic/Environmental impact assessment/remedy.

Apply relevant technologies while considering societal needs, environmental impact keeping in view sustainable and ethical responsibilities.

PO6: Project Management and Communication

Apply engineering management principles, work effectively as an individual or in a team, and communicate clearly on activities.

PO7: Lifelong Learning

Recognize the importance of continuous learning and actively pursue self-improvement to keep pace with technological developments.

3. EMPLOYMENT OPPORTUNITIES FOR DIPLOMA HOLDERS IN CIVIL ENGINEERING

Keeping in view, the present scenario of activities in the field of Civil Engineering (EP&C), following employment opportunities are visualized for diploma holders in Civil Engineering

a) Wage Employment in:

- i) Government Departments/ Public sector /Boards / Corporations/ private construction companies
- ii) Service sector i.e. Estate Offices of Business organizations/Universities/ Colleges, Hotels, Hospitals etc. specially for repair and maintenance of buildings and their upkeep.
- iii) Military Engineering Services/BRO/Defence/Railways/Power Projects/Banks/ Municipal Corporations and Committees/Airport Authority and Harbours etc.
- iv) Installation of communication towers and framed structure.
- v) Testing laboratories
- vi) Technical institutions.

b) Self-employment opportunities:

- i) Small building contractors/Licensed contractors (Class B)
- ii) Approved building planner and valuer
- iii) Plumbing and water supply fitting contracts
- iv) White washing, distempering, repair and maintenance of buildings, renovations, POP work, texture work, false ceiling, specialized flooring etc. Anti - termite treatment Erection job
- v) Construction material suppliers/marketing
- vi) Preparation of computer aided design and drafting jobs
- vii) Estimating and costing jobs/bill maker
- viii) Surveyor/loss assessment/valuation of buildings etc.
- ix) Water proofing of existing and new building

- x) A small enterprise like precast elements/ hume pipes/water proofing chemicals, RCC pipes, hollow blocks, shuttering etc.
- xi) Rain water harvesting system installation
- xii) Sanitary Installation

4. LEARNING OUTCOMES OF DIPLOMA PROGRAMME IN CIVIL ENGINEERING

At the end of the programme, a diploma holder in Civil Engineering, will be able to:

1.	Communicate effectively in English with others
2.	Apply basic principles of Mathematics and Science to solve engineering problems
3.	computer application software Prepare computerized reports, presentations using IT tools and
4.	Use cutting tools and tooling for fabrication of jobs by following safe practices during work
5.	Use appropriate procedures for preventing environmental pollution and energy conservation
6.	Use basic concepts and principles of fluid mechanics as applied to civil engineering practices.
7.	Apply concepts of mechanics to solve Engineering problems
8.	Carry out various types of surveying like levelling, plane tabling, theodolite surveying, and tachometry and contouring; and use modern surveying techniques like total station, remote sensing, GIS and GPS.
9.	Select, Use and carry our testing of construction materials including ecofriendly and advanced materials as per their suitability and availability
10	Supervise various building construction works from substructure to superstructure and their finishing operations.
11	Prepare, read and interpret, component drawing, building drawings and layout
12	Supervise production, placement and quality control of concrete operations.
13	Supervise construction of pre cast elements.
14	Carry out layout plan of water supply, sewerage and sanitary systems and monitor quality of water and waste water
15	Supervise constructional aspects pertaining to irrigation structures
16	Prepare, read and interpret public health and irrigation engineering drawings
17	Analyse and design simple structural elements of R.C.C.
18.	Supervise constructional aspects pertaining to highway engineering
19.	Prepare, read and interpret R.C.C. drawings

20.	Prepare topographical plan of an area
21.	Use various computer software's in the field of Civil & Environment Engineering
22.	Supervise constructional aspects pertaining to railways, bridges and tunnels
23.	Analyses, use and treat various types of soils for foundation purpose
24.	Plan and execute given task/projects as a team member/ leader
25.	Analyses and design simple structural elements of steel
26.	Prepare material estimates as per CSR, Specifications, costing, valuation and tender documents as per given drawings and prepare bill of quantity of construction.
27.	Apply basic principles of construction management techniques and accounts in Civil Engineering
28.	Carry out repair, maintenance and retrofitting of buildings as per requirement
29.	Use various advanced constructional techniques for construction of high rise and earthquake resistant structures keeping safety aspects in mind.
30.	Plan and execute activities related to disaster management.
31.	Apply the knowledge and skills gained through various courses in solving live problems/projects in the field
32.	Demonstrate appropriate values and attitude.

5. DERIVING CURRICULUM AREAS FROM LEARNING OUTCOMES OF THE PROGRAMME

The following curriculum area subjects have been derived from learning outcomes:

Sr. No.	Learning Outcomes	Curriculum Areas/Subjects
1.	Communicate effectively in English with others	<ul style="list-style-type: none"> - Communication Skills - Student Centered Activities (SCA)
2.	Apply basic principles of Mathematics and Science to solve engineering problems	<ul style="list-style-type: none"> - Applied Mathematics - Applied Physics - Applied Chemistry
3.	Prepare computerized reports, presentations using IT tools and computer application software	<ul style="list-style-type: none"> - Introduction to IT Systems
4.	Use cutting tools and tooling for fabrication of jobs by following safe practices during work	<ul style="list-style-type: none"> - General Workshop Practice - Basics of Mechanical and Electrical Engineering.
5.	Use appropriate procedures for preventing environmental pollution and energy conservation	<ul style="list-style-type: none"> - Environmental Studies
6.	Use basic concepts and principles of fluid mechanics as applied to civil engineering practices.	<ul style="list-style-type: none"> - Hydraulics
7.	Apply concepts of mechanics to solve Engineering problems	<ul style="list-style-type: none"> - Applied Mechanics - Structural Mechanics
8.	Carry out various types of surveying like leveling, plane tabling, theodolite surveying, and tachometry and contouring; and use modern surveying techniques like total station, remote sensing, GIS and GPS.	<ul style="list-style-type: none"> - Quantity Surveying and Valuation
9.	Select, Use and carry our testing of construction materials including eco-friendly and advanced materials as per their suitability and availability	<ul style="list-style-type: none"> - Construction Materials
10.	Supervise various building construction works from substructure to superstructure and their finishing operations.	<ul style="list-style-type: none"> - Building Construction - Building Drawings
11.	Prepare, read and interpret, component drawing, building drawings and layout	<ul style="list-style-type: none"> - Engineering Drawing

12.	Supervise production, placement and quality control of concrete operations.	– Concrete Technology
13.	Supervise construction of precast elements.	– Reinforced Cement Concrete Structures (RCC Structures)
14.	Carry out layout plan of water supply, sewerage and sanitary systems and monitor quality of water and waste water	– Water and Waste water Engineering
15.	Supervise constructional aspects pertaining to irrigation structures	– Irrigation Engineering
16.	Prepare, read and interpret public health and irrigation engineering drawings	– Waste Water and Irrigation Engineering Drawing
17.	Analyses and design simple structural elements of R.C.C.	– Reinforced Cement Concrete Structures (RCC Structures)
18.	Supervise constructional aspects pertaining to highway engineering	– Highway Engineering
19.	Prepare, read and interpret R.C.C. drawings	– RCC Drawing
20.	Prepare topographical plan of an area	– Surveying
21.	Use various computer software's in the field of Civil Engineering	– Computer Aided Drawing – Software Application in Civil Engineering
22.	Supervise constructional aspects pertaining to railways, bridges and tunnels	– Railways, Bridges and Tunnels
23.	Analyses, use and treat various types of soils for foundation purpose	– Soil Mechanics and Foundation Engineering
24.	Plan and execute given task/projects as a team member/ leader	– Project Work
25.	Analyses and design simple structural elements of steel	– Design of Steel Structure – Steel Structure Drawing
26.	Prepare material estimates as per CSR, Specifications, costing, valuation and tender documents as per given drawings and prepare bill of quantity of construction.	– Quantity Surveying and Valuation
27.	Apply basic principles of construction management techniques and accounts in Civil Engineering	– Construction Management, Accounts and Entrepreneurship Development
28.	Identify major sources of pollution and plan remedial measures for its control	– Environmental Management

29.	Plan and execute activities related to disaster management.	– Analysis of Structures
30.	Apply the knowledge and skills gained through various courses in solving live problems/projects in the field	– Project Work
31.	Demonstrate appropriate values and attitude.	– Student Centered Activities

6. ABSTRACT OF CURRICULUM AREAS

a) HUMANITIES & SOCIAL SCIENCES COURSES(HS)

1. Communication Skills in English
2. Sports & Yoga
3. Entrepreneurship and Starts-ups

b) BASIC SCIENCES COURSE (BS)

4. Mathematics
5. Applied Physics
6. Applied Chemistry

c) ENGINEERING SCIENCE COURSE (ES)

7. Engineering Graphics
8. Engineering Workshop Practice
9. Introduction to Information Technology
10. Fundamental of Mechanical and Electrical Engg.
11. Engineering Mechanics

d) PROGRAMME CORE COURSE (PC)

12. Construction Materials
13. Basic Surveying
14. Basic Surveying Lab.
15. Mechanics of Material
16. Mechanics of Material Lab.
17. Building Construction
18. Building Planning and Drawings
19. Concrete Technology
20. Concrete Technology Lab.
21. Summer Internship
22. Hydraulics
23. Hydraulics Lab.
24. Advance Surveying
25. Advance Surveying Lab.
26. Theory of Structure
27. Design of Reinforced Cement Concrete Structures

28. Reinforced Cement Concrete Structures Drawing
29. Water Resource Engineering
30. Public Health Engineering

e) PROJECT WORK, SEMINAR AND INTERNSHIP IN INDUSTRY OR ELSE WHERE

- Summer Internship-I (4 weeks) after IInd Semester.
- Summer Internship-II (6 weeks) after IVth Semester.
- Major Project (In-House)/Internship/Industrial Training.

f) AUDIT COURSES (AU)

- Environmental Science
- Essence of Indian Knowledge and Tradition (Q)
- Indian Constitution

6- STUDY AND EVALUATION SCHEME FOR DIPLOMA PROGRAMME IN CIVIL ENGINEERING

NOTE: I & II Sem. is common to all engineering & technology branches and implemented from the session 2024-2025

3rd SEMESTER {CIVIL ENGINEERING }

Sr. No.	SUBJECTS	COURSE TYPE & CATEGORY	STUDY SCHEME			Credits	MARKS IN EVALUATION SCHEME									Total Marks of Internal & External
			Periods/Week				INTERNAL ASSESSMENT			EXTERNAL ASSESSMENT						
			L	T	P		Th	Pr	Tot	Th	Hrs	Pr	Hrs	Tot		
3.1	CONSTRUCTION MATERIALS	PROGRAM CORE (PRACTICUM/THEORY)	02	-	02	2+1=3		40	40	60	3	-	-	60	100	
3.2	BASIC SURVEYING	PROGRAM CORE (THEORY)	01	-	-	1+0=1	40	-	40	60	3	-	-	60	100	
3.3	BASIC SURVEYING LAB	PROGRAM CORE (PRACTICAL)	-	-	04	0+2=2	-	60	60	-	-	40	3	40	100	
3.4	MECHANICS OF MATERIAL	PROGRAM CORE (THEORY)	02	-	-	2+0=2	40	-	40	60	3	-	-	60	100	
3.5	MECHANICS OF MATERIAL LAB	PROGRAM CORE (PRACTICAL)	-	-	02	0+1=1	-	60	60	-	-	40	3	40	100	
3.6	BUILDING CONSTRUCTION	PROGRAM CORE (PRACTICUM/THEORY)	02	-	02	2+1=3	40	-	40	60	3	-	-	60	100	
3.7	BUILDING PLANNING AND DRAWING	PROGRAM CORE (PRACTICUM/PRACTICAL)	01	-	04	1+2=3	-	60	60	-	-	40	3	40	100	
3.8	CONCRETE TECHNOLOGY	PROGRAM CORE (THEORY)	02	-	-	2+0=2	40	-	40	60	3	-	-	60	100	
3.9	CONCRETE TECHNOLOGY LAB	PROGRAM CORE (PRACTICAL)	-	-	04	0+2=2	-	60	60	-	-	40	3	40	100	
3.10	*SUMMER INTERNSHIP-I (4 weeks after IInd sem.)	PRACTICAL	-	-	-	1	-	50	50	-	-	-	-	-	50	
#STUDENT CENTERED ACTIVITIES			-	-	08	-	-	50	50	-	-	-	-	-	50	
Total			10	-	26	20	160	380	540	300	-	160	-	460	1000	

1) Each period will be 60 minutes duration.

2) Each session will be of 16 weeks.

3) Effective teaching will be at least 14 weeks.

* Students will present a seminar on their summer internship along with certificate and project report.

Student Centered Activities will comprise of co-curricular activities like extension lectures, games, hobby clubs e.g. photography etc., seminars, declamation contests, educational field visits, N.C.C., NSS, library, Cultural Activities and self-study etc.

4th SEMESTER { CIVIL ENGINEERING }

Sr. No.	SUBJECTS	COURSE TYPE & CATEGORY	STUDY SCHEME			Credits	MARKS IN EVALUATION SCHEME									Total Marks of Internal & External
			Periods/Week				INTERNAL ASSESSMENT			EXTERNAL ASSESSMENT						
			L	T	P		Th	Pr	Tot	Th	Hrs	Pr	Hrs	Tot		
4.1	HYDRAULICS	PROGRAM CORE (THEORY)	02	-	-	2+0=2	40	-	40	60	3	-	-	60	100	
4.2	HYDRAULICS LAB	PROGRAM CORE (PRACTICAL)	-	-	02	0+1=1	-	60	60	-	-	40	3	40	100	
4.3	ADVANCE SURVEYING	PROGRAM CORE (THEORY)	02	-	-	2+0=2	40	-	40	60	3	-	-	60	100	
4.4	ADVANCE SURVEYING LAB	PROGRAM CORE (PRACTICAL)	-	-	04	0+2=2	-	60	60	-	-	40	3	40	100	
4.5	THEORY OF STRUCTURE	PROGRAM CORE (THEORY)	02	01	-	3+0=3	40	-	40	60	3	-	-	60	100	
4.6	DESIGN OF REINFORCED CEMENT CONCRETE STRUCTURES	PROGRAM CORE (THEORY)	02	01	-	3+0=3	40	-	40	60	3			60	100	
4.7	REINFORCED CEMENT CONCRETE STRUCTURES DRAWING	PROGRAM CORE (PRACTICUM/PRACTICAL)	01	-	04	1+2=3		60	60	-	-	40	3	40	100	
4.8	WATER RESOURCE ENGINEERING	PROGRAM CORE (THEORY)	02		-	2+0=2	40	-	40	60	3			60	100	
4.9	PUBLIC HEALTH ENGINEERING	PROGRAM CORE (PRACTICUM/THEORY)	01	-	02	1+1=2		40	40	60	3	-	-	60	100	
4.10	(Q) ESSENCE OF INDIAN KNOWLEDGE AND TRADITION	AUDIT COURSE	02	-	-	-	50*	-	50*	-	-	-	-	-	-	
#STUDENT CENTERED ACTIVITIES			-	-	08	-	-	50	50	-	-	-	-	-	50	
Total			14	02	20	20	200	270	470	360	-	120	-	480	950	

Note -(Q) - It is compulsory to appear & to pass in examination, But marks will not be included for division and percentage of obtained marks.

Student Centered Activities will comprise of co-curricular activities like extension lectures, games, hobby clubs e.g. photography etc., seminars, declamation contests, educational field visits, N.C.C.NSS, library, Cultural Activities and self-study etc.

PRACTICUM: It means that the teacher supervise and involves students in practical application of previously studied theory.

SEMESTER-III

PRACTICUM/ THEORY	3.1 CONSTRUCTION MATERIALS	L	T	P
		2	-	2

COURSE OBJECTIVES:

Following are the objectives of this course:

- To learn about various construction materials, and understand their relevant characteristics.
- To be able to identify suitability of various materials for different construction purposes.
- To know about natural, artificial, and processed materials available for various purposes of construction activities.

COURSE OUTCOMES:

After completing this course, student will be able to:

- Identify relevant construction materials.
- Identify relevant natural construction materials.
- Select relevant artificial construction materials.
- Select relevant special type of construction materials.
- Identify and use of processed construction materials.

COURSE CONTENTS

Unit – I: Overview of Construction Materials (4 periods)

- Scope of construction materials in Building Construction, Transportation Engineering, Environmental Engineering, Irrigation Engineering (applications only).
- Selection of materials for different civil engineering structures on the basis of strength, durability, Eco friendly and economy.
- Broad classification of materials – Natural, Artificial, special, finishing and recycled.

Unit – II: Natural Construction Materials (6 periods)

- Requirements of good building stone; general characteristics of stone; quarrying and dressing methods and tools for stone.
- Classification of Rocks : Geological, Physical and chemical classification
- Structure of timber, general properties and uses of good timber, different methods of seasoning for preservation of timber, defects in timber, use of bamboo in construction.
- Asphalt, bitumen and tar used in construction, properties and uses.

- Types of Lime, Properties of lime and uses. Slacking of lime
- Properties of sand and uses
- Classification of aggregate according to size

Unit- III: Artificial Construction Materials

(8 periods)

- Constituents of brick earth, Conventional / Traditional bricks, Modular and Standard bricks, Special bricks–fly ash bricks, Characteristics of good brick, Field tests on Bricks, Classification of burnt clay bricks and their suitability, Manufacturing process of burnt clay brick, fly ash bricks, Aerated concrete blocks(AAC).
- Flooring tiles – Types, uses
- Manufacturing process of Cement - dry and wet (only flow chart), types of cement and its uses. Field tests on cement.
- Pre-cast concrete blocks- hollow, solid, pavement blocks, and their uses.
- Plywood, particle board, Veneers, laminated board and their uses.
- Types of glass: soda lime glass, lead glass, borosilicate glass, Toughened glass, Reinforced glass, Fiber glass and their uses.
- Ferrous and non-ferrous metals and their uses.

Unit– IV: Special Construction Materials

(4 periods)

- Types of material and suitability in construction works of following materials: Water proofing, Termite proofing; Thermal and sound insulating materials.
- Fibers and its Types –Jute, Glass, Plastic, Asbestos Fibers, (only uses).

Unit– V: Processed Construction Materials

(6 periods)

- Constituents and uses of POP (Plaster of Paris), POP finishing boards, sizes and uses. Gypsum and Gypsum based material.
- Paints- whitewash, cement paint, Distempers, Oil Paints and Varnishes with their uses.(Situations where used).
- Industrial waste materials- Fly ash, Blast furnace slag, Granite and marble polishingwaste and their uses.
- Agro waste materials - Rice husk, Bagasse, coir fibers and their uses.
- Special processed construction materials; Geo-synthetic, Ferro Crete, Artificial timber, artificial sand and their uses.

List of Recommended Books/References

1. Ghose, D. N., Construction Materials, Tata McGraw Hill, New Delhi.
2. S.K. Sharma, Civil Engineering Construction Materials, Khanna Publishing House, Delhi

3. Varghese, P.C. , Building Materials, PHI learning, New Delhi.
4. Rangwala, S.C., Engineering Materials, Charator publisher, Ahemdabad.
5. Somayaji, Shan, Civil Engineering Materials, Pearson education, New Delhi.
6. D.V.Gupta , Vikram Singh ,Construction Materials, Asian Publishers, Muzaffarnagar ISBN no. 978-93-5502-020-8
7. Rajput, R.K, Engineering Materials, S. Chand and Co., New Delhi.
8. Sood H., Laboratory Manual on Testing of Engineering Materials, New Age Publishers, NewDelhi.
9. Sharma C. P., Engineering Materials, PHI Learning, New Delhi.
10. Duggal, S. K, Building Materials, New International, New Delhi.

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-semester and end-semester written tests
- Actual practical work, exercises and viva-voce
- Presentation and viva-voce

SUGGESTED DISTRIBUTION OF MARKS

Topic No.	Time Allotted (Hrs)	Marks Allotted (%)
1	4	15
2	6	20
3	8	30
4	4	15
5	6	20
Total	28	100

CONSTRUCTION MATERIALS LAB.

List of practical to be performed:

1. Identify various sizes of available coarse aggregates from sample of 10 kg in laboratory and prepare report (60,40, 20,10 mm)
2. Identify the available construction materials in the laboratory on the basis of their sources.
3. Prepare the lime putty by mixing lime (1 kg) with water in appropriate proportion and pre-prepare report on slaking of lime.
4. Select first class, second class and third-class bricks from the stake of bricks and prepare report on the basis of its properties.
5. Measure dimensions of 10 bricks and find average dimension and weight. Perform field tests - dropping, striking and scratching by nail and correlate the results obtained.
6. Identify different types of flooring tiles such as vitrified tiles, ceramic tiles, glazed tiles, mosaic tiles, anti- skid tiles, chequered tiles, paving blocks and prepare report about the specifications.
7. Apply the relevant termite chemical on given damaged sample of timber.
8. Identify the type of glasses from the given samples.
9. To determine the Compressing Strength of Bricks, CLC and AAC blocks.
10. To determine the water absorption of bricks and efflorescence of bricks.
11. Construct a brick masonry 3D models of Flemish / English bonds
12. Construct a 3D models on sustainable construction practices.

THEORY	3.2 BASIC SURVEYING	L	T	P
		1	-	-

COURSE OBJECTIVES:

Following are the objectives of this course:

- To understand types of surveying works required.
- To know the types of equipment and method to be used for different surveys.
- To know the use and operational details of various surveying equipment.

COURSE OUTCOMES:

After completing this course, student will be able to:

- Select the type of survey required for given situation.
- Compute area of open field using chain, tape and cross staff.
- Conduct traversing in the field using chain and compass.
- Use leveling instruments to determine reduced level for preparation of contour maps
- Use digital planimeter to calculate the areas.

COURSE CONTENTS

Unit – I Overview and Classification of Survey (2 periods)

- Survey- Purpose and Use.
- Types of surveying- Primary and Secondary, Classification: Plane, Geodetic, Cadastral, Hydro-graphic, Photogrammetry and Aerial.
- Principles of Surveying.
- Scales: Engineer’s scale, Representative Fraction (RF) and diagonal scale.

Unit– II Chain Surveying (3 periods)

- Instruments used in chain survey: Types of Chains, Tapes, Arrow, Ranging rod, Line ranger, Off-set rod, Open cross staff, Optical square.
- Chain survey Station, Base line, Check line, Tie line, Offset, Tie station.
- Ranging: Direct and Indirect Ranging.
- Methods of Chaining, obstacles in chaining and Ranging
- Errors in length: Instrumental error, personal error, error due to natural cause, random error, Tape corrections.
- Principles of triangulation.
- Types of offsets: Perpendicular and Oblique.
- Conventional Signs, Recording of measurements in a field book.

Unit– III Compass Traverse Survey

(3 periods)

- Compass Traversing- open, closed.
- Technical Terms: Geographic/ True Magnetic Meridians and Bearings, Whole Circle Bearing system and Reduced Bearing system and examples on conversion of given bearing to another bearing (from one form to another), Fore Bearing and Back Bearing, Calculation of internal and external angles from bearings at a station, Dip of Magnetic needle, Magnetic Declination.
- Components of Prismatic Compass and Surveyor compass and their Functions, Methods of using Prismatic Compass- Temporary adjustments and observing bearings.
- Local attraction, Methods of correction of observed bearings - Correction at station and correction to included angles.
- Methods of plotting a traverse and closing error, Graphical adjustment of closing error.

Unit– IV Levelling and Contouring

(4 periods)

- Basic terminologies: Level surfaces, Horizontal and vertical surfaces, Datum, Bench Marks- GTS, Permanent, Arbitrary and Temporary, Reduced Level, Rise, Fall, Line of collimation, Station, Back sight, Fore sight, Intermediate sight, Change point, Height of instruments.
- Types of levels: Dumpy, Tilting, Auto level, Digital level, Components of Dumpy Level and its fundamental axes, Temporary and permanent adjustments of Level.
- Types of Leveling Staff: Self-reading staff and Target staff.
- Reduction of level by Line of collimation and Rise and Fall Method.
- Leveling Types: Simple, Differential, Fly, Profile and Reciprocal Levelling.
- Curvature and refraction correction.
- Contour, contour intervals, horizontal equivalent.
- Uses of contour maps, Characteristics of contours, Methods of Contouring: Direct and indirect.

Unit– V Measurement of Area and Volume

(2 periods)

- Components and use of Digital planimeter.
- Measurement of area using digital planimeter.
- Measurement of volume of reservoir and earthwork calculation from contour map.

SUGGESTED LEARNING RESOURCES

1. Punmia, B.C.; Jain, Ashok Kumar; Jain, Arun Kumar, Surveying I, Laxmi Publications, New Delhi.
2. Basak, N. N., Surveying and Leveling, McGraw Hill Education, New Delhi.
3. Kanetkar, T. P.; Kulkarni, S. V., Surveying and Levelling volume I, Pune Vidyarthi Gruh Prakashan.
4. Duggal, S. K., Survey I, McGraw Hill Education, New Delhi.
5. Saikia, M D.; Das. B.M.; Das. M.M., Surveying, PHI Learning, New Delhi.

6. Subramanian, R., Fundamentals of Surveying and Levelling, Oxford University Press. New Delhi.
7. D.V.Gupta, Vikram Singh, Land Surveying-I , Asian Publishers, Muzaffarnagar, ISBN no. 978-93-5502-121-2
8. Rao, P. Venugopala Akella, Vijayalakshmi, Textbook of Surveying, PHI Learning New Delhi.
9. Bhavikatti, S. S., Surveying and Levelling, Volume 1, I. K. International, New Delhi.
10. Arora K R , Surveying Vol. I, Standard Book House.

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-semester and end-semester written tests
- Actual practical work, exercises and viva-voce
- Presentation and viva-voce

SUGGESTED DISTRIBUTION OF MARKS

Topic No.	Time Allotted (Hrs)	Marks Allotted (%)
1	2	10
2	3	25
3	3	25
4	4	25
5	2	15
Total	14	100

PRACTICAL	3.3 BASIC SURVEYING LAB.	L	T	P
		-	-	4

LIST OF PRACTICAL TO BE PERFORMED

1. Measure distance between two survey stations using chain, tape and ranging rods when two stations are inter visible.
2. Undertake reciprocal ranging and measure the distance between two stations.
3. Determine area of open field using chain and cross staff survey.
4. Measure Fore Bearing and Back Bearing of survey lines of open traverse using Prismatic Compass.
5. Measure Fore Bearing and back bearing of a closed traverse of 5 or 6 sides and correct the bearings and included angles for the local attraction.
6. Undertake Survey Project with chain and compass for closed traverse for minimum 5 sides around a building **and** Plot the traverse on A1 size imperial drawing sheet for data collected in Survey Project mentioned in practical
7. Undertake simple leveling using dumpy level/ Auto level and leveling staff.
8. Undertake differential leveling and determine Reduced Levels by Height of instrument method and Rise and fall method using dumpy level/Auto Level and leveling staff and set up gradient.
9. Undertake fly leveling with double check using dumpy level/ Auto level and leveling staff.
10. Undertake Survey Project with Leveling instrument for Profile leveling and cross-sectioning for a road/canal/Railways length of 500 m with cross-section at 30 m interval.
11. Plot the L-section with minimum 3 cross-sections on A1 size imperial sheet for data collected in Survey Project mentioned in practical.
12. Undertake Survey Project for plotting contour map using block contouring method for a block of 150m x 150m with grid of 10m x 10m.
13. Plot the contours on A1 size imperial drawing sheet for data collected in
14. Survey Project mentioned in practical.

THEORY	3.4 MECHANICS OF MATERIAL	L	T	P
		2	-	-

COURSE OBJECTIVES:

Following are the objectives of this course:

- To learn properties of area and structural material properties.
- To understand the concept of stress and strain.
- To calculate shear force, bending moment for different shapes of structural elements and corresponding stresses.
- To understand the concept of buckling loads for short and long columns.

COURSE OUTCOMES:

After competing this course, student will be able to:

- Articulate practical applications of moment of inertia of symmetrical and unsymmetrical structural sections.
- Analyse structural behaviour of materials under various loading conditions.
- Interpret shear force and bending moment diagrams for various types of beams and loading conditions.
- Determine the bending and shear stresses in beams under different loading conditions.
- Analyse the column for various loading and end conditions.

COURSE CONTENTS:

Unit-I Simple Stresses and Strains

(6 periods)

- Properties of Materials, Classification of materials, elastic materials, plastic materials, ductile materials, brittle materials. Introduction to tensile test, compressive test, impact test, fatigue test, torsion test on metals.
- Concept of stress, normal and shear stresses, Concept of strain and deformation, longitudinal and transverse strain, poisson's ratio, volumetric strain, Hooke's law, moduli of elasticity and rigidity, Bulk modulus of elasticity, relationship between the elastic constants.
- Stresses and strains in bars subjected to tension and compression. Extension of uniform bar under its own weight, stress produced in compound and tapering bars due to axial load.
- Stress-strain diagram for mild steel and HYSD steel, proof stress, mechanical properties, factor of safety. Temperature stresses and strains

Unit-II Moment of Inertia

(6 periods)

- 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.

Unit-III Shear Force and Bending Moment

(6 periods)

- Concept of a beam and supports (Hinges, Roller and Fixed), types of beams: simply supported, cantilever, propped, over hang, fixed and continuous beams (only concept).
- 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)
- Concept of bending moment and shear force, sign conventions, Bending Moment and shear force diagrams for cantilever, simply supported and overhanging beams subjected to concentrated, uniformly distributed and varying loads
- Relationship between load, shear force and bending moment, point of maximum bending moment, and point of contraflexure.
- Fixed and continuous beams-simple numerical problems.

Unit-IV Bending and Shear Stresses in Beams

(6 periods)

- Bending Stresses in Beams, Concept of pure/simple bending, Assumptions made in the theory of simple bending, derivation and application of bending equation to circular cross-section, I section, T&L sections only, Moment of resistance, Calculations of bending stresses
- Shear Stresses in Beams, Concept of shear stresses in beams, shear stress distribution in rectangular, circular I, T, L sections for beams

Unit-V Columns

(4 periods)

- Theory of columns- long and short columns, slenderness ratio, Problem solving using Euler's and Rankine formula

Suggested learning resources:

1. Bedi D.S. , Strength of Materials, Khanna Publishing House, Delhi, Ed. 2018
2. Timoshenko, S., Strength of Materials, Vol. I, CBS, New Delhi.
3. Khurmi, R.S., Strength of Materials, S Chand and Co. Ltd. New Delhi.
4. Ramamurtham, S, Strength of Materials, Dhanpat Rai and sons, New Delhi.
5. Punmia B C, Strength of Materials, Laxmi Publications (p) Ltd. New Delhi.
6. Rattan S.S., Strength of Materials, McGraw Hill Education; New Delhi.
7. Bansal R K, Strength of Materials, Laxmi Publications.
8. Subramaniam R, Strength of Materials, Oxford University Press.

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-semester and end-semester written tests
- Actual practical work, exercises and viva-voce
- Presentation and viva-voce

SUGGESTED DISTRIBUTION OF MARKS

TopicNo.	TimeAllotted (Hrs)	MarksAllotted (%)
1	6	20
2	6	20
3	6	20
4	6	20
5	4	20
Total	28	100

PRACTICAL	3.5 MECHANICS OF MATERIAL LAB.	L	T	P
		-	-	2

COURSE OBJECTIVES:

Following are the objectives of this course:

- To know the procedure for the conduct of tensile and compressive strength.
- To understand the concept of stress and strain through testing of different materials.
- To calculate shear force, bending moment and their corresponding stresses.
- To understand flexural strength and abrasive properties of floor tiles.

COURSE OUTCOMES:

After competing this course, student will be able to:

- Test different Civil engineering materials on Universal Testing Machine.
- Analyse structural behaviour of materials under various loading conditions.
- Interpret shear force and bending moment diagrams for various types of beam sections and different loading conditions.
- Determine bending and shear stresses in beams under different loading conditions.
- Calculate flexural strength of different types of floor tiles.

LIST OF PRACTICALS TO BE PERFORMED:

- Study and understand the use and components of Universal Testing Machine (UTM).
- Perform Tension test on mild steel as per IS:432(1) and compute value of young's modulus.
- Perform tension test on Tor steel as per IS:1608, IS:1139.
- Conduct compression test on sample test piece using Compression Testing Machine.
- Conduct Izod Impact test on three metals. e.g. mild steel/ brass/aluminum /copper /castiron etc as per IS:1598.
- Conduct Charpy Impact test on three metals. e.g. mild steel/ brass/aluminum/ copper /castiron etc as per IS:1757.
- Plot Shear force and Bending Moment diagrams for cantilever, simply supported beams.
- Plot Shear force and Bending Moment diagrams for overhanging beams for different types of loads including moment loading.
- Conduct Flexural test on timber beam on rectangular section in both orientation as per IS:1708, IS:2408.

SUGGESTED LEARNING RESOURCES:

1. Bedi D.S., Strength of Materials, Khanna Publishing House, New Delhi (Edition 2018)
2. Timoshenko, S., Strength of Materials, Vol. I, CBS, New Delhi.
3. Khurmi, R.S., Strength of Materials, S Chand and Co. Ltd. New Delhi.
4. Ramamurtham, S, Strength of Materials, Dhanpat Rai and sons, New Delhi.
5. Punmia B C, Strength of Materials, Laxmi Publications (p) Ltd. New Delhi.
6. Rattan S.S., Strength of Materials, McGraw Hill Education; New Delhi.
7. Bansal R K, Strength of Materials, Laxmi Publications.
8. Subramaniam R, Strength of Materials, Oxford University Press.

PRACTICUM / THEORY	3.6 BUILDING CONSTRUCTION	L	T	P
		2	-	2

COURSE OBJECTIVES:

Following are the objectives of this course:

- To identify different components of building.
- To understand different types of foundation and their significance.
- To know different types of masonry and their construction.
- To highlight the importance of communications in building planning.

COURSE OUTCOMES:

After completing this course, student will be able to:

- Identify components of building structures.
- Propose suitable type of foundation for building structures.
- Select suitable type of masonry for building structures.
- Propose relevant means of communications for different types of buildings.
- Select relevant material for finishing works.

COURSE CONTENTS:

Unit – I: Overview of Building Components (4 periods)

- Classification of Buildings as per National Building Code Group A to I, As per Types of Constructions- Load Bearing Structure, Framed Structure, Composite Structure.
- Building Components - Functions of Building Components, Substructure– Foundation, Plinth.
- Superstructure – Walls, Partition wall, Cavity wall, Sill, Lintel, Doors and Windows, Floor, Mezzanine floor, Roof, Columns, Beams, Parapet.

Unit – II: Construction of Substructure (5 periods)

- Job Layout: Site Clearance, Layout for Load Bearing Structure and Framed Structure by Center Line and Face Line Method, Precautions.
- Earthwork: Excavation for Foundation, Timbering and Strutting, Earthwork for embankment, Material for plinth Filling, Tools and plants used for earthwork.
- Foundation: Functions of foundation, Types of foundation – Shallow Foundation, Stepped Footing, Wall Footing, Column Footing, Isolated and Combined Column Footing, Raft Foundation, Grillage Foundation. Deep Foundation - Pile Foundation, Well foundation and Caissons, Pumping Methods of Dewatering, Deep wells, Well points, Cofferdams (Introduction only).

Unit- III: Construction of Superstructure. (6 periods)

- **Stone Masonry:** Terms used in stone masonry- facing, backing, hearting, Through stone, corner stone, cornice. Types of stone masonry: Rubble masonry, Ashlar Masonry and their

types. Joints in stone masonry and their purpose. Selection of Stone Masonry, Precautions to be taken in Stone Masonry Construction.

- **Brick masonry:** Terms used in brick masonry- header, stretcher, closer, quoins, course, face, back, hearting, bat bond, joints, lap, frog line, level and plumb. Bonds in brick masonry- header bond, stretcher bond, English bond and Flemish bond. Requirements of good brick masonry. Junctions in brick masonry and their purpose and procedure. Precautions to be observed in Brick Masonry Construction. Comparison between stone and Brick Masonry. Tools and plants required for construction of stone and brick masonry. Hollow concrete block masonry and composite masonry.
- **Scaffolding and Shoring:** Purpose, Types of Scaffolding, Process of Erection and Dismantling. Purpose and Types of Shoring, Underpinning. Formwork: Definition of Formwork, Requirements of Formwork, Materials used in Formwork, Types of Formwork for slabs, beams, columns, stripping time for removal of formwork as per IS456

Unit– IV: Building Communication and Ventilation

(7 periods)

- **Horizontal Communication: Doors** –Components of Doors, Full Paneled Doors, Partly Paneled and Glazed Doors, Flush Doors, Collapsible Doors, Rolling Shutters, Revolving Doors, Glazed Doors. Sizes of Door recommended by BIS.
- **Windows:** Component of windows, Types of Windows - Full Paneled, Partly Paneled and Glazed, wooden, Steel, Aluminum windows, Sliding Windows, Louvered Window, Bay window, Corner window, clear-storey window, Gable and Dormer window, Skylight. Sizes of Windows recommended by BIS. Ventilators.
- Fixtures and fastenings for doors and windows- Material used and functions of Window Sill and Lintels, Shed / Chajja.
- **Vertical Communication:** Means of Vertical Communication- Stair Case, Ramps, Lift, Elevators and Escalators. Terms used in staircase-steps, tread, riser, nosing, soffit, waist slab, baluster, balustrade, scotia, hand rails, newel post, landing, headroom, winder. Types of stair- case (On the basis of shape): Straight, dog-legged, open well, Spiral, quarter turn, bifurcated, Three quarter turn and Half turn, (On the basis of Material): Stone, Brick, R.C.C., wooden and Metal.

Unit– V: Building Finishes

(6 periods)

- **Floors and Roofs:** Types of Floor Finishes and its suitability- Kota, Marble, Granite, Ceramic Tiles, Vitrified, Chequered Tiles, Paver Blocks, Concrete Floors, wooden Flooring, Skirting and Dado. Process of Laying and Construction, Finishing and Polishing of Floors, Roofing Materials- RCC, Mangalore Tiles, AC Sheets, G.I. sheets, Corrugated G.I. Sheets, Plastic and Fibre Sheets. Types of Roof: Flat roof, Pitched Roof-King Post truss, Queen Post Truss, terms used in roofs.
- **Wall Finishes:** Plastering – Necessity of Plastering, Procedure of Plastering, Single Coat Plaster, Double Coat Plaster, Rough finish, Neeru Finishing and Plaster of Paris (POP). Special Plasters- Stucco plaster, sponge finish, pebble finish. Plaster Board and Wall Claddings. Pre- cautions to be taken in plastering, defects in plastering. Pointing – Necessity, Types of pointing and procedure of Pointing. Painting –Necessity, Surface Preparation for painting, Methods of Application.

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)

SUGGESTED LEARNING RESOURCES:

1. S. P. Arora and Bindra., Building Construction, Dhanpat Rai Publication, Delhi.
2. Sushil Kumar., Building Construction, Standard Publication.
3. Rangawala, S. C., Building Construction, Charotar Publication, Anand.
4. Punmia B. C., and Jain A. K., Building Construction ,Firewall Media.
5. D.V. Gupta, Vikram Singh, Building Construction, Asian Publishers, Muzaffarnagar. ISBN: 978-93-91541-27-9
6. Sharma S. K., Building Construction, S. Chand and Co. Pvt. Ltd., New Delhi.
7. Janardan Zha , Building Construction, Khanna Publication.
8. Bhavikatti S. S., Building Construction, Vikas Publication House Pvt. Ltd., Delhi.
9. Mantri S., A to Z Building Construction, Satya Prakashan, New Delhi.

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-semester and end-semester written tests
- Actual practical work, exercises and viva-voce
- Presentation and viva-voce

SUGGESTED DISTRIBUTION OF MARKS

TopicNo.	TimeAllotted (Hrs)	MarksAllotted (%)
1	4	15
2	5	20
3	6	20
4	7	25
5	6	20
Total	28	100

PRACTICUM / PRACTICAL	3.7 BUILDING PLANNING AND DRAWING	L	T	P
		1	-	4

COURSE OBJECTIVES:

Following are the objectives of this course:

- To learn basic principles of building planning and drawing.
- To know graphical representation of various components of buildings.
- To draw complete plan and elevation of a building.
- To learn basics of perspective drawings and Computer Aided Drawings.

COURSE OUTCOMES:

After completing this course, student will be able to:

1. Interpret the symbols, signs and conventions from the given drawing.
2. Prepare line plans of residential and public buildings using principles of planning.
3. Prepare submission and working drawing for the given requirement of Load Bearing Structure.
4. Prepare submission and working drawing using CAD for the given requirement of Framed Structure.
5. Draw two-point perspective drawing for given small objects.

COURSE CONTENTS:

Unit – I Planning of Building

(4 periods)

- Conventions as per IS 962, symbols for different materials such as earthwork, brickwork, stonework, concrete, woodwork and glass.
- Graphical symbols for doors and windows, Abbreviations, symbols for sanitary and electrical installations.
- Principles of planning for Residential and Public building- Aspect, Prospect, Orientation, Grouping, Privacy, Elegance, Flexibility, Circulation, Furniture requirements, Sanitation, Economy.
- Space requirement and norms for minimum dimension of different units in the residential and public buildings as per IS 962.
- Rules and bye-laws of sanctioning authorities for construction work.
- Plot area, built up area, super built up area, plinth area, carpet area, floor area and FAR (Floor Area Ratio).

Unit– II

(3 periods)

Drawing No. 1 : Details of spread footing foundations for a load bearing and non-load bearing wall for given thickness of walls with the help of given data or rule of the thumb, showing offsets, position of DPC. The details of the concrete and brick apron have to be shown in the drawing.

Drawing No. 2 : Plans of 'T' and Corner junction of walls of 1 Brick, 1-1/2 Brick and 2 brick thick in English bond.

Drawing No. 3 : Drawing plan, elevation of arches: circular arch, segmental arch

Unit– III

(3 periods)

Drawing No. 4 : Elevation, sectional plan and sectional side elevation of flush door, fully glazed door, fully panelled door with wire gauge shutter, Partly panelled and partly glazed door.

Drawing No. 5 : Drawing plan, elevation of a small building by measurement and foundation detail and sectional elevation.

Drawing No. 6 : Drawing detailed working plan, elevation and section of a two rooms residential building from a given line plan or given data showing details of foundations, roof and parapet.

Unit– IV

(2 periods)

Drawing No. 7 : Drawings of following floors:

1. Cement concrete floors at ground level and at first floor level.
2. Brick floors:
 - a) Diagonal Bond
 - b) Herring Bone Bond
3. Bonded cement concrete flooring/ Marble flooring/ Terrazzo flooring
4. Ceramic/vitrified tile flooring

Drawing No. 8 : Drawing of flat roof, showing the heat/thermal insulation provisions.

Unit– V

(2 periods)

Drawing No. 9 : Drawing details of damp proofing arrangement of roofs and walls as per BIS Code. Show the rain water drainage arrangement also.

Drawing No 10: Drawing Damp Proofing details in basement of buildings.

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-semester and end-semester written tests
- Actual practical work, exercises and viva-voce
- Presentation and viva-voce

SUGGESTED DISTRIBUTION OF MARKS

Topic No.	Time Allotted (Hrs)	Marks Allotted(%)
1	4	20
2	3	20
3	3	20
4	2	20
5	2	20
Total	14	100

BUILDING PLANNING AND DRAWING LAB

List of Practical / Drawings to be completed:

1. Introduction to Computer Aided Drafting (2D) commands of any one software (Auto CAD, ProE, Solid works, Unigraphics etc.
 - 1.1 Concept of AutoCAD, Tool bars in CAD software, coordinate system, snap, grid, and ortho mode (Absolute, Relative and Polar), setting of units and layout.
 - 1.2 Drawing commands – point, line, arc, circle, ellipse,
 - 1.3 Editing commands – scale, erase, copy, stretch, lengthen and explode.
 - 1.4 Dimensioning and placing text in drawing area
 - 1.5 Sectioning and hatching
 - 1.6 Inquiry for different parameters of drawing entity
 - 1.7 Create layers within a drawing
 - 1.8 Specifying Geometrical Dimensioning & tolerance (GD&T) parameters in drawing
2. 2-D Plan of a Two-Room Building
3. Isometric Drawing by CAD using any part modeling Software (3D) Drawings of following on computer:
 - Cone
 - Cylinder
 - Cube
 - Spring
 - Isometric view of objects

4. Draw submission drawing to the scale of 1:100, of (G+1) Framed Structure Residential Building (2BHK) with Flat Roof and staircase showing using CAD software.
 - a) Developed plan
 - b) Elevation.
 - c) Section passing through Staircase, W.C. and Bath
 - d) Foundation plan.
 - e) Site plan (1:200), area statement, Schedule of openings and construction notes.
5. Draw working drawing to the scale of 1:100, of (G+1) Framed Structure Residential Building (2BHK) with Flat Roof and staircase showing using CAD software
 - a) Foundation plan to the scale 1:50
 - b) Detailed enlarged section of RCC column and footing with plinth filling.
 - c) Detailed enlarged section of RCC Beam, Lintel and Chajjas.
 - d) Detailed enlarged section of RCC staircase and slab.
6. Draw two point perspective drawing of small objects - steps, monuments, pedestals (any one) scale 1:50 using CAD software
 - a) Draw plan, elevation, eye level, picture plane and vanishing points
 - b) Draw perspective view.

SUGGESTED LEARNING RESOURCES:

1. Shah. M.G. Kale, CM, Patki, S.Y., Building Drawing, Mcgraw Hill Publishing
2. Malik and Mayo, Civil Engineering Drawing, Computech Publication Ltd
3. M. G. Shah and C. M. Kale, Principles of Perspective Drawing, Mcgraw Hill
4. Swamy, Kumara; Rao, N, Kameshwara, A ., Building Planning and Drawing, Charotar Publication, Anand.
5. Bhavikatti, S. S., Building Construction, Vikas Publication House Pvt. Ltd., Delhi.
6. Mantri, Sandip, A to Z Building Construction, Satya Prakashan, New Delhi.
7. Singh, Ajit, Working with Auto CAD 2000, Mcgraw Hill Publishing company Ltd.
8. M.K. Varshney, Building Drawing, Asian Publishers, Muzaffarnagar. ISBN: 978-93-91541-28-6
9. Sane, Y.S., Planning and design of Building, Allied Publishers, New Delhi.

THEORY	3.8 CONCRETE TECHNOLOGY	L	T	P
		2	-	-

COURSE OBJECTIVES:

Following are the objectives of this course:

- To know properties of cement, aggregate and water used in concrete.
- To understand different characteristics of concrete.
- To learn about role of admixtures in concrete.

COURSE OUTCOMES:

After completing this course, student will be able to:

- Use different types of cement and aggregates in concrete
- Prepare concrete of desired compressive strength.
- Prepare concrete of required specification.
- Maintain quality of concrete under different conditions.
- Apply relevant admixtures for concreting.

COURSE CONTENTS:

Unit – I Cement, Aggregates and Water

(6 periods)

- Physical properties of OPC and PPC: fineness, standard consistency, setting time, soundness, compressive strength. Different grades of OPC and relevant BIS codes
- Testing of cement: Laboratory tests-fineness, standard consistency, setting time, soundness, compressive strength. Storage of cement and effect of storage on properties of cement.
- BIS Specifications and field applications of different types of cements: Rapid hardening, Low heat, Portland pozzolana, Sulphate resisting, Blast furnace slag, High Alumina and White cement.
- Aggregates: Requirements of good aggregate, Classification according to size and shape.
- Fine aggregates: Properties, size, specific gravity, bulk density, water absorption and bulking, fineness modulus and grading zone of sand, silt content and their specification as per IS 383. Concept of crushed Sand.
- Coarse aggregates: Properties, size, shape, surface texture, water absorption, soundness, specific gravity and bulk density, fineness modulus of coarse aggregate, grading of coarse aggregates, crushing value, impact value and abrasion value of coarse aggregates with specification.
- Water: Quality of water, impurities in mixing water and permissible limits for solids as per IS: 456-2000

Unit– II Concrete

(6 periods)

- Concrete: Different grades of concrete, provisions of IS 456.
- Duff Abraham water cement (w/c) ratio law, significance of w/c ratio, selection of w/c ratio for different grades, maximum w/c ratio for different grades of concrete for different exposure conditions as per IS 456.
- Properties of fresh concrete: Workability: Factors affecting workability of concrete. Determination of workability of concrete by slump cone, compaction factor, Vee-Bee Consistometer. Value of workability requirement for different types of concrete works. Segregation, bleeding and preventive measures.
- Properties of Hardened concrete: Strength, Durability, Impermeability.

Unit– III Concrete Mix Design and Testing of Concrete

(4 periods)

- Concrete mix design: Objectives, methods of mix design, study of mix design as per IS 10262-2009 (only procedural steps).
- Testing of concrete, determination of compressive strength of concrete cubes at different ages, interpretation and co-relation of test results.
- Non-destructive testing of concrete: Rebound hammer test, working principle of rebound hammer and factor affecting the rebound index, Ultrasonic pulse velocity test as per IS 13311 (part 1 and 2), Importance of NDT tests.

Unit– IV Quality Control of Concrete

(6 periods)

- Concreting Operations: Storage, Batching, Mixing, Transportation, Placing, Compaction, Curing and Finishing of concrete.
- Joints in concrete construction: Types of joints, methods for joining old and new concrete, materials used for filling joints.
- Defects in Concrete: Identification of defects and methods of removing defects.

Unit– V Chemical Admixture, Special Concrete and Extreme Weather concreting

(6 periods)

- Admixtures in concrete: Purpose, properties and application for different types of admixture such as accelerating admixtures, retarding admixtures, water reducing admixtures, air entraining admixtures and super plasticizers.
- Special Concrete: Properties, advantages and limitation of following types of Special concrete: Ready mix Concrete, Fiber Reinforced Concrete, High performance Concrete Self-compacting concrete and light weight concrete.
- Cold weather concreting: effect of cold weather on concrete, precautions to be taken while concreting in cold weather condition.
- Hot weather concreting: effect of hot weather on concrete, precautions to be taken while concreting in hot weather condition.
- Under water concrete

SUGGESTED LEARNING RESOURCES:

1. Gambhir, M.L., Concrete Technology, Tata McGraw Hill Publishing Co. Ltd., Delhi.
2. Shetty, M.S., Concrete Technology, S.Chand and Co.Pvt. Ltd., Ram Nagar, Delhi.
3. D.V. Gupta, Vikram Singh, Concrete Technology, Asian Publishers, Muzaffarnagar. ISBN: 978-93-91541-22-4
4. Santhakumar, A. R., Concrete Technology, Oxford University Press, New Delhi.
5. Neville, A. M. and Brooks, J.J., Concrete Technology, Pearson Education Pvt. Ltd.
6. Neville, A. M., Concrete Technology, Pearson Education Pvt. Ltd., New Delhi.
7. Sood, H., Kulkarni P. D., Mittal L. N., Laboratory Manual in Concrete Technology, CBS Publishers, New Delhi.

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-semester and end-semester written tests
- Actual practical work, exercises and viva-voce
- Presentation and viva-voce

SUGGESTED DISTRIBUTION OF MARKS

TopicNo.	TimeAllotted (Hrs)	MarksAllotted(%)
1	6	20
2	6	20
3	4	20
4	6	20
5	6	20
Total	28	100

PRACTICAL	3.9 CONCRETE TECHNOLOGY LAB.	L	T	P
		-	-	4

COURSE OBJECTIVES:

Following are the objectives of this course:

- To know properties of cement, aggregate and water used in concrete.
- To understand different characteristics of concrete.
- To learn about role of admixtures in concrete.

COURSE OUTCOMES:

After completing this course, student will be able to:

- Identify different types of cement by performing laboratory tests.
- Know the physical properties of fine and coarse aggregates.
- Prepare concrete of required specification.
- Maintain the quality of concrete applying scientific principles.
- Use relevant admixtures for improving the workability of concrete.

LIST OF PRACTICAL TO BE PERFORMED:

1	Determine fineness of cement by Blaine's air permeability apparatus Or by sieving.
2	Determine specific gravity, standard consistency, initial and final setting times of cement.
3	Determine compressive strength of cement.
4	Determine silt content in sand.
5	Determine bulking of sand.
6	Determine bulk density of fine and coarse aggregates.
7	Determine water absorption of fine and coarse aggregates.
8	Determine Fineness modulus of fine aggregate by sieve analysis.
9	Determine impact value of aggregate.
10	Determine crushing value of aggregate.
11	Determine abrasion value of aggregate.
12	Determine elongation and flakiness index of coarse aggregates
13	Determine workability of concrete by slump cone test.
14	Determine workability of concrete by compaction factor test.
15	To prepare concrete mix of a particular grade and determine compressive strength of concrete for 7 and 28 days.
16	Demonstration of NDT equipment's .

SEMESTER-IV

THEORY	4.1 HYDRAULICS	L	T	P
		2	-	-

COURSE OBJECTIVES:

Following are the objectives of this course:

- To understand parameters associated with fluid flow and hydrostatic pressure.
- To know head loss and water hammer in fluid flowing through pipes.
- To learn different types of pumps and their uses.

COURSE OUTCOMES:

After competing this course, student will be able to:

- Measure pressure and determine total hydrostatic pressure for different conditions.
- Understand various parameters associated with fluid flow
- Determine head loss of fluid flow through pipes.
- Find the fluid flow parameters in open channels.
- Select relevant hydraulic pumps for different applications.

COURSE CONTENT:

Unit – I Pressure measurement and Hydrostatic pressure (6 periods)

- Technical terms used in Hydraulics–fluid, fluid mechanics, hydraulics, hydrostatics and hydrodynamics - ideal and real fluid, application of hydraulics.
- Physical properties of fluid – density-specific volume, specific gravity, surface tension, capillarity, viscosity-Newton’s law of viscosity.
- Various types of pressure – Atmospheric Pressure, Gauge Pressure, Absolute Pressure, Vacuum Pressure. Concept of Pressure head and its unit, Pascal’s law of fluid pressure and its uses.
- Measurement of differential Pressure by different methods.
- Variation of pressure with depth, Pressure diagram, hydrostatic pressure and center of pressure on immersed surfaces and on tank walls.
- Determination of total pressure and center of pressure on sides and bottom of water tanks, sides and bottom of tanks containing two liquids, vertical and inclined surface in contact with liquid on either side

Unit– II Fluid Flow Parameters (4 periods)

- Types of flow – Gravity and pressure flow, Laminar, Turbulent, Uniform, Non-uniform, Steady, Unsteady flow. Stream line, stream tube, streak line, path line Reynolds number.

- Discharge and its unit, continuity equation of flow.
- Energy of flowing liquid: potential, kinetic and pressure energy.
- Bernoulli's theorem : statement, assumptions, equation. (Without proof of theorem)

Unit– III Flow through pipes

(8 periods)

- Major head loss in pipe: Frictional loss and its computation by Darcy's Weisbach equation, Use of Moody's Diagram and Nomograms.
- Critical velocity and velocity distribution in a pipe for laminar flow
- Minor losses in pipe: loss at entrance, exit, sudden contraction, sudden enlargement and fittings.
- Flow through pipes in series, pipes in parallel and Dupuit's equation for equivalent pipe. Hydraulic gradient line and total energy line.
- Water hammer in pipes: Causes and Remedial measures.
- Discharge measuring device for pipe flow: Venturimeter - construction and working.
- Discharge measurement using Orifice, Hydraulic Coefficients of Orifice.

Unit– IV Flow through Open Channel

(5 periods)

- Geometrical properties of channel section: Wetted area, wetted perimeter, hydraulic radius for rectangular and trapezoidal channel section.
- Determination of discharge by Chezy's equation and Manning's equation.
- Conditions for most economical rectangular and trapezoidal channel section.
- Discharge measuring devices: Triangular and rectangular Notches.
- Velocity measurement devices: current meter, floats and Pitot tube.
- Specific energy diagram, Froude's' Number, Hydraulic jump.

Unit– V Hydraulic Pumps

(5 periods)

- Concept of pump, Types of pump - centrifugal, reciprocating, submersible.
- Centrifugal pump: components and working
- Reciprocating pump: single acting and double acting, components and working.
- Suction head, delivery head, static head, Manometric head
- Power of centrifugal pump.
- Selection and choice of pump.
- Introduction of Impulse and Reaction turbine.

SUGGESTED LEARNING RESOURCES:

1. Modi, P. N. and Seth, S.M., Hydraulics and Fluid Mechanics, Standard book house, Delhi.
2. S.S. Rattan, Fluid Mechanics & Hydraulic Machines, Khanna Book Publishing Co., New Delhi

3. Ramamrutham, and Narayan, R., Hydraulics, Fluid Mechanics and Fluid Machines, Dhanpat Rai Publishing, New Company Delhi.
4. Khurmi R S, Hydraulics, Fluid Mechanics, Hydraulic machines, S. Chand Publishers
5. Rajput, R K, Fluid Mechanics, S Chand, New Delhi.
6. Ojha, C S P, Berndtsson, R, and Chandramoulli P. N., Fluid Mechanics and Machinery, Oxford University Press, New Delhi.

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-semester and end-semester written tests
- Actual practical work, exercises and viva-voce
- Presentation and viva-voce

SUGGESTED DISTRIBUTION OF MARKS

Topic No.	Time Allotted (Hrs)	Marks Allotted (%)
1	6	20
2	4	15
3	8	25
4	5	20
5	5	20
Total	28	100

PRACTICAL	4.2 HYDRAULICS LAB.	L	T	P
		-	-	2

COURSE OBJECTIVES:

Following are the objectives of this course:

- To understand parameters associated with fluid flow and hydrostatic pressure.
- To know head loss and water hammer in fluid flowing through pipes.
- To learn different types of pumps and their uses.

COURSE OUTCOMES:

After completing this course, student will be able to:

- Ensure pressure and determine total hydrostatic pressure for different conditions.
- Understand various parameters associated with fluid flow.
- Determine head loss of fluid flow through pipes.
- Find the fluid flow parameters in open channels.
- Select relevant hydraulic pumps for different applications.

LIST OF PRACTICALS TO BE PERFORMED:

1	Use piezometer to measure pressure at a given point.
2	Use U-tube differential manometer to measure pressure difference between two given points.
3	Use Reynold's apparatus to determine type of flow.
4	Use Bernoulli's apparatus to apply Bernoulli's theorem to get total energy line for a flow in a closed conduit of varying cross sections.
5	Determine minor losses in pipe fittings due to sudden contraction and sudden enlargement.
6	Calibrate Venturimeter to find out the discharge in a pipe.
7	Calibrate the Orifice to find out the discharge through a tank
8	Use Current meter to measure the velocity of flow of water in open channel.
9	Use Pitot tube to measure the velocity of flow of water in open channel.
10	Use Rectangular and triangular notch to measure the discharge through open channel.

SUGGESTED LEARNING RESOURCES:

1. Modi, P. N. and Seth, S.M., Hydraulics and Fluid Mechanics, Standard book house, Delhi.
2. S.S. Rattan, Fluid Mechanics and Hydraulic Machines, Khanna Publishing House, Delhi

3. Ramamrutham, and Narayan, R., Hydraulics, Fluid Mechanics and Fluid Machines, DhanpatRai Publishing Company, New Delhi.
4. Khurmi,R S, Hydraulics, Fluid Mechanics, Hydraulic machines, S Chand Publishers, New Del-hi.
5. Rajput, R K, Fluid Mechanics, S Chand, New Delhi.
6. Ojha, C S P, Berndtsson, R, and Chandramoulli P. N., Fluid Mechanics and Machinery, Oxford University Press, New Delhi.

THEORY	4.3 ADVANCED SURVEYING	L	T	P
		2	-	-

COURSE OBJECTIVES:

Following are the objectives of this course:

- To know methods of plane surveying and Theodolite surveying and their uses
- To learn tachometric surveying and curve setting
- To understand the principles of Electronic Distance Measurement equipment and Total station and their use.
- To know the concept of remote sensing, GPS and GIS

COURSE OUTCOMES:

After completing this course, student will be able to:

- Prepare plans using Plane Table Surveys.
- Prepare plans using Theodolite surveys.
- Find distances and elevations using Tachometer.
- Prepare plans using Total Station instrument.
- Locate coordinates of stations using GPS.

COURSE CONTENT:

Unit – I Plane Table Surveying (4 periods)

- Principles of plane table survey.
- Accessories of plane table and their use, Telescopic alidade.
- Setting of plane table; Orientation of plane table - Back sighting and Magnetic meridian method, True Meridian Method.
- Methods of plane table surveys- Radiation, Intersection, Traversing and resection (Two point and Three point methods).
- Merits and demerits of plane table survey.

Unit– II Theodolite Surveying (6 periods)

- Types and uses of Theodolite, Components of transit Theodolite and their functions, Reading the Vernier of transit Theodolite.
- Technical terms- Swinging, Transiting, Face left, Face right.
- Fundamental axes of transit Theodolite and their relationship
- Temporary adjustment of transit Theodolite.
- Measurement of horizontal angle- Direct and Repetition method and reiteration methods.
- Measurement of magnetic bearing of a line, Prolonging and ranging a line, deflection angle.
- Measurement of vertical Angle.

- Theodolite traversing by Included angle method and Deflection angle method.
- Checks for open and closed traverse, Calculations of bearing from angles.
- Traverse computation-Latitude, Departure, Consecutive coordinates, Independent coordinates, balancing the traverse by Bowditch's rule and Transit rule, Gale's Traverse table computation.
- Errors and Precautions in theodolite surveying.

Unit– III Tacheometric surveying and Curve setting (6 periods)

- Principles of Tacheometry, Tacheometer and its component parts, Anallactic lens.
- Tacheometric formula for horizontal distance with telescope horizontal and staff vertical.
- Field method for determining constants of tacheometer, Determining horizontal and vertical distances with tacheometer by fixed hair method and staff held vertical, Limitations of tacheometry.
- Simple circular curve: Basic definitions, Designation of curves, Types of curves used in roads and railway alignments.
- Transition curves: Definition and requirement.
- Setting simple circular curve by offsets from long chord, Tangent and Rankine's method of deflection angles.
- Introduction of vertical circular curve.

Unit– IV Advanced surveying equipments (6 periods)

- Principle of Electronic Distance Meter (EDM), its component parts and their Functions, use of EDM.
- Use of micro optic Theodolite and Electronic Digital Theodolite.
- Use of Total Station, Use of function keys.
- Measurements of Horizontal angles, vertical angles, distances and coordinates using Total Station, Traversing, Profile Survey and Contouring with Total Station.

Unit– V Remote sensing, GPS and GIS (6 periods)

- Remote Sensing – Overview, Remote sensing system, Applications of remote sensing in Civil engineering, land use / Land cover, mapping, disaster management.
- Use of Global Positioning System (G.P.S.) instruments.
- Geographic Information System (GIS): Overview, Components, Applications, Software for GIS.
- Introduction to Drone Surveying.

SUGGESTED LEARNING RESOURCES:

1. Kanetkar, T. P.; Kulkarni, S. V., Surveying and Levelling Part I and II, Pune Vidyarthi GruhPrakashan, Pune.
2. Basak, N. N., Surveying and Levelling, McGraw Hill Education (India) Pvt. Ltd., Noida.
3. Duggal, S. K., Survey I and Survey II, Tata McGraw Hill Education Pvt. Ltd., Noida.
4. Saikia, M D.; Das. B.M.; Das. M.M., Surveying PHI Learning Pvt. Ltd., New Delhi.
5. D.V. Gupta, Vikram Singh, Land Surveying-II. Asian Publishers. Muzaffarnagar, ISBN: 978-93-91541-59-0
6. Subramanian, R., Surveying and Levelling, Oxford University Press. New Delhi.
7. Punmia, B.C.; Jain, Ashok Kumar; Jain, Arun Kumar, Surveying Vol. I and Surveying Vol. II, Laxmi Publications Pvt. Ltd., New Delhi.
8. Rao, P. Venugopala Akella, Vijayalakshmi, Textbook of Surveying, PHI Learning Pvt. Ltd., New Delhi.
9. Venkatramaiah, C, Textbook of Surveying, Universities Press, Hyderabad.
10. Anderson, James M and Mikhail, Edward M, Surveying theory and practice, McGraw Hill Education, Noida.
11. De, Alak, Plane Surveying, S.Chand Publications, New Delhi.

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-semester and end-semester written tests
- Actual practical work, exercises and viva-voce
- Presentation and viva-voce

SUGGESTED DISTRIBUTION OF MARKS

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

PRACTICAL	4.4 ADVANCED SURVEYING LAB.	L	T	P
		-	-	4

COURSE OBJECTIVES:

Following are the objectives of this course:

- To know methods of plane surveying, Theodolite surveying and their uses.
- To learn tachometric surveying and curve setting.
- To understand the principles of Electronic Distance Measurement and Total station and their uses.
- To know the concept of Remote Sensing, GPS and GIS.

COURSE OUTCOMES:

After completing this course, student will be able to:

- Prepare plans using Plane Table Surveys.
- Prepare plans using Theodolite surveys.
- Find distances and elevations using Tachometer.
- Make measurements using Total Station.
- Locate coordinates of survey stations using GPS

LIST OF PRACTICALS TO BE PERFORMED

1.	Use plane table survey to prepare plans of a plot of seven sided closed traverse by Radiation Method.
2.	Use plane table survey to prepare plans, locate details by Intersection Method and resection method.(Two point problem & three point problem)
3.	Use plane table survey to prepare plans, locate details by Traversing Method.
4.	Use plane table survey to carry out Survey Project for closed traverse for minimum five sides around a building.
5.	Use transit theodolite to measure Horizontal and Vertical angle by Direct Method.
6.	Plot the traverse on A1 size imperial drawing sheet for the collected data from preceding Theodolite Survey Project.
7.	Set out a circular curve by Rankine's Method of Deflection Angles.
8.	Use EDM to measure horizontal distance.
9.	Use Total station instrument to measure horizontal distances.
10.	Use Total station instrument to measure vertical angle.
11.	Use Total station instrument to carry out Survey Project for closed traverse for minimum five sides.
12.	Plot the traverse on A1 size imperial drawing sheet for the collected data from preceding Total Station Survey Project.
13.	Use GPS to locate the coordinates of a station.

SUGGESTED LEARNING RESOURCES

1. Kanetkar, T. P.; Kulkarni, S. V., Surveying and Levelling Part I and II, Pune Vidyarthi GruhPrakashan, Pune.
2. Basak, N. N., Surveying and Levelling, McGraw Hill Education (India) Pvt. Ltd., Noida.
3. Duggal, S. K., Survey I and Survey II, Tata McGraw Hill Education Pvt. Ltd., Noida.
4. Saikia, M D.; Das. B.M.; Das. M.M., Surveying PHI Learning Pvt. Ltd., New Delhi.
5. Subramanian, R., Surveying and Levelling, Oxford University Press. New Delhi.
6. Punmia, B.C.; Jain, Ashok Kumar; Jain, Arun Kumar, Surveying Vol. I and Surveying Vol. II, Laxmi Publications Pvt. Ltd., New Delhi.
7. Rao, P. Venugopala Akella, Vijayalakshmi, Textbook of Surveying, PHI Learning Pvt. Ltd., New Delhi.
8. Venkatramaiah, C, Textbook of Surveying, Universities Press, Hyderabad.
9. Anderson, James M and Mikhail, Edward M, Surveying theory and practice, McGraw Hill Education, Noida.
10. De, Alak, Plane Surveying, S.Chand Publications, New Delhi.

THEORY	4.5 THEORY OF STRUCTURES	L	T	P
		2	1	-

COURSE OBJECTIVES:

Following are the objectives of this course:

- To learn concept of eccentric loading and stresses in vertical members like column, chimneys, dam
- To analyze beams using various methods like slope deflection, three moment, and moment distribution
- To understand different methods of finding axial forces in trusses.

COURSE OUTCOMES:

After competing this course, student will be able to:

- Analyze stresses induced in vertical member subjected to direct and bending loads.
- Analyze slope and Deflection in fixed and continuous beams.
- Analyze continuous beam under different loading conditions using the principles of Three Moments.
- Analyze continuous beam using Moment Distribution Method under different loading conditions.
- Evaluate axial forces in the members of simple truss.

COURSE CONTENT:

Unit – I Principal stress and strain (6 periods)

- Stress on inclined planes, principal plane and principal stress in elements subjected to direct and shear stress and their combinations. Mohr Circle for calculation of stress on inclined planes and principal strain for above cases

Unit – II Combined Direct and Bending stress (6 periods)

- Eccentric loading middle third rule columns subjected to uni-axial and bi-axial eccentric loading. Dams- application of middle third rule for finding the base width calculation of stresses at the base of dam and stability of dam against overturning and sliding vertical structures like chimney subjected to movement due to wind forces.

Unit- III Strain Energy (6 periods)

- Strain energy stored in a member due to axial loading and bending. Strain energy stored by a beam due to uniform bending moment. Work done by a force on a member law of reciprocal deflection, Betti's law. The first theorem of castigliano. Deflection of truss joints.

Unit– IV Moment distribution method and Slope Deflection Method

(5 periods)

- Moment distribution method: Basic proposition relative stiffness, continuous beams with and without fixed ends. Sinking of support portal frames with and without sway (simple problem only)
- Slope Deflection Method : Basic concepts, stiffness of members with far end fixed or hinged. Development of slope deflection equations and their application to beam and frames.

Unit– V Simple trusses

(5 periods)

- Types of trusses (Simple, Fink, compound fink, French truss, Pratt truss, Howe truss, North-light truss, King post and Queen post truss)
- Calculate support reactions for trusses subjected to point loads at joints
- Calculate forces in members of truss using Method of joints and Method of sections.

SUGGESTED LEARNING RESOURCES:

1. Ramamrutham.S, Theory of structures, Dhanpatrai & Sons.
2. Khurmi, R. S. , Theory of Structures S. Chand and Co., New Delhi.
3. Bhavikatti, S S , Structural Analysis Vol-1, ,Vikas Publishing House Pvt Ltd.New Delhi.
4. Dr. Vijay Mittal, Amit Verma, Structural Mechanics, Asian Publishers Muzaffarnagar. ISBN: 978-93-91541-23-1
5. Junnarkar, S. B. , Mechanics of structures, Volume-I and II Charotar Publishing House, Anand.
6. Pandit, G.S. and Gupta, S.P., Theory of Structures, Tata McGraw Hill, New Delhi.
7. Agor R, Structural Analysis, Khanna Publishing House, Delhi.

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-semester and end-semester written tests
- Actual practical work, exercises and viva-voce
- Presentation and viva-voce

SUGGESTED DISTRIBUTION OF MARKS

TopicNo.	TimeAllotted (Hrs)	MarksAllotted (%)
1	6	20
2	6	20
3	6	20
4	5	20
5	5	20
Total	28	100

THEORY	4.6 DESIGN OF REINFORCED CEMENT CONCRETE STRUCTURES	L	T	P
		2	1	-

COURSE OBJECTIVES:

Following are the objectives of this course:

- To learn the concept of limit state design for tension and compression steel members.
- To learn the concept of limit state design of steel beams.
- To understand design of RCC elements.
- To know the design of short and long RCC columns.

COURSE OUTCOMES:

After completing this course, student will be able to perform:

- Design of steel tension and compression member.
- Design of steel I and Channel sections.
- Design of singly and doubly reinforced RCC beam.
- Design of RCC beam for shear and development length.
- Design of short and long RCC columns.

COURSE CONTENT:

Unit – I Introduction

(8 periods)

Concept of Reinforced Cement Concrete (RCC)

Reinforcement Materials: - Suitability of steel as reinforcing material
- Properties of mild steel, HYSD steel and TMT bars

Loading on structures as per IS: 875

Introduction to following methods of RCC design : Working stress method: Definition and basic assumptions
Limit state method: Definition and basic assumptions

Working stress method: Shear and Development length Problems of singly, doubly and T beam analysis by Working stress method

Shear as per IS: 456-2000 by working stress method

- Shear strength of concrete without shear reinforcement
- Maximum shear stress
- Shear reinforcement
- Development Length

Unit– II Concept of Limit State Method

(8 periods)

Concept of Limit State Method:

- Definitions and assumptions made in limit state of collapse (flexure)
- Partial factor of safety for materials
- Partial factor of safety for loads

- Design loads
- Stress block, parameters

Unit– III Design of Reinforced Concrete Beams by Limit State Method

(9 periods)

Singly Reinforced beam : Theory and design of singly reinforced beam by Limit State Method

Doubly Reinforced Beams : Theory and design of simply supported doubly reinforced rectangular beam by Limit State Method

Behavior of T beam, inverted T beam, isolated T beam and ‘L’ beams. Simple problems related to moment capacity.

Unit– IV Design of One way and Two way slab

(9 periods)

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

Two Way Slab : 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)

Unit– V Design of axially loaded RCC Column and Pre-stressed Concrete

(9 periods)

- Axially Loaded Column:
- Definition and classification of columns
- Effective length of column,
- Specifications for longitudinal and lateral reinforcement
- Design of axially loaded square, rectangular and circular short columns by Limit State Method including sketching of reinforcement(sectional elevation and plan)
- Pre-stressed Concrete:
- Concept of pre-stressed concrete
- Methods of pre-stressing: pre-tensioning and post-tensioning
- Advantages and disadvantages of pre-stressing
- Losses in pre-stress

SUGGESTED LEARNING RESOURCES:

- Shah, V. L., and Karve, S.R., Limit State Theory and Design of Reinforced Concrete Structures, Structures Publications, Pune,2014.
- Sinha N.C., and Roy S.K., Fundamentals of Reinforced Concrete, S. Chand & Co., New Delhi.
- D.V. Gupta, Vikram Singh, Reinforced Concrete Technology, Asian Publishers,

Muzaffarnagar. ISBN: 978-93-5502-123-6

- Krishna Raju, and N. Pranesh, R.N., Reinforced Concrete Design Principles and Practice, New Age International, Mumbai.
- Pillai, S.U., and Menon, Devdas, Reinforced concrete Design, McGraw Hill Publications, New Delhi.
- Varghese, P. C., Limit State Design of Reinforced Concrete, Prentice Hall India Learning Private Limited, Delhi.

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-semester and end-semester written tests
- Actual practical work, exercises and viva-voce
- Presentation and viva-voce

SUGGESTED DISTRIBUTION OF MARKS

TopicNo.	TimeAllotted (Hrs)	MarksAllotted (%)
1	8	20
2	8	20
3	9	20
4	9	20
5	9	20
Total	42	100

PRACTICUM / PRACTICAL	4.7 REINFORCED CEMENT CONCRETE STRUCTURES DRAWING	L	T	P
		1	-	4

COURSE OBJECTIVES:

Following are the objectives of this course:

- To learn the concept of limit state design of tension and compression steel members.
- To understand design of steel beams.
- To learn the concept of limit state design of RCC beams.
- To know the limit state design of RCC columns.

COURSE OUTCOMES:

After competing this course, student will be able to perform:

- Design of steel tension and compression member.
- Design of steel beams including check for shear.
- Design of singly and doubly reinforced RCC beam.
- Design of shear reinforcement in RC beams.
- Design of RCC column as per IS 456.

LIST OF PRACTICAL TO BE PERFORMED:

RC Drawing:

1. Reinforcement details from the given data for the following structural elements with bar bending schedules
2. General instruction and rules, Drawing 1- lap, joint, development drawing: length, rings, hook etc.
3. Drawing No. 2: RC Slabs - One way slab, Two way slab and Cantilever Slab.
4. Drawing No.3: Beams - Singly and doubly reinforced rectangular beams and Cantilever beam (All beams with vertical stirrups), T Beam, Tapered Beam.
5. Drawing No.4: Columns and Footings – Square, Rectangular and Circular Columns with lateral ties and their isolated sloped column footings, column and beam junction
6. Drawing No. 5: Portal Frame – Three bay two storey RC portal frame with blow up of column beam junctions.
7. Drawing of cantilever retaining wall showing details of all the members and reinforcement.
8. Drawing of Intze type water tank showing details of all the members and reinforcement.

SUGGESTED LEARNING RESOURCES:

1. Shah, V. L., and Karve, S.R., Limit State Theory and Design of Reinforced Concrete Structures, Structures Publications, Pune, 2014.
2. Sinha N.C., and Roy S.K., Fundamentals of Reinforced Concrete, S. Chand & Co., New Delhi.
3. Krishna Raju, and N.Pranesh, R.N., Reinforced Concrete Design Principles and Practice, New Age International, Mumbai.
4. Pillai, S.U., and Menon, Devdas, Reinforced concrete Design, McGraw Hill Publications, New Delhi.
5. Varghese, P. C., Limit State Design of Reinforced Concrete, Prentice Hall India Learning Private Limited, Delhi.

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-semester and end-semester written tests
- Actual practical work, exercises and viva-voce
- Presentation and viva-voce

THEORY	4.8 WATER RESOURCE ENGINEERING	L	T	P
		2	-	-

COURSE OBJECTIVES:

Following are the objectives of this course:

- To learn estimation of hydrological parameters.
- To understand water demand of crops and provisions to meet the same.
- To know planning of reservoirs and dams.
- To design irrigation projects, canals and other diversion works.

COURSE OUTCOMES:

After completing this course, student will be able to:

- Estimate hydrological parameters.
- Estimate crop water requirements of a command area and capacity of canals.
- Execute Minor and Micro Irrigation Schemes.
- Select the relevant Cross Drainage works for the specific site conditions.
- Design, construct and maintain simple irrigation regulatory structures.

COURSE CONTENT:

Unit – I Introduction to Hydrology (5 periods)

Hydrological Cycle : Rainfall, definition rain-gauges – automatic and non-automatic, methods of estimating average rainfall, Advantages of keeping rainfall records, (Arithmetic system); catchment area, runoff, factors affecting runoff, hydrograph, basic concept of unit hydrograph.

Unit– II Crop water requirement (6 periods)

- Principal crops in India and their water requirements, Crop seasons – Kharif and Rabi
- Soil water, soil crop and crop water relationships, Duty, Delta and Base Period, their relationship, Gross commanded area (GCA), culturable commanded area (CCA), Intensity of Irrigation, Paleo irrigation, Kor, Crop Ratio, Crop period, Base period, Duty, Delta. Relation between Duty-Delta and Base period.
- Definition of water logging – its causes and ill effects, detection, prevention and remedies, Surface and sub-surface drains and their layout.

Unit– III Methods of Irrigation (5 periods)

- Definition of irrigation, Necessity of irrigation, Role of Irrigation in country's economy. History of development of irrigation in India, Major, medium and minor irrigation projects of India.
- Flow irrigation - its advantages and limitations, Lift Irrigation – Tubewell, submersible and well irrigation advantages and disadvantages, Sprinkler irrigation conditions favourable and essential requirements for sprinkler irrigation, sprinkler system – classification and component parts, Drip irrigation, suitability of drip irrigation, layout, component parts, advantages
- Tubewell Irrigation comparison with canal irrigation, Tubewells, explanation of terms: water table, radius of influence, depression head, cone of depression, confined and unconfined aquifers. Types of tubewells (cavity type, strainer type and slotted type) and their choice
- Method of boring, installation of well assembly, development of well, pump selection and installation and maintenance, 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.

Unit– IV Diversion Head Works & Canals

(6 periods)

- Canals: Factors to be considered in Canal Alignment. Functions/Purpose of various components of Canal. Classification of Canals and their functions, sketches of different canal cross-sections, Various types of canal lining - their related advantages and disadvantages, sketches of different lined canal X-sections, Breaches – Causes, Method to plug canal breaches and their control, Maintenance of lined and unlined canals
- Canal Head Works and Regulatory Works : Choice of location of Canal Head Works, definition, object, general layout, functions of different parts of head works. Difference between weir and barrage Cross Drainage Works : Functions and necessity Cross Drainage Works, Types of Cross Drainage Works: aqueduct, super passage, level crossing, inlet and outlet, Sketches of the above cross drainage works .Introduction of Kennedy and lacy theory.
- Cross Drainage Works : Functions and necessity Cross Drainage Works, types of Cross Drainage Works: aqueduct, super passage, level crossing, inlet and outlet, Sketches of the above cross drainage works.

Unit– V Dams and Spillways and river training works

(6 periods)

- Dams : Classification of dams; earthen dams - types, causes of failure; cross-section of homogeneous, zoned and diaphragm type earthen dams, method of construction. Gravity dams – types, cross-sections of a dam, method of construction, Concept of small and micro dams, Concept of spillways and energy dissipators.
- River Training Works : Various River Stages, Purpose/functions of River Training works, Meandering of rivers, Methods of river training, guide banks, Marginal Embankment, retired (levees) embankments, groynes and spurs, pitched island, cut-off

SUGGESTED LEARNING RESOURCES:

1. Punmia, B.C., Pande, B, Lal, Irrigation and Water Power Engineering, Laxmi Publications
2. Subramanayan, Engineering Hydrology, McGraw Hill.
3. D.V. Gupta, Vikram Singh, Irrigation Engineering, Asian Publishers, Muzaffarnagar, ISBN: 978-93-5502-115-1
4. Mutreja K N, Applied Hydrology, McGraw Hill
5. Sharma, R.K. and Sharma, T.K., Irrigation Engineering, S.Chand
6. Basak, N.N., Irrigation Engineering, McGraw Hill Education
7. Asawa, G.L., Irrigation and water resource Engineering, New Age
8. Dahigaonkar, J.G., Irrigation Engineering, Asian Book Pvt. Ltd., New Delhi.
9. Garg, S K, Irrigation and Hydraulic Structures, Khanna Publishers, Delhi.
10. Priyani V.B., Irrigation Engineering, Charotar Book Stall, Anand.

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-semester and end-semester written tests
- Actual practical work, exercises and viva-voce
- Presentation and viva-voce

SUGGESTED DISTRIBUTION OF MARKS

TopicNo.	TimeAllotted (Hrs)	MarksAllotted (%)
1	5	20
2	6	20
3	5	20
4	6	20
5	6	20
Total	28	100

PRACTICUM / THEORY	4.9 PUBLIC HEALTH ENGINEERING	L	T	P
		1	-	2

COURSE OBJECTIVES:

Following are the objectives of this course:

- To learn the principles for identification of sources of surface and subsurface water
- To learn calculation of population and requirement of drinking water
- To understand the plotting of water supply scheme highlighting different features
- To know evaluation of characteristics and treatment of sewage.

COURSE OUTCOMES:

After competing this course, student will be able to:

- Know the procedure to identify the sources of surface and subsurface water
- Estimate the quantity of drinking water required for a population
- Draw labelled layout for water supply scheme.
- Device suitable water treatment technique.
- Evaluate the characteristics and suggest treatment of sewage.

COURSE CONTENT:

UNIT – I Sources, Demand and Quality of water (3 periods)

Water supply schemes - Objectives, components,

- Sources of water: Surface and Subsurface sources of water, Intake Structures, Definition and types, Factors governing the location of an intake structure, Types of intakes.
- Demand of water: Factors affecting rate of demand, Variations of water demands, Forecasting of population, Methods of forecasting of population, (Simple problems on forecasting of population), Design period, Estimating of quantity of water supply required for city or town.
- Quality of water: Need for analysis of water, Characteristics of water- Physical, Chemical and Biological, Testing of water for Total solids, hardness, chlorides, dissolved Oxygen, pH, Fluoride, Nitrogen and its compounds, Bacteriological tests, E coli, B coli index, MPN, Sampling of water, Water quality standards as per IS 10500.

UNIT - II Purification of water (3 periods)

- Purification of Water: Objectives of water treatment, Aeration- objects and methods of aeration, Plain sedimentation, Sedimentation with coagulation, principles of coagulation, types of coagulants, Jar Test, process of coagulation, types of sedimentation tanks, Clariflocculator.
- Filtration - mechanism of filtration, classification of filters: slow sand filter, rapid sand filter, pressure filter. Construction and working of slow sand filter and rapid

sand filter, operational problems in filtration. Disinfection: Objects, methods of disinfection, Chlorination- Application of chlorine, forms of chlorination, types of chlorination practices, residual chlorine and its importance, Flow diagram of water treatment plants.

- Miscellaneous water Treatments: Introduction to water softening, Dechlorination and Defluoridation techniques.

UNIT III Conveyance and Distribution of water (2 periods)

- Conveyance: Types of Pipes used for conveyance of water, choice of pipe material, Types of joints & Types of valves- their use, location and function on a pipeline and other related appurtenances.
- Distribution of water: Methods of distribution of water- Gravity, pumping, and combined system, Service reservoirs - functions and types, Layouts of distribution of Water-Dead end system, grid iron system, circular system, radial system; their suitability, advantages and disadvantages.
- Laying of pipe, testing of pipe lines, Building water supply (Practical aspect only).

UNIT IV Domestic sewage and Sewerage System (3 periods)

- Introduction: Purpose of sanitation, Necessity of systematic collection and disposal of waste, Definition of terms in sanitary engineering, Collection and conveyance of sewage, Conservancy and water carriage systems, their advantages and Disadvantages (a) Surface drains (only sketches) : various types, suitability (b) Types of sewage: Domestic, industrial, storm water and its seasonal variation.
- Sewerage System : Types of sewerage systems, materials for sewers, their sizes and joints 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.
- Laying and Construction of Sewers : Setting out/alignment of sewers, Excavations, checking the gradient with boning rods preparation of bedding, handling and jointing testing and back filling of sewers/pipes. Construction of surface drains and different sections required.

UNIT V Characteristics and treatment of Sewage (3 periods)

- Sewage Characteristics : Properties of sewage and IS standards for analysis of sewage, Physical, chemical and bacteriological parameters
- Natural Methods of Sewerage Disposal: General composition of sewage and disposal methods, Disposal by dilution, Self purification of stream, Disposal by land treatment, Nuisance due to disposal
- Sewage Treatment : Meaning and principle of primary and secondary treatment and activated sludge process their flow diagrams, Introduction and uses of screens, grit chambers, detritus tanks, skimming tanks, plain sedimentation tanks, primary clarifiers, secondary clarifiers, filters, control beds, intermittent sand filters, trickling filters, sludge treatment and disposal, oxidation ponds (Visit to a sewage

- treatment plant) Oxidation ditch, duckweed pond, Vermiculture
- Building Drainage : Aims of building drainage and its requirements, Different sanitary fittings and installations, Traps
 - Introduction to smart water supply and waste water management : A field visit may be planned to explain and show the relevant things.

SUGGESTED LEARNING RESOURCES

1. Sharma S.C, Environmental Engineering, Khanna Publishing House, New Delhi
2. Garg, S.K., Environmental Engineering Vol. I and Vol. II, Khanna Publishers
3. Birdie, G. S. and Birdie, J. S. Water Supply and Sanitary Engineering, Dhanpat Rai
4. Gupta, O.P., Elements of Environmental Pollution Control, Khanna Publishing House, Delhi
5. Rao, C.S., Environmental Pollution Control Engineering, New Age International
6. Punmia, B C, Environmental Engineering, vol. I and II, Laxmi Publishers
7. D.V. Gupta, Vikram Singh, Water & Waste Water Engineering, Asian Publishers, Muzaffarnagar. ISBN: 978-93-91541-52-1
8. Peavy H S, Rowe D R, and Tchobanoglous G, Environmental Engineering, McGraw
9. Basak N N, Environmental Engineering, McGraw Hill Publishers.

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-semester and end-semester written tests
- Actual practical work, exercises and viva-voce
- Presentation and viva-voce

SUGGESTED DISTRIBUTION OF MARKS

TopicNo.	Time Allotted (Hrs)	Marks Allotted (%)
1	3	20
2	3	20
3	2	20
4	3	20
5	3	20
Total	14	100

PUBLIC HEALTH ENGINEERING LAB.

COURSE OBJECTIVES:

Following are the objectives of this course:

- To learn the tests for measuring quality of drinking water.
- To learn determination of BOD and COD requirement in sewage.
- To understand the plotting of water supply scheme highlighting different features.

COURSE OUTCOMES:

After competing this course, student will be able to:

- Perform various tests to assess quality of water.
- Estimate dissolved solids as per BIS codes.
- Measure BOD and COD of sewage sample.
- Draw line diagram of water pipeline system for a locality.

LIST OF PRACTICAL TO BE PERFORMED:

1	Determine pH value of given sample of water.
2	Determine the turbidity of the given sample of water.
3	Determine residual chlorine in a given sample of water.
4	Determine suspended, dissolved solids and total solids of given sample of water.
5	Determine the dissolved oxygen in a sample of water.
6	Determine the optimum dose of coagulant in a given raw water sample by jar test.
7	Determine B.O.D. of given sample of sewage.
8	Determine pH value of given sample of sewage.
9	Determine suspended solids dissolved and total solids for sample of sewage.
10	Determine the dissolved oxygen in the given sample of sewage.
11	Determine C.O.D. of given sample of sewage.
12	Prepare a report of a field visit to sewage treatment plant or water treatment plant

AUDIT COURSE	4.10 ESSENCE OF INDIAN KNOWLEDGE AND TRADITION	L	T	P
		2	-	-

COURSE OBJECTIVE:

Understand the fundamental aspects of the Indian Knowledge System, its integration with modern science, principles of Yoga and holistic healthcare, and practical applications in contemporary contexts.

COURSE OUTCOMES:

Upon completion of the course, the student will be able to demonstrate knowledge of the following topics:

- Overview, importance, and relevance of the Indian Knowledge System, including Vedas, Upavedas, Vedangas, and Upangas.
- Relevance of science and spirituality, and contributions of ancient Indian science and technology.
- Basic principles of Yoga, benefits of holistic healthcare, and integration with modern healthcare.
- Practical applications and case studies of the Indian Knowledge System's relevance today.

COURSE CONTENTS

Unit 1: Introduction to Indian Knowledge System (07 Periods)

Overview of Indian Knowledge System

- Importance and relevance
- Introduction to the Vedas
- Upavedas
- Vedangas
- Upangas

Unit 2: Modern Science and Indian Knowledge System (07 Periods)

- Relevance of Science and Spirituality,
- Science and Technology in Ancient India,

Unit 3: Yoga and Holistic Healthcare (07 Periods)

- Basic principles of Yoga

- Benefits of holistic healthcare practices
- Integration with modern healthcare

Unit 4: Case Studies / Assignment

(07 Periods)

- Practical Applications / Case studies demonstrating the relevance of Indian Knowledge System in modern times

SUGGESTED DISTRIBUTION OF MARKS

TopicNo.	TimeAllotted (Hrs)	MarksAllotted (%)
1	07	30
2	07	25
3	07	25
4	07	20
Total	28	100

	SUMMER INTERNSHIP-I/SUMMER INTERNSHIP-II	L	T	P

SUMMER INTERNSHIP-I/SUMMER INTERNSHIP-II

(Summer Internship-I will be During summer vacation after II Semester & Summer Internship-II will be During summer vacation after IV Semester)

It is needless to emphasize further the importance of Professional Training of students during their 3 years of studies at Polytechnics. It is Professional training, which provides an opportunity to students to experience the environment and culture of corporate construction offices/ Government construction and Design departments/ Construction Agencies/ Builder's Organisations / Design Consultation units and commercial activities undertaken in field organizations. It prepares student for their future role as diploma Civil engg. In the world of work and enables them to integrate theory with practice. Polytechnics have been arranging Professional training of students of various durations to meet the above objectives.

This document includes guided and supervised Professional training of a minimum of 4 weeks duration to be organised during the semester break starting after first year and 6 weeks duration after second year i.e. after IInd & IVth 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, Working environment, Designing and Drafting process, important machines and Drafting tools used in the training organization.

Equally important with the guidance is supervision of students training in the office/organization by the teachers. A minimum of one visit 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 external assessment of 50 marks has been provided in the study and evaluation scheme of IIIrd & 100 marks in Vth Semester. Evaluation of professional training report through viva-voce/presentation aims at assessing student's understanding of Drafting various working drawings, Designing process, practices in offices/field organization and their ability to engage in activities related to problem solving in professional setup as well as understanding of application of knowledge and skills learnt in real life situations. The formative and summative evaluation may comprise of weightage to performance in testing, general behaviour, quality of report and presentation during viva-voce examination. It is recommended that such evaluations may be carried out by a team comprising of concerned HOD, teachers and representative from Organisation . Teachers and students are requested to see the footnote below the study and evaluation scheme of II& IV Semester for further details.

The teacher along with field supervisors will conduct performance assessment of students. The components of evaluation will include the following:

- Punctuality and regularity 15%
- Initiative in learning new things/field exposure 20%
- Presentation and viva 40%
- Industrial training report 25%

9. GUIDELINES FOR ASSESSMENT OF STUDENT CENTRED ACTIVITIES (SCA)

It was discussed and decided that the maximum marks for SCA should be 50 as it involves a lot of subjectivity in the evaluation. The marks may be distributed as follows:

- i. 15 Marks for general behavior and discipline
(by HODs in consultation with all the teachers of the department)
- ii. 10 Marks for attendance as per following:
(by HODs in consultation with all the teachers of the department)
 - a) 75 - 80% 6 Marks
 - b) 80 - 85% 8 Marks
 - c) Above 85% 10Marks
- iii. 25 Marks maximum for Sports/NCC/Cultural/Co-curricular/ NSS activities as per following:
(by In-charge Sports/NCC/Cultural/Co-curricular/NSS)
 - a) 25 - State/National Level participation
 - b) 20 - Participation in two of above activities
 - c) 15 - Inter-Polytechnic level participation

Note: There should be no marks for attendance in the internal sessional of different subjects.

10. RESOURCE REQUIREMENT

10.1 PHYSICAL RESOURCES

(A) Space requirement

Norms and standards laid down by All India Council for Technical Education (AICTE) are to be followed to work out space requirement in respect of class rooms, tutorial rooms, drawing halls, laboratories, space required for faculty, student amenities and residential area for staff and students.

(B) Laboratory requirement:

Following Laboratories are required for Diploma Program in Civil Engineering:

- Communication Laboratory
- Applied Physics Laboratory
- Applied Chemistry Laboratory
- Engineering Drawing
- Electrical Engineering Laboratory
- Applied Mechanics Laboratory
- Basics of IT/Computer Laboratory
- Carpentry Shop
- Painting and Polishing Shop
- Electrical Shop
- Welding Shop
- Fitting and Plumbing Shop

- Sheet Metal Shop
- Mason Shop
- Machine Shop
- Construction Material Testing
 - a. Concrete Laboratory
 - b. Roads and Solids Laboratory
- Survey Equipment and Stores
- Fluid Mechanics and Irrigation Laboratory
- Civil Engineering Fabrication and Erection Shop
- Environmental Engineering Laboratory , Energy Conservation Lab

10.2 EQUIPMENT REQUIRED FOR CIVIL ENGINEERING

Sr. No.	Description	Qty
CONSTRUCTION MATERIALS TESTING		
A. CONCRETE LABORATORY		
1.	Compression testing machine (100 T. Capacity)	1
2.	Vibration machine	1
3.	Electrically heated oven (Thermostatically controlled)	1
4.	Blaine Air permeability Apparatus (for testing fineness of cement)	2
5.	Vicat's Apparatus	4
6.	Le Chatelier's soundness apparatus (to determine quantity of free lime in cement)	2
7.	Slump Cone (to determine the workability of concrete)	2
8.	Compaction factor apparatus (to determine the workability of concrete)	1
9.	Vee-Bee apparatus (to determine the workability of concrete)	1
10.	Platform weighing machine	1
11.	Concrete cube moulds	12 each
12.	Concrete mixers	1
13.	Sieve shaker	1
14.	Set of sieves	2 Set
15.	Beam mould	2
16.	Impact testing machine	2
17.	Needle vibrator	1 Each
18.	Flakiness index apparatus	2
19.	Elongation index apparatus	2
20.	Bar bending and cutter apparatus	2 Set
21.	Bulk density apparatus	2
22.	Wire basket	4
23.	Riffle sampler	2
24.	Table vibrator	2
25.	Concrete test hammer	1
26.	Ultrasonic pulse velocity apparatus	1
B. ROADS AND SOILS LABORATORY		
1.	Ring and Ball apparatus (with heating mantle)	1
2.	CBR apparatus with loading machine	1
3.	Flash point and fire point apparatus (Cleaveland type)	1
4.	Los angles Abrasion testing machine apparatus	1

Sr. No.	Description	Qty
5.	Water bath (Thermostatically controlled)	1
6.	Aggregate impact value testing apparatus with automatic blow counter	2
7.	Penetration value apparatus with timer	1
8.	Viscometer Capillary type	1
9.	Ductility machine	1
10.	Direct shear test apparatus	1
11.	Drying oven(Thermostatically controlled)	1
12.	Electronic balance	1
13.	Standard penetration test equipment	1
14.	Soil exploration equipment (Augers etc)	1
15.	Sand replacement method apparatus	2
16.	Liquid limit and plastic limit apparatus	2 Each
17.	Compaction apparatus using light compaction (Proctor Test)	2
18.	Grain size distribution test apparatus (sieve set)	2 Set
19.	Sieve shaker	2
20.	Permeability apparatus	1
21.	Proctor penetrometer	1
22.	Core cutter apparatus	2
23.	Rapid moisture meter	2
24.	Pycnometer with burette	6
25.	Liquid limit apparatus (Cone penetrometer method)	2
SURVEY EQUIPMENT AND STORES		
1.	Plane Table with stand and accessories	16
2.	Dumpy level, quick setting level and engineers level i) Dumpy level - 8 ii) Quick setting level - 8 iii) Engineer' level - 1	17
3.	Transit theodolite (Vernier type)	12
4.	Prismatic compass	15
5.	Planimeter	5
6.	Leveling staves (All aluminum)	5
7.	Total Station	2
8.	Ranging rods	60
9.	Pentagraph	2
10.	Optical square	5
11.	Abney level	5

12.	Tangent clinometer (Indian Pattern)	5
13.	Mirror stereoscope	1
14.	Telescopic Alidade	2
15.	Prismatic binoculars	1
16.	Metric chain/non-metrics	10
17.	Metallic taps/Fibre glass/Invar tape	20
18.	Tentage, camp equipment and other misc. items and instruments	L.S
19.	Modern survey equipment	L.S
20.	Theodolite (Digital) Distomat	1
21.	Electronics Distance Measurement (EDM)	1
22.	Total Station	1
23.	GPS Hands Instrument	1
FLUID MECHANICS AND IRRIGATION LABORATORY		
1.	Hydraulic Bench	2
2.	Impact of Jet apparatus	1
3.	Flow measurement apparatus by Venturimeter and Orificemeter	1
4.	Pipe Friction apparatus	1
5.	Orifice and Mouthpiece apparatus	1
6.	Bernoulli's Theorem apparatus	1
7.	Flow over a notch apparatus	1
8.	Losses in pipe bends apparatus	1
9.	Reynold's apparatus	1
10.	Working models of: <ul style="list-style-type: none"> - Pelton wheel Turbine - Francis - Reciprocating - Centrifugal pump - Hydraulic Ram - Kaplan turbine 	1 Each
11.	Manometers of different types and pressure gauges like: <ul style="list-style-type: none"> - Piezometer - 6 - Differential Manometers (Double column type manometer) - 10 - Universal manometers (Single column type manometer) - 2 - Inclined tube manometer - 2 - Bourden pressure gauges - 2 - Compound Gauges (Vacuum and pressure gauge combined) - 2 <p>This apparatus should be purchased along with hydraulic bench as the design of these apparatus depend upon the design of Hydraulic bench</p>	24

12.	Current meter	1
13.	Centrifugal pump test Rig.	1
14.	Submergible pump set apparatus	1
15.	Misc. Tools etc.	L.S
CIVIL ENGINEERING FABRICATION AND ERECTION SHOP		
1.	Masonry erection tools, such as iron pans, trowels, plumb bobs, showels, sets pick axes, corner squares etc.	10
2.	Carpenter's tool such as tenon saw, planes screw drivers, chisel sets, sets marking gauges, pliers, hammers, augers, bevel squares, files, drills etc.	10
3.	Plumber tools, plumbing vice, die and tap sets, pipe wrenches of different sets sizes, pipe cutters, spanner sets, hammer plier.	5
4.	Centering, shuttering and scaffolding (for an ordinary residential building)	1 Set
5.	Pipes and pipe fittings, valves, gully traps, GI grating, manhole, cover traps, WC pan with foot rest, flushing cistern, urinal pan with cistern, taps, wash basin, water meter etc.	L.S
6.	Hoisting and conveying equipment tripod, hoist, pulleys, ladders, ballis etc. Compressed air equipment with accessories - 1	L.S
7.	Steel fabrication equipment with fabricating small trusses, reinforcement cages, small girder, column beam connections, column truss connection	1 Set
8.	Floor grinding/polishing machine, spray guns etc.	L.S

Sr. No.	Description	Qty
ENVIRONMENTAL ENGINEERING LABORATORY		
1.	Lovibond comparator (for color determination	1
2.	Colorimeter (for color determination)	1
3.	Centrifuge	1
4.	Turbidimeter	1
5.	pH meter	1
6.	Jar test apparatus (Flocculator)	1
7.	Dissolved oxygen meter	1
8.	B.O.D incubator	1
9.	Water bath with digital controller	1
10.	Hot air oven	1
11.	Hot plate	2
12.	Bacteriological incubator	1
13.	Colony counter	1

14.	Water sampler	1
15.	Water analysis kit	1
16.	Water distills	1
17.	Conductivity meter	1
18.	Electronic balance	1
19.	Chemical Balance	1
20.	Inverted microscope	1
21.	Model of oxidation ditch	1
22.	Working model of Trickling Filter	1
23.	Misc. items like noise measurement apparatus etc.	L.S

NOTE:

In addition to the above, laboratories in respect of physics, chemistry, Computer Centre etc will be required for effective implementation of the course. Provision for photocopiers, PC facilities along with LCD Projection System etc. has also to be made.

10.3 Furniture Requirement

Norms and standards laid down by AICTE be followed for working out furniture requirement for this course.

10.4 Human Resources Development:

Weekly work schedule, annual work schedule, student teacher ratio for various group and class size, staffing pattern, work load norms, qualifications, experience and job description of teaching staff workshop staff and other administrative and supporting staff be worked out as per norms and standards laid down by the AICTE.

11. EVALUATION STRATEGY

INTRODUCTION

Evaluation plays an important role in the teaching-learning process. The major objective of any teaching- learning endeavour is to ensure the quality of the product which can be assessed through learner's evaluation.

The purpose of student evaluation is to determine the extent to which the general and the specific objectives of curriculum have been achieved. Student evaluation is also important from the point of view of ascertaining the quality of instructional processes and to get feedback for curriculum improvement. It helps the teachers in determining the level of appropriateness of teaching experiences provided to learners to meet their individual and professional needs. Evaluation also helps in diagnosing learning difficulties of the students. Evaluation is of two types: Formative and Summative (Internal and External Evaluation)

Formative Evaluation

It is an on-going evaluation process. Its purpose is to provide continuous and comprehensive feedback to students and teachers concerning teaching-learning process. It provides corrective steps to be taken to account for curricular as well as co-curricular aspects.

Summative Evaluation

It is carried out at the end of a unit of instruction like topic, subject, semester or year. The main purpose of summative evaluation is to measure achievement for assigning course grades, certification of students and ascertaining accountability of instructional process. The student evaluation has to be done in a comprehensive and systematic manner since any mistake or lacuna is likely to affect the future of students. In the present educational scenario in India, where summative evaluation plays an important role in educational process, there is a need to improve the standard of summative evaluation with a view to bring validity and reliability in the end-term examination system for achieving objectivity and efficiency in evaluation.

• STUDENTS' EVALUATION AREAS

The student evaluation is carried out for the following areas:

- Theory
- Practical Work (Laboratory, Workshop, Field Exercises)
- Project Work
- Professional Industrial Training

A. Theory

Evaluation in theory aims at assessing students' understanding of concepts, principles and procedures related to a course/subject, and their ability to apply learnt principles and solve problems. The formative evaluation for theory subjects may be caused through sessional /class-tests, home-assignments, tutorial-work, seminars, and group discussions etc. For end-term evaluation of theory, the question paper may comprise of three sections.

Section-I

It should contain objective type items e.g. multiple choice, matching and completion type. Total weightage to Section-1 should be of the order of 20 percent of the total marks and no choice should be given in this section. The objective type items should be used to evaluate students' performance in knowledge, comprehension and at the most application domains only.

Section-II

It should contain short answer/completion items. The weightage to this section should be of the order of 40 percent of the total marks. Again, no choice should be given in section-II

Section-III

It may contain two to three essay type questions. Total weightage to this section should be of the order of 40 percent of the total marks. Some built-in, internal choice of about 50 percent of the questions set, can be given in this section

Table II : Suggested Weightage to be given to different ability levels

Abilities	Weightage to be assigned
Knowledge	10-30 percent
Comprehension	40-60 percent
Application	20-30 percent
Higher than application i.e., Analysis, Synthesis and Evaluation	Up to 10 percent

B. Practical Work

Evaluation of student's performance in practical work (Laboratory experiments, Workshop practical/field exercises) aims at assessing students' ability to apply or practice learnt concepts, principles and procedures, manipulative skills, ability to observe and record, ability to interpret and draw conclusions and work-related attitudes. Formative and summative evaluation may comprise of weightages to performance on task, quality of product, general behavior and it should be followed by viva-voce.

C. Project Work

The purpose of evaluation of project work is to assess students' ability to apply, in an integrated manner, learnt knowledge and skills in solving real life problems, manipulative skills, ability to observe, record, creativity and communication skills. The formative and summative evaluation may comprise of weightage to nature of project, quality of product, quality of report and quality of presentation followed by viva-voce.

D. Professional Industrial Training

Evaluation of professional industrial training report and viva-voce/presentation aims at assessing students' understanding of materials, industrial processes, practices in the industry/field and their ability to engage in activities related to problem-solving in industrial setting as well as understanding of application of learnt knowledge and skills in real life situation. The formative and summative evaluation may comprise of weightages to performance in testing, general behavior, quality of report and presentation during viva-voce.

12. RECOMMENDATIONS FOR EFFECTIVE CURRICULUM IMPLEMENTATION

This curriculum document is a Plan of Action and has been prepared based on exhaustive exercise of curriculum planning and design. The representative sample comprising selected senior personnel (lecturers and HODs) from various institutions and experts from industry/field have been involved in curriculum design process.

The document so prepared is now ready for its implementation. It is the faculty of polytechnics who have to play a vital role in planning instructional experiences for the courses in four different environments viz. class-room, laboratory, library and field and execute them in right perspective. It is emphasized that a proper mix of different teaching methods in all these places of instruction only can bring the changes in stipulated students' behavior as in the curriculum document. It is important for the teachers to understand curriculum document holistically and further be aware of intricacies of teaching-learning process (T-L) for achieving curriculum objectives. Given below are certain suggestions which may help the teachers in planning and designing learning experiences effectively. These are indicative in nature and teachers using their creativity can further develop/refine them. The designers of the programme suggest every teacher to read them carefully, comprehend and start using them.

(A) Broad Suggestions:

1. Curriculum implementation takes place at programme, course and class-room level respectively and synchronization among them is required for its success. The first step towards achieving synchronization is to read curriculum document holistically and understand its rationale and philosophy.
2. An academic plan needs to be prepared and made available to all polytechnics well in advance. The principals have a great role to play in its dissemination and, percolation up to grass-root level. Polytechnics, in turn are supposed to prepare institutional academic plan.
3. HOD of every Programme Department along with HODs and in charges of other departments are required to prepare academic plan at department level referring to institutional academic plan.
4. All lecturers/Senior lecturers are required to prepare course level and class level lesson plans referring departmental academic plan.

(B) Course Level Suggestions

Teachers are educational managers at class room level and their success in achieving course level objectives lies in using course plan and their judicious execution which is very important for the success of programme by achieving its

objectives. Polytechnic teachers are required to plan various instructional experiences viz. theory lecture, expert lectures, lab/workshop practical's, guided library exercises, field visits, study tours, camps etc. In addition, they have to carry out progressive assessment of theory, assignments, library, practical and field experiences. Teachers are also required to do all these activities within a stipulated period of time. It is essential for them to use the given time judiciously by planning all above activities properly and ensure execution of the plan effectively.

Following is the gist of suggestions for subject teachers to carry out T-L process effectively:

1. Teachers are required to prepare a course plan, taking into account departmental academic plan, number of weeks available and courses to be taught.
2. Teachers are required to prepare lesson plan for every theory class. This plan may comprise of contents to be covered, learning material for execution of a lesson plan. They may follow steps for preparing lesson plan e.g., drawing attention, state instructional objectives, help in recalling pre-requisite knowledge, deliver planned subject content, check desired learning outcomes and reinforce learning etc.
3. Teachers are required to plan for expert lectures from field/industry. Necessary steps are to plan in advance, identify field experts, make correspondence to invite them, take necessary budgetary approval etc.
4. Teachers are required to plan for guided library exercises by identification of course specific experience requirement, setting time, assessment, etc. The assignments and seminars can be thought of as terminal outcome of library experiences.
5. Concept and content-based field visits may be planned and executed for such content of course which is abstract in nature and no other requisite resources are readily available in institute to impart them effectively.
6. There is a dire need for planning practical experiences in right perspective. These slots in a course are the avenues to use problem-based learning/activity learning/experiential learning approach effectively. The development of lab instruction sheets for the course is a good beginning to provide lab experiences effectively.
7. Planning of progressive assessment encompasses periodical assessment in a semester, preparation of proper quality question paper, assessment of answer sheets immediately and giving constructive feedback to every student
8. The student-centered activities may be used to develop generic skills like task management, problem solving, managing self, collaborating with others etc.

9. Where ever possible, it is essential to use activity- b a s e d learning rather than relying on delivery based conventional teaching all the time.
10. Teachers may take initiative in establishing liaison with industries and field organizations for imparting field experiences to their students.
11. Students be made aware about issues related to ecology and environment, safety, concern for wastage of energy and other resources etc.
12. Students may be given relevant and well thought out project assignments, which are purposeful and develop practical skills. This will help students in developing creativity and confidence for their gainful employment.
13. A Project bank may be developed by the concerned department of the polytechnics in consultation with related Industry, research institutes and other relevant field organizations in the state.

13 - List of Participants/Experts

The following experts have participated/ contributed in workshop for Developing Curriculum Scheme / Competency Profile according to AICTE and NEP-2020, of Three Year Diploma course in Civil Engineering at IRDT Kanpur.

1. Sri Ravi Sachan, HOD Civil, Government Polytechnic Lucknow.
2. Sri Vinod Kumar Dwivedi, Lecturer Civil Engineering Manyavar Kashiram
Government Polytechnic, Kannauj
3. Sri Lokendra Narayan Tripathi, HOD Civil Engineering, Government Polytechnic, Kanpur
4. Sri Imran Khan, Lecturer Civil Engineering, Government Polytechnic, Deeh sadar, Unnao
5. Sri Ajeet Srivastava, Lecturer Civil, Government Polytechnic, Deeh Sadar, Unnao
6. Sri Anant Prakash, Lecturer Civil, Government Polytechnic, Bargad Chitrakoot.
7. Smt. Charu Bajpai, Lecturer Civil, Government Polytechnic, Sikandra, Kanpur Dehat
8. Smt. Ruchi Singh, Lecturer Civil, Government Polytechnic, Kanpur
9. Sri Piyush Kumar Malviya, Lecturer Civil, Government Polytechnic, Kanpur