

TECHNICAL EDUCATION DEPARTMENT (DIPLOMA SECTOR) UTTAR PRADESH

CURRICULUM FOR FIRST AND SECOND SEMESTER

FOR PACKAGING TECHNOLOGY DIPLOMA COURSES^

Semester System



EFFECTIVE FROM YEAR 2025-26

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 Packaging Technology	3 Years

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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. The initiatives being taken by the State Board of Technical Education, UP has designed 1st year syllabus for Diploma in Packaging Technology 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

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1. Sh. M. Devraj, IAS, Principal Secretary Govt. of UP, Technical Education Department, Secretariat Lucknow.
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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 : 75 (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 (Listed in Annexure -1)

FIRST SEMESTER

FIRST SEMESTER															
Sr. No.	SUBJECTS	STUDY SCHEME Periods/Week			Credits	MARKS IN EVALUATION SCHEME									Total Marks of Internal & External
						INTERNAL ASSESSMENT			EXTERNAL ASSESSMENT						
		L	T	P		Th	Pr	Tot	Th	Hrs	Pr	Hrs	Tot		
1.1	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 & AI	3	-	2	4	40	60	100	60	3	40	3	100	200	
	2	-	4												
1.4	Communication Skills in English OR Fundamentals of Packaging Science	3	-	2	4	40	60	100	60	3	40	3	100	200	
1.5	Engineering Graphics OR Basic Packaging 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)		-	-	6	-	-	50	50	-	-	-	-	-	50	
TOTAL				22	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.

SECOND SEMESTER:

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 Introduction to IT & AI	3	-	2	4	40	60	100	60	3	40	3	100	200	
	2	-	4												
2.4	Fundamentals of Packaging Science OR Communication Skills in English	3	-	2	4	40	60	100	60	3	40	3	100	200	
2.5	Introduction to Packaging Materials	2	1	2	4	40	60	100	60	3	40	3	100	200	
2.6	Engineering Graphics OR Basic Packaging Workshop Practice			4	2	-	40	40	60	3	-	-	60	100	
	-	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

COURSE OBJECTIVES

L	T	P
3	-	2

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): Portland 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 resources 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.wastewaterelearning.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

Humanities & Social Science	1.4 Communication Skills in English	L	T	P
		3	-	2

COURSE OBJECTIVES

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 will be able to:

CO1: Explain the fundamentals and principles of effective communication and apply appropriate communication tools in professional contexts

CO2: Demonstrate effective listening and speaking skills using appropriate pronunciation and professional soft skills

CO3: Read and interpret professional and technical texts to extract relevant information

CO4: Apply correct grammar and vocabulary in written and spoken communication

CO5: Write clear and grammatically correct professional documents and formal correspondence

SUGGESTED COURSE ARTICULATION MATRIX (CAM):

CO No.	PO1 Basic and Discipline Specific Knowledge	PO2 Problem Analysis	PO3 Design/ Development of Solutions	PO4 Engineering Tools	PO5 Practices for Society, Sustainability and Environment	PO6 Project Management	PO7 Life Long Learning	PSO1	PSO2
CO1	3	2	-	1	-	1	3	*	*
CO2	3	3	-	-	2	3	3	*	*
CO3	3	3	2	-	-	2	3	*	*
CO4	3	2	-	-	2	2	3	*	*
CO5	3	2	2	1	2	2	2	*	*

Legend: High (3), Medium (2), Low (1) and No mapping (-)

* PSOs will be developed by respective programme coordinator at institute level. As per latest NBA guidelines, formulating PSOs is optional.

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

Unit – 3 Reading Comprehension: Unseen Passages (08 Periods)

- 3.1 Introduction to Reading Comprehension
- 3.2 Questions & Answers
- 3.3 Prefix & Suffix
- 3.4 Antonyms & Synonyms

Unit: 4 Functional Grammar (08 Periods)

- 4.1 Sentence and its Types
- 4.2 Parts of Speech
- 4.3 Tenses
- 4.4 Active and Passive Voice
- 4.5 Punctuation

Unit: 5 Professional Writing (14 Periods)

- 5.1 CV Writing, Resume, Covering Letter
- 5.2 Agenda, Minutes of Meeting
- 5.3 Notices
- 5.4 Official Letters: Memo, Circular, Office Orders
- 5.5 Letter-Reports
- 5.6 E-mail Drafting

LIST OF PRACTICALS

Unit-1 Listening Skills

- 1.1 Introduction to listening process and practice
- 1.2 Listening to lectures/speeches/poems/interviews and Dialogues

Unit 2 Beginning to Express

- 2.1 Introducing Self and Others
- 2.2 Extempore- Just a minute session
- 2.3 Scenario and role-based conversations (e.g. Manager and Team; Customer and Salesperson)
- 2.4 Leave taking

Unit 3 Speaking Skills

- 3.1 Talking about likes and dislikes
- 3.2 Asking questions-polite responses
- 3.3 Apologizing & forgiving
- 3.4 Complaining & Warning

Unit 4 Steps Towards Future

- 4.1 Delivering formal speeches
- 4.2 Mock Interviews
- 4.3 Presentation
- 4.4 Group Discussion

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	8	20
5	14	30
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 Sukhasana, Vyayams
- Practice of Asans and Benefits – Sidhasana, Padmasana, Vajrasana, Shasakasan, Singhasana, Gomukhasana, Virasana, Dhanurasana, Matsnyendrasana, Gorakhasana, Paschimottasana, Mayurasana, Garunasana, Pawanmuktasana, Kurmasana, Mandukasana, Shalabhasana, Makrasana, Bhujangasana, Naukasana, Shavasana, Sharvangasana, Halasana.
- Practice and Benefits of Pranayamas – Anulom- Vilom, Surya Bhedhi, Ujjayi, Sheetkari, Bhastrika, Bhramari, Murchha, kawali 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, Dhyanachand 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
- Asana and pranayama as 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, Crammer'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 $\int_0^{\frac{\pi}{2}} \sin^n x dx$, $\int_0^{\frac{\pi}{2}} \cos^n x dx$, $\int_0^{2\pi} \sin^m x \cos^n x dx$ 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, directrices 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 Kirchhoff'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 AND AI

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., after the introductory knowledge of IT tools and definitions it is required to know new age technology of industry 4.0,. to fulfil this objects, we also introduced the fundamental of artificial intelligent (AI) & Its application in several areas for 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.

COURSE OUTCOMES

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

- CO1:** Explain the basic concepts of computers, their generations, components, memory types, and commonly used input and output devices.
- CO2:** Demonstrate the use of operating systems and application software including document creation, spreadsheets, presentations, and basic system utilities.
- CO3:** Describe the fundamentals of computer networking and the Internet, including network types, connecting devices, IP addressing, and web-based services such as email and search engines.
- CO4:** Identify information security principles and cyber threats, and explain basic protection mechanisms, cyber security practices, and relevant cyber laws.
- CO5:** Explain the fundamentals of Artificial Intelligence, including types of AI, differences between AI, Machine Learning, and Deep Learning, and demonstrate basic interaction with AI tools using prompt engineering

SUGGESTED COURSE ARTICULATION MATRIX (CAM):

CO No.	PO1 Basic and Discipline Specific Knowledge	PO2 Problem Analysis	PO3 Design/ Development of Solutions	PO4 Engineering Tools	PO5 Practices for Society, Sustainability and Environment	PO6 Project Management	PO7 Life Long Learning	PSO1	PSO2
CO1	3	1	-	2	-	-	1	*	*
CO2	2	1	1	3	-	1	2	*	*
CO3	2	2	1	2	1	-	2	*	*
CO4	2	2	1	1	2	-	2	*	*
CO5	2	2	2	3	1	1	3	*	*

Legend: High (3), Medium (2), Low (1) and No mapping (-)

* PSOs will be developed by respective programme coordinator at institute level. As per latest NBA guidelines, formulating PSOs is optional.

COURSE CONTENTS**1. Introduction to Computers and Peripherals (05 Periods)**

Introduction, Computer Generations, Components of Computer, Types of Computers, CPU, Memory & its types, Input & Output devices, Printer, Scanner, Modem, Sound Cards, CMOS battery, Sharing of Printers.

2. Operating System and Application Software (06 Periods)

System Software, Application Software, Utility Software, MS Office/Open Office/Office 365: Creation of document, Spreadsheets and Presentation, working with windows OS, Desktop components, Menu bars, Creating shortcut of program. Google Suite (Google drive, google sheet, google doc, google presentation), Installation of Application software's, Antivirus and Drivers.

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, CIA Triads, Security threats: Virus, Worms, Malware, Trojan Horse, Detection and prevention, Types of Attacks: Active Passive attacks, Cyber Security & Frauds, Access control Biometrics, Indian Cyber laws.

5. Fundamentals and Applications of Artificial Intelligence: (06 Periods)

Definition and scope of AI, History and evolution of AI, Types of AI (Narrow AI, General AI, Super AI), Difference among AI, Machine Learning and Deep Learning, Basic Introduction to Popular Tools: ChatGPT, Gemini and other text, audio and video generator tools. The basics of talking to AI: Prompt Engineering, Introduction to Heuristic Search Techniques (Uninformed and Informed search).

Applications and use cases of AI: AI in healthcare, AI in finance, AI in agriculture, AI in education, AI in cyber security etc.

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/LibreOffice) Addition, deletion, formulation, Security etc.
11. PowerPoint Presentation (MS Office/Open Office/Libre Office) Preparing Slides, customization, animation, Security etc.
12. Google Suite.
13. Working on Power point presentation, spreadsheet, document preparation using AI tools.
14. Working on Text, Audio and Video using AI tools.
15. Generating different documents by using AI prompts.

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 Suit 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.sf.net
2. Gsuite.google.com
3. Spoken-tutorial.org
4. Swayam.gov.in

SUGGESTED DISTRIBUTION OF MARKS

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

2.4 FUNDAMENTALS OF PACKAGING SCIENCE

L T P
3 - 2

COURSE OBJECTIVES

The objective of this course is to provide learners with knowledge of the basic principles, functions, and role of packaging in product protection, preservation, communication, and marketing. It also aims to familiarize them with packaging testing methods and standards, while developing an understanding of packaging design for safety, shelf life, transportation, and consumer convenience

COURSE OUTCOMES

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

- Understand the fundamental principles, functions, and role of packaging.
- Identify appropriate packaging materials based on product characteristics and performance requirements.
- Apply standard testing methods to evaluate packaging quality and effectiveness.
- Analyze packaging systems for efficient storage, handling, transportation, and distribution.
- Evaluate and recommend consumer-friendly, and cost-effective packaging strategies.

COURSE CONTENTS

UNIT I: Fundamentals of Packaging

(08 Periods)

Introduction to packaging, classifications of packaging (flexible and rigid), functions of packaging, types of packaging, factors influencing package design, elements of package design, hazards affecting packaging (mechanical, climatic, biological, and other hazards)

UNIT II: Packaging Materials and Paperboard

(09 Periods)

Folding cartons: production process and types, paperboard types used in carton making, components of corrugated board, overview of packaging materials for different applications

UNIT III: Fundamentals of Printing

(08 Periods)

Introduction to printing in packaging, types of printing (flexography, gravure, offset, screen

printing), printing inks, substrates, printing techniques and processes, color reproduction, applications of printing in packaging

UNIT IV: Packaging Distribution, Logistics, and Markings (10 Periods)

Introduction to logistics and elements of logistics, distribution channels, packaging cycle and product life curve, pallet classification and material handling techniques (warehousing & storage), markings on packages (handling, routing, information marks), shelf-life considerations

UNIT V: Packaging Finishing and Future Trends (07 Periods)

Futuristic trends in packaging, adhesive tapes (fabric, paper, film, foil, foam, two-faced tapes), labels (designing, manufacturing, applications), packaging finishing operations (coating, lamination, hot & cold foil stamping, die-cutting, embossing & de-embossing, lining, folding, gluing).

INSTRUCTIONAL STRATEGY

The instructional strategy combines lectures, demonstrations, and hands-on labs. Lectures will cover key concepts, while demonstrations will illustrate functions and operations. Hands on labs will provide practical experience with basics of packaging handling and characterization. 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 Practical's:- (8 practical to be performed)

1. Study and identify different types of packaging (flexible, rigid) and their functions.
2. Identify and classify packaging into primary, secondary, and tertiary types with examples.
3. Study and compare types of paperboard used in folding cartons.
4. Prepare a sample package and calculate the costing of materials and production.
5. Measure and analyze mechanical properties of packaging materials (burst strength, tear resistance, stiffness).
6. Demonstrate different printing techniques used in packaging (flexography, offset, screen printing).

7. Study the effect of substrate type on print quality in packaging materials.
8. Prepare a printed label or packaging sample using one printing technique.
9. Study and mark packages with handling, routing, and information symbols.
10. Analyze pallet types and material handling techniques used in storage and distribution.
11. Demonstrate finishing operations: lamination, coating, or embossing on packaging material.
12. Prepare a sample package with finishing operations and labels applied.

REFERENCE BOOKS –

1. Soroka, W. – Fundamentals of Packaging Technology, Institute of Packaging Professionals (IoPP).
2. Paine, F.A., and Paine, H.Y. – Handbook of Packaging, Springer.
3. Yam, K.L. – Encyclopedia of Packaging Technology, Wiley.
4. Selke, S.E., Culter, J.D., and Hernandez, R.J. – Plastics Packaging: Properties, Processing, Applications, and Regulations, Hanser Publications.
5. Lockhart, H., Paine, F.A., and Paine, H.Y. – Packaging of Pharmaceuticals and Healthcare Products, Springer.
6. Levy, S. – Cartons, Crates and Corrugated Board: Handbook of Paper and Wood Packaging Technology, DEStech Publications.
7. Helmut Kipphan – Handbook of Print Media: Technologies and Production Methods, Springer.
8. Twede, D., and Goddard, R. – The Packaging Handbook, DEStech Publications.
9. Selke, S.E. – Packaging and the Environment, CRC Press.
10. Paine, F.A. – The Packaging User's Handbook, Springer.

SUGGESTED DISTRIBUTION OF MARKS

Topic No.	Time Allotted (Periods)	Marks Allotted (%)
1	08	20
2	09	20
3	08	20
4	10	25
5	07	15
Total	42	100

2.5 INTRODUCTION TO PACKAGING MATERIALS

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2 1 2

COURSE OBJECTIVES

The course aims to provide learners with knowledge of various packaging materials, their properties, and applications. It focuses on understanding how paper, plastic, glass, and metals are selected for packaging, emphasizing product protection, preservation, sustainability, cost-effectiveness, and suitability, thereby enabling effective and responsible material choices for diverse packaging needs.

COURSE OUTCOMES

After completing this course, student will be able to:

- Identify and classify various packaging materials based on their physical and functional properties,
- Understand the applications of paper, plastic, glass, and metal in packaging,
- Analyse the suitability of different packaging materials for diverse product categories,
- Evaluate the physical and mechanical properties of packaging materials through testing methods,
- Calculate cost-effectiveness and material efficiency for selected packaging solutions,
- Assess the environmental impact and sustainability aspects of packaging material usage.

COURSE CONTENTS

Unit I: Plastics

(08 Periods)

Polymers, Plastics in packaging — types, advantages; Flexible and Rigid packaging — Properties, applications; Thermoplastic Materials, Thermoset Materials, Food grade plastics — properties, processing methods, applications; Recycling; Biodegradable and Eco friendly packaging - Advantages and disadvantages.

Unit II: Wood, Paper and Textile

(10 Periods)

Wood — Types, Materials, characteristic properties, application, Nature of wood, properties, wood treatment; Textile — Types of cloth, properties, application; Paper and Board — Types, Properties, Specialty papers for Packaging, Corrugated Boards — Types, Applications, Specifications.

Unit III: Glass and Metals

(06 Periods)

Glass — Types, Properties, use, Chemistry, coatings, defects and application areas; Metals — Tin, Steel, Aluminium — Cans, drums, lacquers, sheet — Materials, properties, treatment, coatings, recycling process; Foil — Materials, characteristics, decoration, lamination and metallization methods.

Unit IV: Ancillary Materials

(10 Periods)

Closures and sealing — materials and properties. Cushioning Materials — properties and areas of application. Lacquers — properties, uses; Special additives for food grade films; Nano materials, Reinforcement — materials and properties.

Unit V: Material Testing (Basic Concepts)**(08 Periods)**

Mechanical —Tensile, Tear, Burst, Impact; Barrier properties - WVTR, OTR, Adhesion test, Optical — Gloss, haze and clarity; Chemical Resistance test — solvents and chemicals, Migration test, Plastic material identification test, solvent retention; Hardness and corrosion test for metals; Clarity and brittleness test for glass, Standards - ISO, ASTM, TAPPI, BIS.

List of Practical (A minimum of eight practical's must be performed)

1. Identification of plastics through Resin Identification Codes (RIC).
2. Examination of paper samples for packaging – identification, properties, and treatment methods.
3. Testing and comparison of different paper and board grades used in packaging.
4. Preparation and evaluation of corrugated board samples (flute types and specifications).
5. Study of textile-based packaging materials and their applications.
6. Testing the properties of glass packaging (clarity, brittleness, defects analysis).
7. Identification and evaluation of metallic packaging materials (tin, aluminium, steel, foils).
8. Demonstration of different closures, sealing methods, and cushioning materials.
9. Testing of physical properties of packaging materials – tensile, tear, burst, impact.
10. Study and testing of lacquers and coatings used in packaging.
11. Demonstration and evaluation of nano-reinforced and additive-enhanced packaging materials.
12. Chemical resistance and migration testing of packaging materials (solvents and food simulants).

INSTRUCTIONAL STRATEGY

The instructional strategy includes lectures, visual aids, and interactive examples for key packaging concepts and materials, along with problem-solving sessions. Practical demonstrations and hands-on lab sessions will reinforce theoretical knowledge, allowing students to test, evaluate, and analyze packaging materials. Case studies, sample analyses, and group activities will be used to illustrate real-world applications, sustainability considerations, and innovative packaging solutions, ensuring an engaging and comprehensive learning experience.

MEANS OF ASSESSMENT

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

RECOMMENDED BOOKS :

1. Soroka, W. – *Fundamentals of Packaging Technology*, 3rd Edition, Institute of Packaging Professionals (IoPP), 2009. ISBN: 9781930268289
2. Paine, F.A., and Paine, H.Y. – *Handbook of Packaging*, 3rd Edition, Springer, 1992. ISBN: 9780750606595
3. Yam, K.L. – *Encyclopedia of Packaging Technology*, 2nd Edition, Wiley, 2009. ISBN: 9780470087046
4. Selke, S.E., Culter, J.D., and Hernandez, R.J. – *Plastics Packaging: Properties, Processing, Applications, and Regulations*, 3rd Edition, Hanser Publications, 2004. ISBN: 9781569903726
5. Lockhart, H., Paine, F.A., and Paine, H.Y. – *Packaging of Pharmaceuticals and Healthcare Products*, Springer, 1996. ISBN: 9780751401588
6. Levy, S. – *Cartons, Crates and Corrugated Board: Handbook of Paper and Wood Packaging Technology*, DEStech Publications, 2012. ISBN: 9781605950770
7. Twede, D., and Goddard, R. – *The Packaging Handbook*, DEStech Publications, 2014. ISBN: 9781605950305
8. Selke, S.E. – *Packaging and the Environment*, 2nd Edition, CRC Press, 2003. ISBN: 9781566766065
9. Paine, F.A. – *The Packaging User's Handbook*, Springer, 1990. ISBN: 9780750602443

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 BASIC PACKAGING WORKSHOP PRACTICE

L T P
- - 4

COURSE OBJECTIVES

The course aims to provide hands-on experience and practical skills in various essential workshops, including Paper & Board Packaging Workshop, Flexible Packaging Workshop, Rigid Packaging Workshop, Packaging Testing & Quality Control and Printing & Package Decoration. 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:

- To introduce students to basic packaging materials, tools, and equipment.
- To develop practical skills in package design, testing, and evaluation.
- To create awareness about packaging standards, safety, and sustainability.
- To prepare students for higher-level packaging technology courses.

DETAILS OF PRACTICAL CONTENTS

1. INTRODUCTION TO PACKAGING WORKSHOP

- 1.1. Importance of workshop training in packaging.
- 1.2. Safety rules & laboratory discipline.
- 1.3. Introduction to basic hand tools and measuring instruments.
- 1.4. Demonstration of packaging operations.

2. PACKAGING MATERIALS – HANDS-ON FAMILIARIZATION

- 2.1. Identification and handling of paper, paperboard, corrugated board, plastics, metals, and glass.
- 2.2. Properties: thickness, GSM, bursting strength, grammage measurement.
- 2.3. 2.3. Simple cutting, folding, creasing, and joining exercises.

3. PAPER & BOARD PACKAGING WORKSHOP

- 3.1. Preparation of cartons, trays, sleeves, and corrugated boxes.
- 3.2. Techniques of die cutting, scoring, folding, and gluing.
- 3.3. Lab exercises: making a folding carton and corrugated box.

4. FLEXIBLE PACKAGING WORKSHOP

- 4.1. Identification of films, laminates, and foils.
- 4.2. Sealing methods: heat sealing, impulse sealing, adhesive bonding.
- 4.3. Exercises: pouch making (3-side seal, stand-up pouch).

5. RIGID PACKAGING WORKSHOP

- 5.1. Handling and filling of bottles, jars, and cans.
- 5.2. Capping, crimping, sealing exercises.
- 5.3. Labeling methods (manual & semi-automatic).

6. PACKAGING TESTING & QUALITY CONTROL

- 6.1. Demonstrations of bursting strength tester, drop tester, compression tester, tensile tester, thickness gauge.
- 6.2. Hands-on exercises with paper & plastic testing.
- 6.3. Introduction to packaging standards (IS, ASTM, ISO, ISTA).

7. PRINTING & PACKAGE DECORATION

- 7.1. Basics of screen printing, flexo, and digital printing.
- 7.2. Hands-on: stencil making, simple label printing, and decoration techniques.

8. SUSTAINABLE PACKAGING PRACTICES

- 8.1. Introduction to eco-friendly packaging materials.
- 8.2. Exercises on reuse/recyclable designs.
- 8.3. Waste minimization and segregation in workshop.

REFERENCES:

1. Soroka, W. – *Fundamentals of Packaging Technology*, 3rd Edition, Institute of Packaging Professionals (IoPP), 2009. ISBN: 9781930268289
2. Paine, F.A., and Paine, H.Y. – *Handbook of Packaging*, 3rd Edition, Springer, 1992. ISBN: 9780750606595
3. Yam, K.L. – *Encyclopedia of Packaging Technology*, 2nd Edition, Wiley, 2009. ISBN: 9780470087046
4. Selke, S.E., Culter, J.D., and Hernandez, R.J. – *Plastics Packaging: Properties, Processing, Applications, and Regulations*, 3rd Edition, Hanser Publications, 2004. ISBN: 9781569903726

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. Students should also be aware of environmental laws related to the control of pollution. Student should know how to manage the waste. Student 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 | CosmosPublication.
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- Resources 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)°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 (NH₃ - 2.5 ltr, NH₄Cl – 1 kg) - Zinc sulphate- 1kg - H₂SO₄- 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 - KMnO₄, Na₂CO₃, KOH, 2-Propanol - Hematite ore, copper pyrite ore - Hypo(Na₂S₂O₃) , 10% KI, CH₃COOH	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

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

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-I 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.
5. 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.
6. 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.
7. 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 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

Basic Packaging Workshop Practice

1. Shri Anil Bharti, Principal, Lucknow Polytechnic, Lucknow
2. Shri Vikas Khanna, Corrugation Industry Expert (Mohanah Enterprises)
3. Prof. (Dr.) Tanweer Alam, In-Charge, IIP Lucknow
4. Prof. (Dr.) Anshuman Srivastava, Professor, IIP Lucknow
5. Dr. Pragya Gupta, Research Associate cum Assistant Professor, IIP Lucknow

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.

Introduction to Packaging Materials

1. Shri Anil Bharti, Principal, Lucknow Polytechnic, Lucknow
2. Shri Vikas Khanna, Corrugation Industry Expert (Mohanah Enterprises)
3. Prof. (Dr.) Tanweer Alam, In-Charge, IIP Lucknow
4. Prof. (Dr.) Anshuman Srivastava, Professor, IIP Lucknow
5. Dr. Pragya Gupta, Research Associate cum Assistant Professor, IIP Lucknow

Fundamentals of Packaging Science

1. Shri Anil Bharti, Principal, Lucknow Polytechnic, Lucknow
2. Shri Vikas Khanna, Corrugation Industry Expert (Mohanah Enterprises)
3. Prof. (Dr.) Tanweer Alam, In-Charge, IIP Lucknow
4. Prof. (Dr.) Anshuman Srivastava, Professor, IIP Lucknow
5. Dr. Pragya Gupta, Research Associate cum Assistant Professor, IIP Lucknow

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 Packaging Technology Branch -

Sr. No.	Name of Diploma Programme	Duration
1	Diploma in Packaging Technology	3 Years