NEP-2020 Aligned Curriculum for

Diploma Programme
in
CHEMICAL TECHNOLOGY (Rubber & Plastic)

(5th to 6th Semester)

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Semester System

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(EFFECTIVE FROM YEAR 2026-27)

Prepared By:

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

CONTENTS

SALIENT FEATURES

1)	Name of the Programme	:	Diploma Programme in Chemical Technology (Rubber & Plastic)
2)	Duration of the Programme	:	Three years (Six Semesters)
3)	Entry Qualification	:	Matriculation or equivalent NEP-2020/NSQF Level-4 as Prescribed by State Board of Technical Education, U.P.
4)	Pattern of the Programme	:	Semester Pattern
5)	NSQF Level	:	Level - 5
6)	Ratio between Theory and Practical	:	40: 60 (Approx.)

7) **Industrial Training**

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

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

8) **Ecology and Environment**

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

9) **Entrepreneurship and Start-ups**

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

10) **Student Centred Activities**

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

11) **Project work**

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

PROGRAM OUTCOMES (POs)

PO1: Basics and Discipline specific Knowledge
Assimilate knowledge of basic mathematics, science, engineering fundamentals.

PO2: Problem's Analysis and solution
Identify, analyse and solve problems using standard methods and established techniques.

PO3: Design and Development
Design solutions for technical problems.
Assist in designing components, systems, or processes to meet specific requirements.

PO4: Engineering Tools, Experimentation, and Testing
Use modern engineering tools and appropriate techniques to conduct experiments as per BIS standard.

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

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

PO6: Project Management and Communication
Apply engineering management principles, work effectively as an individual or in a team, and communicate clearly on activities.

PO7: Lifelong Learning
Recognize the importance of continuous learning and actively pursue self-improvement to keep pace with technological developments.

STUDY AND EVALUATION SCHEME FOR CHEMICAL TECHNOLOGY (Rubber & Plastic)

FIFTH SEMESTER

SR. NO.	SUBJECTS	COURSE TYPE & CATEGORY	STUDY SCHEME PERIODS/WEEK			CREDITS	MARKSINEVALUATIONSCHEME								TOTAL MARKS OF INTERNAL & EXTERNAL
							INTERNAL ASSESSMENT			EXTERNAL ASSESSMENT					
			L	T	P		TH	PR	TOT	TH	HRS	PR	HRS	TOT	
5.1	POLYMER RECYCLING AND WASTE MANAGEMENT	Program Core (Theory)	3	-	-	3+0=3	40	-	40	60	3	-	-	60	100
5.2	POLLUTION CONTROL AND INDUSTRIAL SAFETY**	(Practicum)	2	-	4	2+2=4	40	-	40	60	3	-	-	60	100
5.3	POLYMER AND RUBBER COMPOSITES	Program Core (Practicum)	2	-	4	2+2=4	40	-	40	60	-	-		60	100
5.4	PROGRAM ELECTIVE-3	Program Core (Theory)	2	-	-	2+0=2	40	-	40	60	3	-	-	60	100
5.5	PROGRAM ELECTIVE-4	Program Core (Practicum)	2	-	2	2+1=3	40	-	40	60	3	-	-	60	100
5.6	(Q) Open Elective-2 OR	Open Elective	2	-	-	02	-	-	**50***	-	-	-	-	**-**	**NA**
	*Advance Skill Development	Certification Course	-	-	4	-	-	-	**-**	-	-	-	-	**-**	**NA**
5.7	**Summer Internship-II (4-6 Weeks)	Summer Training	-	-	-	02	-	60	**60**	-	-	40	3	**40**	**100**
5.8	(Q) Indian Constitution	Audit Course	2	-	-	-	50*	-	**-**	-	-	-	-	**-**	**NA**
# Student Centered Activities			-	-	7	-	-	50	**50**	-	-	-	-	**-**	**50**
Total			15	-	21	20	-	-	310	-	-	--	-	340	650

** Common with chemical eng

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

* Advance skill development mention at **5.6** in the table provide the scope of selecting the course as per choice from the elective list provided in the syllabus conducted by various agency of repute of duration not less than 20 Hrs (Offline/Online).

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

Student Centered Activities will comprise of co-curricular activities like extension lectures, games, hobby clubs e.g. Photography etc., Seminars, Declamation Contests, voluntary contribution in physical activities, Educational Field Visits, NCC, NSS, Cultural Activities and Self-Study. The lecture alloted to SCA can also be utilized for the course completion of other subject

STUDY AND EVALUATION SCHEME FOR CHEMICAL TECHNOLOGY (Rubber & Plastic)

A: NORMAL PATHWAY

SIXTH SEMESTER

SR. NO.	SUBJECTS	COURSE TYPE & CATEGORY	STUDYSCHEME PERIODS/WEEK			CREDITS	MARKSINEVALUATIONSCHEME								TOTAL MARKS OF INTERNAL & EXTERNAL
							INTERNAL ASSESSMENT			EXTERNAL ASSESSMENT					
			L	T	P		TH	PR	TOT	TH	HRS	PR	HRS	TOT	
6.1**	Process Control & Instrumentation	Program Core (Practicum)	2	-	4	2+2=4	40	-	40	60	3	-	-	60	**100**
6.2	Entrepreneurship And Start-Up	Program Core (Theory)	2	-	-	2+0=2	40	-	40	60	3	-	-	60	**100**
6.3	In-House Project	Project	4	-	16	12	-	240	240	-	-	160	-	160	**400**
6.4	(Q) Open elective-3 OR	Open elective (Theory)	2	-	-	2	-	-	50*	-	-	-	-	-	**NA**
#STUDENT CENTERED ACTIVITIES			-	-	6	-	-	50	50	-	-	-	-	-	50
TOTAL			10	-	26	20			370	-		280		280	650

** Common with another diploma programme

* Students will submit the certificate.

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

Student Centred Activities will comprise of co-curricular activities like extension lectures, games, hobby clubs e.g. Photography etc., Seminars, Declamation Contests, voluntary contribution in physical activities, Educational Field Visits, NCC, NSS, Cultural Activities and Self-Study.

The lecture alloted to SCA can also be utilized for the course completion of other subjects

INDUSTRIAL PATHWAY

Sr. No.	SUBJECTS	Category & Course Type	STUDY SCHEME Periods/ Week			Credits(C) (L+T)+P=C	MARKS IN EVALUATION SCHEME								Total Marks of Internal & External	Assessment
							INTERNAL ASSESSMENT			EXTERNAL ASSESSMENT						
			L	T	P		Th	Pr	Tot	Th	Hrs	Pr	Hrs	Tot		
6.1	Entrepreneurship and Start-ups (ONLINE Mode)	Humanities & Social Science (Theory)	-	-	-	2	-	-	-	100	03	-	-	**100**	**100**	**Theory**
6.2	Industrial Hands On Practice	Industrial Training	-	-	-	12	150*			200**					**350**	
6.3	Industrial Project	Industrial Training	-	-	-	4	50*			50**					**100**	
6.4	# Seminar	In House	-	-	-	2	-	100	100	-	-	-	-	-	**100**	
Total			**-**	**-**	**-**	**20**	**-**							**-**	**650**	

NOTE:

1. The Industrial training tenure should not be less than 14 Weeks.
2. Industry must be registered with MSME / Directorate of industries/Limited Organization/ State/Central Government establishments.
3. Monthly progress reports of Intern/ Trainee should be attested and forwarded by industrial supervisor (allotted to Intern/Trainee) during industrial Internship/Training.
4. The Industrial unit/organisation must evaluate students using the format provided by polytechnic in the form of marks.
5. The Industrial Hands on Practice, Industrial Project and seminar must be evaluated on the basis of the AICTE Internship Policy: Guidelines and procedures (Chapter -9 Procedures / format for organizing internship)
6. **"Entrepreneurship and Start-up"** course is also mandatory in Industrial internship/training mode. It will be conducted online mode by his/her polytechnic institute. After completing the online course, students must appear for exam conducted by the Board of Technical Education, Lucknow.

7. ***Evaluation by faculty mentor**
   The institute will depute one faculty member for mentoring at least 20-30 students undertaking apprenticeship training. Such mentors will monitor, guide and provide counselling to the students as and when required. Faculty mentor of the institute(s) may make a surprise visit to the internship/apprenticeship site to check the student's presence physically. (The Proforma of the evaluation is attached as the Annexure -1)

8. ** **Evaluation by industry** : The industry shall assess the candidates based on the following parameters attendance, discipline and punctuality, familiarity of tools and material, engineering skills, application of knowledge and problem-solving skills, comprehension and observation, professional ethics, safety and environmental consciousness, communication skills, supervisory skills and general conduct during the period (The Proforma of the evaluation is attached as the Annexure -2)

9. **# Evaluation through seminar presentation/Viva-Voce at the institute :** The student will give a seminar based on his training report, before an expert committee constituted by the concerned department as per norms of the institute. The evaluation will be based on the following criteria .

1. .

PROGRAM ELECTIVE-3

SR. NO.	SUBJECT NAME
1	PLASTIC & RUBBER MOULD DESIGN
2	Development of Plastic and Rubber Product Using CAD

PROGRAM ELECTIVE-4

SR. NO.	SUBJECT NAME
1	Rubber Product Manufacturing
2	Rubber Latex Technology

OPEN ELECTIVE-2

SR. NO.	(Q) THEORY COURSES NAME
OE 2.1	ENERGY CONSERVATION AND AUDITS
OE 2.2	INDUSTRIAL AUTOMATION AND MES
OE 2.3	**CERTIFICATION COURSE**
1	Courses conducted by center of excellence (established by 3rd party as –TATA TECHNOLOGIES etc.)
2	Courses conducted by INFOSYS PRINGBOARD
3	Courses conducted by TCS ION
4	Courses conducted by other relevant Government, International/national organization or platforms of repute
5	Courses conducted by AICTE-ELIS and Centrally funded technical institutes
6	Courses conducted by C-DAC
7	Courses conducted by NEILIT

OPEN ELECTIVE

SR. NO.	(Q) THEORY COURSES NAME
OE 3.1	ECONOMIC POLICIES IN INDIA
OE 3.2	DISASTER MANAGEMENT
OE 3.3	SUSTAINABLE DEVELOPMENT
OE 3.4	**CERTIFICATION COURSE**
1	Courses conducted by center of excellence (established by 3rd party as –TATA TECHNOLOGIES etc.)
2	Courses conducted by INFOSYS PRINGBOARD
3	Courses conducted by TCS ION
4	Courses conducted by other relevant Government ,International/national organization or platforms of repute
5	Courses conducted by AICTE-ELIS and Centrally funded technical institutes
6	Courses conducted by C-DAC
7	Courses conducted by NEILIT

ANNEXTURE-1

LIST OF COURSES CONDUCTED BY TATA TECHNOLOGIES

1. Fundamentals of Innovation and Design Thinking
2. Product Design and Development
3. Product Verification and Analysis
4. Advanced Automobile
5. Electric Vehicle
6. Internet of Things
7. Advanced Manufacturing
8. Advanced Welding & Painting using Simulator
9. Industrial Automation and MES
10. Industrial Robotics
11. Inspection and Quality Control
12. Advanced Plumbing
13. AI and ML

THEORY	5.1 PLASTIC, RUBBER RECYCLING AND WASTE MANAGEMENT	L	T	P
		3	-	-

INTRODUCTION

This course explores modern practices in polymer recycling and plastic waste management. Students will learn methods for sorting, processing, and reusing various plastic and rubber materials, understand waste management frameworks, and apply chemical and mechanical recycling techniques in an environmentally responsible manner.

Course Objectives

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

CO1: Understand sources of plastic waste, classification, global trends, challenges, and techniques for sorting and separation of polymer waste.

CO2: Understand environmental and economic impact of plastic waste, integrated waste management hierarchy, and 4R's approach including reduction, reuse, repair, and recycling.

CO3: Understand different recycling techniques for plastics including mechanical recycling, chemical recycling, energy recovery, incineration, and applications of recycled materials.

CO4: Understand recycling of rubbers and polymer composites, including tyre recycling, thermoset and thermoplastic composites, and value-added utilization.

CO5: Understand legislation, government guidelines, environmental regulations, extended producer responsibility (EPR), and compliance systems for plastic waste management in India.

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	2	2	2	–	1	–	–
CO2	3	2	2	2	3	–	1	–	–
CO3	3	2	2	2	3	–	2	–	–
CO4	3	2	2	2	2	–	2	–	–
CO5	3	2	2	2	3	–	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: INTRODUCTION (06 Periods)

Introduction, Global plastic consumption trends and waste generation, Classification of plastic waste (post-consumer, post-industrial), Challenges in polymer waste management - sources of plastics waste – separation techniques – density-based sorting –optical sorting - spectroscopic sorting - electrostatic sorting - melting temperature— sorting by size reduction - selective dissolution.

UNIT II PLASTICS WASTE MANAGEMENT APPROACH (06 Periods)

Environmental and economic impact Integrated solid waste management hierarchy

Plastics Waste Management - 4R's approach - reduction – reuse – repair – recycling, classification-code of practice - primary - secondary - tertiary - quaternary recycling with examples. Size reduction: Shredder – Granulator – Slicer – Laminate separation by size reduction

UNIT -III DIFFERENT RECYCLING TECHNIQUES (12 PERIODS)

Types of Recycling, -mechanical process - applications of recycled materials, PET, Polystyrene, Nylon, PMMA, Chemical Recycling, - Hydrolysis, Glycolysis, Aminolysis, Energy Recovery & Incineration - Calorific value of polymers Incineration: Controlled combustion with/without energy recovery, Emission control (dioxins, furans, heavy metals) Co-processing in cement kilns, Plastic Roads.

UNIT IV RECYCLE OF RUBBERS & POLYMER COMPOSITE (08 Periods)

Rubber tyre recycling - Tyre size reduction - Applications of recycled rubber – Tyre derived fuel Recycling of polymer composites - thermoset composites- thermoplastic composites , Value added utilization.

UNIT- V LEGISLATIONS (10 PERIODS)

Environmental Impact and Government Guidelines (India), Plastic Waste Management Rules, 2016 (Amended 2022), Extended Producer Responsibility (EPR), Ban on single-use plastic items, Waste generator responsibilities, Swachh Bharat Mission and Solid Waste Management Rules, 2016, Central Pollution Control Board (CPCB) guidelines for plastic processing units, BIS and IS codes for use of recycled plastics in construction and packaging, Environmental Clearance and Consent under the Air & Water Act for recycling units, Policy Tools and Market Mechanisms Eco-labeling, green certifications, Incentives for recycling industries, Plastic credits and EPR compliance systems

Instructional Strategy

1. To help students learn and appreciate new concepts and principals, teachers should provide examples from daily life, realistic situations and real-world engineering and technological applications.
2. The demonstration can make the subject exciting and foster the student's scientific mindset.
3. ICT tools must be used to deliver the content more attractively so that the attention of the learners is drawn and will create a curiosity in them to understand the content in a better way.
4. Industrial visit can be arranged to make the students realise the application of theoretical knowledge gained in the classroom.

MEANS OF ASSESSMENT

Assignments and quiz/class tests

Mid-term and end-term written tests

RECOMMENDED BOOKS

1 Plastic Waste Management Turning Challenges into Opportunities, Publisher: Bharti Publications
2. Environmental Engineering and Management, by Dr. Suresh K. Dhameja S K Kataria and Sons, 1 January 2010

SUGGESTED DISTRIBUTION OF MARKS

Topic No.	Time allotted (Periods)	Marks Allotted (%)
1.	06	15
2.	06	15
3.	12	30
4.	08	15
5.	10	25
Total	42	100

PRACTICUM	5.2 POLLUTION CONTROL AND INDUSTRIAL SAFETY	L	T	P
		2	-	4

COURSE OBJECTIVES

A Chemical Engineering technician must have the knowledge of different types of pollution caused due to industrialization so that he may help in balancing the eco-system and control the pollution by means of control devices. The technician must know various types of accidents which occur in chemical plants and how to safeguard them to avoid injury to men and material.

LEARNING OUTCOMES

After completion of this course, the students will be able to:

CO1: Understand air pollution, its types, sources, effects, and control mechanisms including settling chambers, cyclones, electrostatic precipitators, bag filters, and ambient air quality standards.

CO2: Understand water pollution, its measurement parameters (pH, BOD, COD, TDS, SS), standards, and treatment methods including chemical, physico-chemical, and biochemical treatment.

CO3: Understand environmental protection measures, pollution acts, hazardous chemical management, and regulations for air, water, and chemical waste in India.

CO4: Understand radioactive pollution, solid waste management, municipal and biomedical waste disposal methods, and importance of green area development.

CO5: Understand chemical industry safety practices including chemical handling, storage, transport, fire and explosion prevention, and adherence to safety codes and standards.

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	2	2	3	–	1	–	–
CO2	3	2	2	2	3	–	1	–	–
CO3	3	2	2	2	3	–	2	–	–
CO4	3	2	2	2	3	–	2	–	–
CO5	3	2	2	2	3	–	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: Introduction & Air Pollution and Control Mechanism (6 Periods)

Environment and Pollution, Classification of pollution e.g. Land, Water, Air, Noise Environment Impact assessment Studies, Character and origin of industrial wastes.

1. Definition of air pollution, Types of Air pollutants and their sources like SPM, SO_X, NO_X, NH_3, F, Cl, CFC, CO_2 etc.
2. Air Pollution control equipment in industries
3. Settling chamber
4. Cyclone
5. Electrostatic precipitator
6. Bag Filter
7. Ambient air quality measurement & their standards

PRACTICALS

1. Removal of suspended impurities from air using fabric filter.
2. Demonstration of Cyclone Separator for removal of suspended particles from air.

Unit-2: Water Pollution (6 Periods)

1. Water pollution, standards for drinking water, domestic waste water and industrial waste water. Methods of measurement of various parameter like BOD, SS, pH, COD, TDS etc.
2. Methods of treatment of industrial waste water like chemical treatment, physio-chemical treatment, bio-chemical treatment

PRACTICALS

1. Determination of pH value
2. Determination of turbidity
3. Determination of total solids, suspended solids, and total dissolved solids
4. Determination of dissolved oxygen (DO)/BOD/COD.
5. Determination of sulphate in water
6. Determination of chloride in water
7. Removal of suspended solids from water by coagulation

Unit-3: Environment Protection & Pollution Acts (6 Periods)

1. Environmental protection from hazardous chemicals waste:
2. Terminology relating to chemical hazards and air pollution, classification of chemical hazards and hazardous chemicals, codes of safety for operational hazards in laboratories, industries etc. (Reference should be made of I.S. Codes)
3. A water pollution prevention control Act 1974, Air Pollution Act 1981, Environment protection Act 1986, Hazardous chemical manufacturing, storage and impact rules 1989 and
4. hazardous waste and management and handling rules 1989, Regulation and control Rules 2000.

Unit-4: Radio Active Pollution & Solid Waste Management (4 Periods)

Sources and effect on human, animal, plant and material; measurement; means to control and preventive measures

1. Municipal solid waste, biomedical waste, Plastic waste and its management, solid waste disposal methods such as open dumping, sanitary landfilling composting, incineration.
2. Importance of development of green area

PRACTICALS

1. Prepare chart for treatments of different solid waste

Unit-5: Safety in Chemical Industry (6 Periods)

1. Receiving and storing chemicals- transporting and moving chemicals- Safety in chemical reactions, pipelines with color coding in chemical factories.
2. Precautions in the case of processes in operations involving explosive or inflammable dusts, gases, vapours etc. Maintenance of chemical plants-corrosion health hazards in common chemical processes, Fire hazards and their prevention.
3. Codes of practice and specification for safety equipment (Reference should be made from I.S. Codes), case study of major chemical process industries disasters/accidents.

INSTRUCTIONAL STRATEGY

1. Case Study of any disaster should be undertaken. Study should be data based. Field visit to the industries should be planned.
2. Student should encourageto undertake project work related to environmental problems.

MEANS OF ASSESSMENT

- Class Test
- Home Assignment
- Attendance
- Sessional Test

RECOMMENDED BOOKS

1. Safety in Process Plant Design by Wells
2. Safety and Accident Prevention in Chemical Operation by H. H, Tanacatte and W. S. Wood
3. Engineering Chemistry by P.C. Ja

SUGGESTED DISTRIBUTION OF MARKS

Topic No.	Time allotted (Periods)	Marks Allotted (%)
1.	6	20
2.	6	20
3.	6	20
4.	4	18
5.	6	22
Total	28	100

PROGRAM CORE PRACTICUM	5.3 POLYMER AND RUBBER COMPOSITES	L	T	P
		2	-	4

INTRODUCTION

Polymer composites are widely used in industries like aerospace, automotive, marine, biomedical, and construction due to their lightweight, high strength, corrosion resistance, and versatility. This course equips students with both theoretical knowledge and hands-on experience in polymer matrix composites, focusing on materials, manufacturing methods, testing techniques, and industrial applications.

Course Objectives

After studying this course, the students will be able to

CO1: Understand basics of polymer and rubber composites, their classification, advantages, applications, and density calculation of composites.

CO2: Understand matrix materials (thermoplastic, thermoset, elastomeric), reinforcements (glass, carbon, Kevlar fibers), and fillers used in composites and rubber systems.

CO3: Understand processing techniques of composites and rubber, including hand layup, compression moulding, filament winding, vacuum bag moulding, resin transfer moulding, and vulcanization.

CO4: Understand testing methods for composites and rubber, including mechanical tests (tensile, flexural, impact), hardness, abrasion, and tear resistance.

CO5: Understand applications of polymer and rubber composites in aerospace, transport, marine, building, electronics, biomedical, tires, seals, hoses, vibration dampers, and protective coatings.

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	2	2	2	–	1	–	–
CO2	3	2	2	2	2	–	1	–	–
CO3	3	2	2	2	2	–	2	–	–
CO4	3	2	2	2	3	–	2	–	–
CO5	3	2	2	2	3	–	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: INTRODUCTION

Definition of polymer composite – Classification of composite — Advantages of polymer composite – Applications – Density calculation of composite, Introduction to Rubber Composites: Types and Applications

Experiments

1. Density calculation of composite using rule of mixtures
2. Identification of thermoplastic, thermoset, and elastomeric polymers

UNIT II MATRIX AND REINFORCEMENT

Properties of thermoplastics matrices: PP – Nylon - PEEK - Properties of thermosets matrices: Epoxy – Polyester - Reinforcement : Glass fiber – Types – Manufacture – Carbon fiber - Types – Manufacture - Kevlar fiber – Types, Elastomeric Matrices (Rubber): Natural Rubber, SBR, NBR,Fillers and Reinforcements in Rubber Composites: Carbon black, Silica

Experiments

3. Manufacturing of a hand lay-up glass fiber composite
4. Preparation of carbon fiber reinforced epoxy composite

UNIT -III PROCESSING

Manufacture of DMC, SMC and prepreg – Hand layup process – Filament winding process – Vacuum bag moulding – Compression moulding – Resin transfer mouldig, Rubber Mixing and Vulcanization Process

Experiments

5. Compression moulding of short fiber reinforced composite
6. Rubber composite mixing with fillers (carbon black, silica) and vulcanization process

UNIT IV TESTING

Definition of isotropic and anisotropic – Test method for tensile strength – Flexural strength – Impact strength – Drop impact test method, Tests for Rubber Composites: Hardness (Shore A), Abrasion Resistance, Tear Strength

Experiments

7. Mechanical Tests of Composite
8. Hardness testing of rubber composite samples (Shore A durometer)

UNIT-V APPLICATION

Applications of polymer composite: Aerospace - Transport – Marine – Building – Industry – Electronic and electrical – Energy – Biomedical industry, Application of rubber Tires, Seals, Hoses, Vibration Dampers, Protective Coatings.

Experiments

9. Microscopic observation of fiber/matrix and filler/matrix interfaces
10. Case study/presentation: Rubber composites in automotive tires or vibration dampers

Instructional Strategy

1. To help students learn and appreciate new concepts and principals, teachers should provide examples from daily life, realistic situations and real-world engineering and technological applications.
2. The demonstration can make the subject exciting and foster the student's scientific mindset.
3. ICT tools must be used to deliver the content more attractively so that the attention of the learners is drawn and will create a curiosity in them to understand the content in a better way.
4. Industrial visit can be arranged to make the students realise the application of theoretical knowledge gained in the classroom.

MEANS OF ASSESSMENT

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

RECOMMENDED BOOKS

Text Books:

1. Holloway - Composite materials – Elsevier, Amsterdam, 1966.

References:

1. Brian Parkyn – Glass Reinforced Plastics , 1970.
2. Gibbs & Cox – Marine Design Manual for FRP- McGraw Hill Book Co. – 1960.
3. P.Ghosh – Fiber science and technology – Tata McGraw Hill, New Delhi, 2004
4. R.H.Sonneborn - Fiberglass Reinforced Plastics – Reinhold, New York, 1954

SUGGESTED DISTRIBUTION OF MARKS

Topic No.	Time allotted (Periods)	Marks Allotted (%)
1.	06	15
2.	06	15
3.	12	30
4.	08	15
5.	10	25
Total	42	100

Program Elective -3

Theory	5.4.1 Plastic & Rubber Mould Design	L	T	P
		2	-	-

INTRODUCTION

The Plastic & Rubber Mould Design course is designed to equip diploma students with the technical knowledge and practical skills required to design efficient and cost-effective moulds
for plastic and rubber components. Understanding mould design is essential for ensuring product quality, reducing production costs, and minimizing manufacturing defects. This course serves as a bridge between material science, product design, and manufacturing technology. It emphasizes real-world industrial practices, standard design methodologies in modern mould making

COURSE OUTCOME

CO1: Understand the overview of plastics and rubber industry, basic properties of plastics and rubbers, classification of moulding processes, and design principles for polymer and rubber products.

CO2: Understand fundamentals of polymer product design including product types, functional requirements, material behavior, aesthetic and ergonomic considerations, and design methodology from concept to prototype.

CO3: Understand mould materials, their selection criteria, heat treatment, surface coatings, and components of injection, compression, and transfer moulds including gates, runners, ejector systems, and cooling systems.

CO4: Understand mould design considerations including rubber flow behavior, shrinkage, flash control, curing parameters, product features, defect analysis, and dimensional tolerance for quality assurance.

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	2	2	2	–	1	–	–
CO2	3	2	3	2	2	–	2	–	–
CO3	3	2	3	2	2	–	2	–	–
CO4	3	2	3	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: INTRODUCTION (06 Periods) Overview of Plastics & Rubber Industry, History & classification of moulding processes, Basic properties of plastic and rubber materials, Thermoplastics vs Thermosetting plastics, Vulcanization and elastomer properties (rubber), Design need, design principle.

UNIT II : FUNDAMENTALS OF POLYMER PRODUCT DESIGN (08 Periods)

Role of product design in polymer industry, Types of products: Structural, aesthetic, consumer, industrial., - Material behavior considerations: Thermoplastics vs thermosets vs elastomers., Functional requirements: Load bearing, flexibility, sealing, damping, insulation. - Aesthetic & ergonomic considerations. - Design methodology: Concept - Sketch - Prototype – Testing-Tooling.

UNIT III MOULD MATERIALS AND COMPONENTS (08 Periods)

Design features, General design considerations Materials used for different moulds and their characteristics, and their selection criteria Selection of mould materials (steel grades, aluminum, copper alloys) Heat treatment and surface coating methods Injection Mould, Standard parts: Ejector pins, guide bushes, spacers, locating rings, Feed system - runner balancing, size of runners, Gates - Types of gates, size of gates. Ejection system and their types, ejector grid and ejector plate assembly. Cooling system-Cooling methods,

UNIT -IV MOULD DESIGN (06 PERIODS)

Rubber flow behavior and shrinkage, Flash control in rubber moulding, Design of compression and transfer rubber moulds, Curing time and temperature factors, product features: ribs, bosses, undercuts, wall thickness Defect analysis: shrinkage, warpage, weld lines Dimensional tolerance and finish quality.

Instructional Strategy

To help students learn and appreciate new concepts and principals, teachers should provide examples from daily life, realistic situations and real-world engineering and technological applications.
The demonstration can make the subject exciting and foster the student's scientific mindset.
ICT tools must be used to deliver the content more attractively so that the attention of the learners is drawn and will create a curiosity in them to understand the content in a better way.
Industrial visit can be arranged to make the students realise the application of theoretical knowledge gained in the classroom.

MEANS OF ASSESSMENT

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

RECOMMENDED BOOKS

1. Plastic Mould Engineering Handbook – J. Harry DuBois
2. Injection Mould Design – R.G.W. Pye
3. Rubber Engineering – Ishan P. Khatri
4. Manufacturer catalogs (DME, HASCO, MISUMI)

SUGGESTED DISTRIBUTION OF MARKS

Topic No.	Time allotted (Periods)	Marks Allotted (%)
1.	06	20
2.	08	30
3.	08	30
4.	06	20
Total	28	100

OR

Program Elective -3

ELECTIVE THEORY	5.4.2 Development of Plastic and Rubber Product Using CAD	L	T	P
		2	-	-

COURSE OBJECTIVES

Modern product development in the plastic and rubber industries requires precise design, simulation, and optimization before production. Computer-Aided Design (CAD) plays a crucial role in developing 3D models, checking product fit and function, and generating detailed mould and tooling layouts. This course introduces students to CAD tools and techniques used for developing plastic and rubber components from concept to mould-ready designs.

COURSE OUTCOMES

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

CO1: Understand the role of CAD in design and manufacturing, and its applications in rubber and plastic product development.

CO2: Apply design considerations for plastic and rubber products including material behavior, functional requirements, aesthetics, ergonomics, and design methodology from concept to prototype.

CO3: Perform 2D sketching and 3D modelling of plastic and rubber components, including feature-based modelling, mating, interference checking, and motion simulation of product assemblies.

CO4: Perform product simulation and validation, including draft analysis, basic FEA concepts, Moldflow introduction, prototyping, creation of 2D drawings from 3D models, GD&T basics, and preparation of BOM and title blocks.

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	2	2	2	–	1	–	–
CO2	3	2	3	2	2	–	2	–	–
CO3	3	2	3	3	2	–	2	–	–
CO4	3	2	3	3	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: Introduction to CAD in Product Development (06 Periods)

Role of CAD in design and manufacturing, Overview of CAD software: SolidWorks, CATIA, Creo, AutoCAD Application of CAD in rubber product design

UNIT II : DESIGN CONSIDERATIONS FOR PLASTIC & RUBBER PRODUCT (06 Periods)

Role of product design in polymer industry, Types of products: Structural, aesthetic, consumer, industrial., - Material behavior considerations: Thermoplastics vs thermosets vs elastomers., Functional requirements: Load bearing, flexibility, sealing, damping, insulation. - Aesthetic & ergonomic considerations. - Design methodology: Concept - Sketch - Prototype – Testing-Tooling.

UNIT III 2D SKETCHING AND 3D MODELLING (06 Periods) Sketch tools and constraint, Feature-based modelling: extrude, revolve, loft, sweep, Part modelling of plastic and rubber products (e.g., bottle caps, seals, handles, gaskets) Mating components, checking interference and alignment, Simulating motion of moving parts (snap fits, hinges)

UNIT -IV PRODUCT SIMULATION AND VALIDATION (12 PERIODS)

Draft analysis, Finite Element Analysis (intro only, optional), Moldflow (conceptual introduction) Prototyping using STL files (for 3D printing or CNC) , Creating 2D drawing views from 3D models, GD&T basics, Bill of materials (BOM), Title block and revision table, Creating 3D models of plastic/rubber product using Catia, PRO E, solid work etc.

Instructional Strategy

1. To help students learn and appreciate new concepts and principals, teachers should provide examples from daily life, realistic situations and real-world engineering and technological applications.
2. The demonstration can make the subject exciting and foster the student's scientific mindset.
3. ICT tools must be used to deliver the content more attractively so that the attention of the learners is drawn and will create a curiosity in them to understand the content in a better way.
4. Industrial visit can be arranged to make the students realise the application of theoretical knowledge gained in the classroom.

MEANS OF ASSESSMENT

Assignments and quiz/class tests

Mid-term and end-term written tests

RECOMMENDED BOOKS

1. AD for Mechanical Engineering – P.N. Rao

2. Injection Mould Design – R.G.W. Pye

3. Plastic Product Design – Paul G. Campbell

4. Software user manuals and online tutorials (e.g., Dassault SolidWorks, Autodesk, PTC)

SUGGESTED DISTRIBUTION OF MARKS

Topic No.	Time allotted (Periods)	Marks Allotted (%)
1.	06	20
2.	08	30
3.	08	30
4.	06	20
Total	28	100

Program Elective -4

5.5 Practicum	5.5.1 RUBBER PRODUCT MANUFACTURING	L	T	P
		2	-	2

COURSE OBJECTIVES

This course rubber product manufacturing emphasis in Rubber products are widely used in industries such as automotive, aerospace, electronics, healthcare, footwear, and construction due to their elasticity, durability, and resistance to wear and chemicals. The manufacturing of rubber products involves a series of specialized processes like mixing, molding, curing, extrusion, and finishing. This course introduces students to the materials, machinery, and production techniques used in rubber product manufacturing, with a focus on industrial applications and quality control.

COURSE OUTCOMES (CO)

CO1: Understand compounding concepts, masterbatch, gum and green compounds, and the role of additives including coupling, peptising, and blowing agents.
CO2: Understand tyre types, components, specifications, and manufacturing processes including bias, belted bias, radial, pneumatic, and solid tyres.
CO3: Understand manufacturing of tubes, hoses, cables, and their curing processes.
CO4: Understand conveyor and transmission belts, their components, manufacturing, and vulcanization techniques.
CO5: Understand moulded rubber products including oil seals, footwear, tennis balls, and cellular rubber manufacturing techniques.

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	2	2	2	–	1	–	–
CO2	3	2	3	2	2	–	2	–	–
CO3	3	2	3	3	2	–	2	–	–
CO4	3	2	3	3	2	–	2	–	–
CO5	3	2	3	3	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: INTRODUCTION (06 Periods)

Compounding – Dispersion vs Distribution – Order of addition –Definition with one formulation of Master batch, Gum compound, Green compound – Definition, role and example of Coupling agent, Peptising agent and Blowing agent – Upside-down mixing with one example - Sulphur curing mechanism for NR

EXPERIMENTS

1. Preparation of a basic NR masterbatch
2. Formulation and preparation of a gum compound

UNIT II TYRE **(06** Periods)

Tyres: Definition – Types – Specification of a tyre - Function o f a tyre, Components of a bias, belted bias and radial tyre and its function - Tubed v s Tubeless tyres – Bias vs Radial tyre. PneumaticTyres:– Manufacture of pneumatic tyres: Tyre building - Vulcanization: Press curing, Bag-o-matic curing, Autoclave curing Solid Tyres: Manufacture of solid tyre – Applications.

Experiments

3. Fabrication of a simple bias-ply tyre tread
4. Sulphur curing of NR sheets using a hot press

Unit -III TUBES, HOSES AND OIL SEALS (06 Periods)

Tubes: Manufacture of Automotive tube Hoses: Types – Components and its function Manufacture of hose – Autoclave curing. Cable: Manufacture of cable

Experiments

5. Fabrication of a simple bias-ply tyre tread
6. Sulphur curing of NR sheets using a hot press

UNIT -IV BELTS (05 PERIODS)

Conveyor belt vs Transmission belt - Conveyor belting – components and its function – Manufacture of conveyor belt - Transmission belting – Components and its function – Manufacture of V-belt – Timing belt - Cogged belt – Vulcanization - Roto curing and Pot curing

Experiments

7. Preparation of a V-belt sample

UNIT -V MOULDED RUBBER PRODUCT (05 PERIODS)

Manufacture of metal OD oil seal – Manufacture of rubber OD oil seal Manufacture of tennis ball - Manufacture of cellular rubber - Manufacture of footwear

Experiments

8. Preparation of cellular rubber using a blowing agent
9. Manufacturing of an oil seal (metal OD and rubber OD)

Instructional Strategy

5. To help students learn and appreciate new concepts and principals, teachers should provide examples from daily life, realistic situations and real-world engineering and technological applications.
6. The demonstration can make the subject exciting and foster the student's scientific mindset.
7. ICT tools must be used to deliver the content more attractively so that the attention of the learners is drawn and will create a curiosity in them to understand the content in a better way.
8. Industrial visit can be arranged to make the students realise the application of theoretical knowledge gained in the classroom.

MEANS OF ASSESSMENT

Assignments and quiz/class tests

Mid-term and end-term written tests

RECOMMENDED BOOKS

Text Books:

1. Rubber Tech., and Manufacture by C.M.Blow-Plastic and Rubber Institute, ButterWorths - 1982
2. Plastics Materials and Product Testing Vol.I & II CIPET, Chennai

References:

1. Plastics by JJ.Harry Dubois and Frederick W.John -Van Nostrand Reinhold Co.
2. Plastics Technology by Robert V.Milby -McGraw Hill BookCo.-1973
3. Technology of Rubber Products byG.P.Mayurya-S.B.P.Publication
4. Complete Manufacturing Details and Know-how on Tyres Tubes Hoses and Belts by R.S.Gupta - SIRI Publications.

SUGGESTED DISTRIBUTION OF MARKS

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

OR

Program Elective 4

5.5 Practicum	5.5.2 RUBBER LATEX TECHNOLOGY	L	T	P
		2	-	2

INTRODUCTION

This course Rubber Latex Technology is the science and engineering discipline focused on the extraction, processing, preservation, compounding, and application of natural rubber latex (NRL) and synthetic latexes. It's a key field in rubber and polymer science, especially relevant in industries producing gloves, balloons, adhesives, foam, and other elastic products..

COURSE OUTCOME

CO1: Understand latex composition, classification, NR field latex, preservatives, coagulants, and determine total solid and dry rubber content.
CO2: Understand latex compounding methods, preparation of dispersions, emulsions, slurries, and perform total alkalinity determination and NR latex compound preparation.
CO3: Understand dipping processes, manufacture of surgical gloves, balloons, and perform mechanical stability and dipped product preparation.
CO4: Understand extrusion and casting of latex products such as elastic threads and tubing, and perform extrusion and casting experiments.
CO5: Understand latex foam and adhesives, manufacturing methods (Talalay, Dunlop), synthetic latexes, and perform KOH number determination and coagulum studies.

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	2	2	2	–	1	–	–
CO2	3	2	3	2	2	–	2	–	–
CO3	3	2	3	3	2	–	2	–	–
CO4	3	2	3	3	2	–	2	–	–
CO5	3	2	3	3	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: INTRODUCTION

Definition of Latex, classification, Comparison between latex and polymer solution; Natural rubber latex – composition of NR field latex - Preservative – Coagulant

List of experiments:

1. Determination of Total solid content of NR latex
2. Determination of Dry rubber content of NR latex

UNIT II LATEX COMPOUNDING

Methods of concentrating latex - creaming, centrifuging, & evaporation. Conversion of NR latex into RSS, Pale crepe - Preparation of Dispersions, Emulsion, Slurries using Ball mill

List of experiments:

3. Determination of Total alkalinity of NR latex
4. Preparation of NR latex compound

Unit -III DIPPING PROCESS

Types of gloves - Manufacture of Surgical Gloves – Manufacture of Balloons – Troubleshooting

List of experiments:

5. Determination of Mechanical stability time of NR latex
6. Manufacture of dipped latex product

UNIT -IV EXTRUSION AND CASTING PROCESS

Manufacture of elastic thread – Manufacture of latex tubing - Troubleshooting

List of experiments:

7. Manufacture of extruded latex product
8. Casting of latex

UNIT -V LATEX FOAM ADHESIVE

Manufacture of foam by Talley process – Dunlop process – Synthetic latex Latex Adhesives:

Used in construction, footwear, carpets. Based on NRL or synthetic latexes like SBR or acrylates.

List of experiments:

9. Study on different coagulant vs coagulum nature
10. Determination of KOH number of NR latex

Instructional Strategy

1. To help students learn and appreciate new concepts and principals, teachers should provide examples from daily life, realistic situations and real-world engineering and technological applications.
2. The demonstration can make the subject exciting and foster the student's scientific mindset.
3. ICT tools must be used to deliver the content more attractively so that the attention of the learners is drawn and will create a curiosity in them to understand the content in a better way.
4. Industrial visit can be arranged to make the students realise the application of theoretical knowledge gained in the classroom.

MEANS OF ASSESSMENT

Assignments and quiz/class tests

Mid-term and end-term written tests

RECOMMENDED BOOKS

Text Books:

1. Blackley, D.C., "High Polymer Latices", Vol 1 and 2, Chapman & Hall, 1997

References:

1. Mausser, R.F., "The Vanderbilt Latex Hand book" 3rdedn.R.T. Vanderbilt Company, 1987.
2. Calvert, "Polymer Latex and Applications", Applied Science Publishing Ltd, 1985.
3. Latex Technology – Lab manual.

Open Elective -2

5.6.1	ENERGY CONSERVATION AND AUDITS	L T P
		2 - -

1. COURSE OBJECTIVES

The pressure of technological development in all sectors on the Renewable energy source has led to the growing cost of energy around the world. Efficient and judicious use of the available energy sores would lead to the easing of such pressure and drastic decrease in the operating costs of the organizations and industries. Thus, it is necessary to save and conserve energy to the maximum possible extent. Also, essential theoretical knowledge and practical skills about the energy conservation is to be provided through different approaches, project management and economic aspects. The process of energy audit will help to identify the various possible avenues in which savings of energy can be effectively adopted. This course makes the Diploma Holder well acquainted in the techniques of energy conservation in the fields of engineering. It also introduces him to the energy audit procedures.

1. COURSE OUTCOMES (CO):

The theory should be taught and practical should be carried out in such a manner that students are able to acquire different learning outcomes in cognitive, psychomotor and affective domain to demonstrate following course outcomes.

CO1 Understand types of energy resources, national and regional energy scenarios, energy conservation principles and provisions of the Energy Conservation Act.

CO2 Analyze electrical supply systems, transformers, motors and utility equipment to identify energy efficiency and conservation opportunities.

CO3 Apply energy-efficient practices in lighting, DG systems and thermal utilities including boilers, furnaces and cooling towers.

CO4 Understand Energy Conservation Building Code (ECBC), building energy efficiency measures, waste heat recovery and co-generation systems.

CO5 Understand and perform basic energy audits and recommend general energy-saving measures for domestic, commercial and industrial applications.

.

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	–	–	2	–	2	–	–
CO2	3	3	2	2	2	–	1	–	–
CO3	3	3	2	2	2	–	1	–	–
CO4	3	2	2	1	2	–	1	–	–
CO5	3	3	2	2	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

2. COURSE CONTENTS

Unit 1-Basics of Energy

Classification of energy- primary and secondary energy, commercial and non-commercial energy, non-renewable and renewable energy with special reference to solar energy, Capacity factor of solar and wind power generators. Global fuel reserve Energy scenario in India and state of U.P. Sector-wise energy consumption (domestic, industrial, agricultural and other sectors), Impact of energy usage on climate Energy Conservation and EC Act 2001.

Introduction to energy management

Energy conservation, energy efficiency and its need, Salient features of Energy Conservation Act 2001 & The Energy Conservation (Amendment) Act, 2010 and its importance. Prominent organizations at centre and state level responsible for its implementation, Standards and Labeling: Concept of star rating and its importance, Types of product available for star rating.

Unit 2-Electrical Supply System and Motors

Types of electrical supply system, Single line diagram, Losses in electrical power distribution system, Understanding Electricity Bill: Transformers Tariff structure, Components of power (kW, kVA and kVAR) and power factor, improvement of power factor, Concept of sanctioned load, maximum demand, contract demand and monthly minimum charges (MMC)

Transformers:

Introduction, Losses in transformer, transformer Loading, Tips for energy savings in transformers, Electric Motors Types of motors, Losses in induction motors Features and characteristics of energy efficient motors, Estimation of motor loading, Variation in efficiency and power factor with loading, Tips for energy savings in motors.

Energy Efficiency in Electrical Utilities

Pumps: Introduction to pump and its applications, Efficient pumping system operation, Energy efficiency in agriculture pumps, Tips for energy saving in pumps

Compressed Air System:

Types of air compressor and its applications, Leakage test, Energy saving opportunities in compressors. Energy Conservation in HVAC and Refrigeration System: Introduction, Concept of Energy Efficiency Ratio (EER), Energy saving opportunities in Heating, Ventilation and Air Conditioning (HVAC) and Refrigeration Systems.

Unit 3-Lighting and DG Systems

Lighting Systems: Basic definitions- Lux, lumen and efficacy, Types of different lamps and their features, Energy efficient practices in lighting.

DG Systems: Introduction, Energy efficiency opportunities in DG systems, Loading estimation Energy Efficiency in Thermal Utilities

Thermal Basics: Thermal energy, Energy content in fuels, Energy Units and its conversions in terms of Metric Tonne of Oil Equivalent (MTOE).

Energy Conservation in boilers and furnaces

Introduction and types of boilers, Energy performance assessment of boilers, Concept of stoichiometric air and excess air for combustion, Energy conservation in boilers and furnaces, Do's and Don'ts for efficient use of boilers and furnaces.

Cooling Towers:

Basic concept of cooling towers, Tips for energy savings in cooling towers, Efficient Steam Utilization.

Unit 4-Energy Conservation Building Code (ECBC)
ECBC and its salient features, Tips for energy savings in buildings: New Buildings, Existing Buildings. Waste Heat Recovery and Co-Generation
Concept, classification and benefits of waste heat recovery, Concept and types of co-generation system

Unit 5-General Energy Saving Tips
Energy saving tips in: Lighting, Room Air Conditioner, Refrigerator, Water Heater, Computer, Fan, Heater, Blower and Washing Machine, Colour Television, Water Pump, Cooking, Transport, Energy Audit, Types and methodology, Energy audit instruments, Energy auditing reporting format

Ex. No.	Name of Experiment	Hours
1.	To conduct load survey and power consumption calculations of small building.	
2.	To check efficacy of different lamps by measuring power consumption and lumens using lux meter.	
3.	To measure energy efficiency ratio (EER) of an air conditioner.	
4.	To measure effect of valve throttling and variable frequency drive (VFD) on energy consumption by centrifugal pump.	
5.	To measure and calculate energy saving by arresting air leakages in compressor.	
6.	To measure the effect of blower speed on energy consumed by it.	

3. REFERENCE BOOKS:

1. Electric Energy Generation, Utilization and Conservation Sivaganaraju, S Pearson, New Delhi, 2012
2. Project Management, Prasanna Chandra, Tata Mcgraw Hill, New Delhi
3. Energy Conservations in Buildings, O.P. Jakhar, Khanna Publishing House, New Delhi
4. Financial Management, Prasanna Chandra Tata Mcgraw Hill, New Delhi.
5. Energy management Handbook, Prasanna Chandra, Tata Mcgraw Hill, New Delhi.
6. Energy Technology, O.P. Gupta, Khanna Publishing House, New Delhi (ed. 2018)
7. E-books/e-tools to be used as recommended by AICTE/NITTTR, Chandigarh.

Websites for Reference:
http://swayam.gov.in

4. INSTRUCTIONAL STRATEGY

Engage students in experiments and demonstrate that illustrate principles of Energy Conservation, incorporate case studies and examples from everyday life to demonstrate the importance of Energy Conservation.

OR

Open Elective -2

5.6.2	**INDUSTRIAL AUTOMATION & MES**	**L T P**
		2 - -

COURSE OBJECTIVES

This course is designed to provide a comprehensive understanding and hands on experience on Industrial Automation and Manufacturing Execution Systems (MES) to excel in the automation sector across various manufacturing domains. This includes Programmable Logic Controllers (PLC), Supervisory Control and Data Acquisition (SCADA), Human Machine Interfaces (HMI), Variable Frequency Drives (VFD), Manufacturing Execution System (MES), and the integration of these components to create cohesive and efficient systems. Participants will gain hands-on experience with the latest software and hardware tools, enabling them to adopt modern automation techniques in line with industry standards and build competency in the automation sector.

COURSE OUTCOME

CO1 Understand industrial safety practices including fire protection systems, safe handling of tools and equipment, occupational safety and health standards and preventive safety measures in industrial environments.

CO2 Describe the fundamentals of industrial automation including types of automation, automation components, manufacturing systems, control strategies and basic industrial communication concepts.

CO3 Apply Programmable Logic Controller concepts including hardware components, memory organization, programming techniques, logic instructions, communication protocols and troubleshooting for industrial applications.

CO4 Understand the working, configuration and application of Variable Frequency Drives for motor control, energy efficiency optimization, fault diagnosis and industrial automation integration.

CO5 Develop and operate Human Machine Interface systems including screen design, alarms, data logging, security management and communication with PLC and SCADA systems.

CO6 Understand Supervisory Control and Data Acquisition systems including architecture, communication protocols, real-time monitoring, data logging, alarm management and Industry 4.0 integration.

CO7 Describe Flexible Manufacturing Systems including pneumatics, machine vision, pick and place systems and automation techniques used in modern manufacturing environments.

CO8 Understand Manufacturing Execution Systems architecture, core functionalities, data flow, integration with Industry 4.0 technologies and smart factory implementation concepts.

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	–	–	3	2	2	–	–
CO2	3	2	2	2	2	–	1	–	–
CO3	3	3	3	2	2	–	1	–	–
CO4	3	3	2	2	3	–	1	–	–
CO5	3	2	2	3	2	–	1	–	–
CO6	3	3	2	3	2	–	2	–	–
CO7	3	2	2	2	2	–	1	–	–
CO8	3	2	2	3	2	1	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

1. CONTENTS

Sr No	Course contents
1	**Industrial Safety Practices** • Fire Extinguishers & its Types • Safely handling Tools & Equipment • Use of proper Tools & Equipment & its maintenance • OSH & practices to be observed as a precaution
2	**Fundamentals of Industrial Automation** • Introduction to industrial automation • Need and application of automation • Benefits of automation • Types of Industrial automation • Important Components of Automation • Discrete, Continuous and Batch Manufacturing • Open-loop vs. Closed-loop systems • Introduction to PLC, HMI, VFD, SCADA, MES • Industrial sensors: types and applications • Actuators: motors, valves, pneumatics • Signal conditioning and A/D conversion • Process variables: temperature, pressure, flow, level • PID control and its applications • Control panel components and wiring standards • Industrial communication protocols
3	**Programmable Logic Controller (PLC)**

	• Introduction to Programmable Logic Controller (PLC) • Types of PLCs and selection criteria. • Application and advantages of PLC. • Important components of PLC • Numbering systems: binary, hexadecimal, BCD • PLC memory organization and addressing. • Explain sink and source concept. • Interfacing of PLC with field devices. • PLC communication protocols: Modbus, Profibus, ethernet/IP • Types of PLC programming • Ladder logic programming basics. • Conditional logic: AND, OR, NOT, NAND, NOR XOR, XNOR Gates • Timers and counters in PLC. • Explain advance instruction used in PLC. • Fault handling and troubleshooting in PLCs • Industrial case study of PLC.
4	**Variable Frequency Drive (VFD)** • Introduction to Variable Frequency Drive (VFD) • Basics of AC motors • Application of VFD • Components of a VFD: rectifier, DC bus, inverter • Types of VFDs: scalar control vs. vector control • Connections and control mechanism • VFD parameter configuration and settings • Study motor protection and overload prevention • Understand energy efficiency optimization using VFD • Troubleshooting and fault diagnosis in VFDs • Regenerative braking and energy recovery in VFD • Learn Modbus and ethernet communication for VFDs • Industry applications of VFD in HVAC, pumps, and conveyors • Case study: VFD implementation for smart energy saving • Interfacing of VFD with PLC & SCADA.
5	**Human Machine Interface** • Introduction to HMI • Role of HMI in industrial automation • Components of HMI • Compare HMI and SCADA • Communication protocols in HMI • User interface of HMI software. • Building basic HMI control animations. • Alarms and event logging • Security and user access management • Multi-screen navigation in HMI systems • Study trending and historical data logging • Communication between HMI and PLC • SCADA-HMI integration • Troubleshooting common issues in HMI.

	• Industrial case study: HMI in production line
6	**Supervisory Control and Data Acquisition (SCADA)** • Introduction to Supervisory Control and Data Acquisition (SCADA). • Application and advantages of SCADA • Important components of SCADA • Block diagram of SCADA • SCADA communication protocols. • Types of tags and its usage. • Explore the features of SCADA. • User interface of SCADA software • Building basic SCADA screens with animation. • Dynamic properties like sizing, location, blinking, visibility, percentage filling, object size, orientation, etc. • Alarm management and event logging in SCADA • Historical data logging and trending in SCADA. • Recipe management. • Script programming. • Security options and administrative levels in SCADA. • Explore data transfer feature in SCADA software. • SCADA and PLC interfacing for real-time control • Troubleshooting and fault detection. • Role of SCADA in industry 4.0 and IIoT. • SCADA applications in water treatment, energy, and manufacturing.
7	**Flexible Manufacturing System (FMS)** • Introduction to FMS and its importance in modern manufacturing • Important Components of FMS, Advantages and Disadvantages of FMS • Applications of Pneumatics in Manufacturing • Use of Machine Vision, important components, sorting application • Pick and Place concept and its important components
8	**Overview of Manufacturing Execution Systems (MES)** • Introduction to manufacturing execution systems (MES) • ISA 88 AND ISA 95 • MES architecture and MES core functionalities. • Key functions of MES: production scheduling, quality control, tracking. • MES data flow and communication protocols • Real-time work order management in MES • Resource allocation via MES • MES reporting and dashboards for production insights • Barcode integration for MES automation • Exploring MES and industry 4.0: digital twin and smart manufacturing • Case study: MES implementation in a smart factory.

2. PRACTICALS

- Explain different safety tools & Kits, Hazard identification & avoidance, proper waste management.
- Demonstrate various components of the automation simulator panel.
- Demonstrate signal measurement using Multimeter
- Identifying and testing of different type of sensors
- Demonstrate wiring and testing of various output devices.
- Show on-off control using relays.
- Test Emergency stop and safety interlock
- Decode alarm and status indications.
- Configuring and opening PLC programming software.
- Use of basic commands and instructions.
- Demonstrate XIC, XIO, coil and addressing concept.
- Interfacing digital I/O with PLC.
- Configuring analog, I/O with PLC.
- Writing basic ladder logic programs
- Implementing start-stop logic using push buttons
- Design logic gates concept using ladder diagram.
- Design and practice various real time scenarios.
- Configuring and programming timers and counters.
- Create various programs based on timer's application.
- Create various programs based on timer, counter and comparators.
- Design a PLC program to execute the elevator system in a 3-floor apartment.
- Troubleshooting faulty I/O modules in a PLC system.
- Programming safety interlocks for emergency shutdown.
- Demonstration of buttons/keys present on VFD.
- Configuring basic VFD parameters for motor speed control.
- Implementing start/stop and forward/reverse operation
- Adjusting acceleration and deceleration ramp times.
- Interfacing VFD with PLC for automated speed control.
- Implementing emergency stop and safety interlocks.
- Analysing VFD faults and troubleshooting issues.
- Opening the HMI programming software.
- Designing HMI screens with buttons and indicators
- Configuring alarms and event logging in HMI
- Setting up data entry fields in HMI for operator input
- Creating HMI screens for tank level monitoring
- Implementing multi-screen navigation and setting up trends in HMI.
- Integration of HMI with PLC.
- Debugging HMI-PLC communication issues
- Demonstrate the SCADA software interface.
- Design program for a switch and a lamp and check out results in runtime.
- Designing start/stop control for pumps and motors via SCADA

- Configuring alarm management system with alerts
- Logging and retrieving historical data for analysis
- Creating live graphs and trend displays for process monitoring
- Interfacing SCADA with PLC, HMI and VFD for motor control applications
- Implementing data export and report generation in SCADA
- Using SCADA for batch processing and recipe management.
- Designing a SCADA simulation for a smart dashboard energy monitoring system.
- Integrate pneumatic systems, sorting, and pick and place.
- Configuring MES software for the first time.
- Setting up work order tracking in MES.
- Implementing barcode/RFIDs-based inventory management
- Creating automated production reports using MES dashboards.
- Setting up automated work scheduling for assembly line operations.
- Demonstrate integration of MES with PLC for process automation.
- Setting up role-based user access for MES data security.

Identify and resolve common issues in the MES assembly line like communication failure, alarms, equipment malfunction and data irregularity.

5.7 SUMMER INTERNSHIP- II (6 WEEKS AFTER 4th SEMESTER)

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

This document includes guided and supervised Summer Internship of 4 weeks duration to be organized during the semester break starting after second year i.e. after 4th semester examinations. The concerned HODs along with other teachers will guide and help students in arranging appropriate training places relevant to their specific branch. It is suggested that an internship schedule may be drawn for each student before starting of the internship in consultation with the internship providers. Students should also be briefed in advance about the organizational setup, product range, manufacturing process, important machines and materials used in the training organization. Equally important with the guidance is supervision of students internship in the industry/organization by the teachers. Students should be encouraged to write daily report in their diary to enable them to write final report and its presentation later on. An external assessment of **50 marks** has been provided in the study and evaluation scheme of 3rd Semester. Evaluation of professional Summer Internship report through viva-voce/presentation aims at assessing students understanding of materials, industrial process, practices in industry/field organization and their ability to engage in activities related to problem solving in industrial setup as well as understanding of application of knowledge and skills learnt in real life situations. Teachers and students are requested to see the footnote below the study and evaluation scheme of 5th semester for further details.

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

a) Punctuality and regularity 15%

b) Initiative in learning new things 15%

c) Presentation and VIVA 15%

d) Industrial training report 55%

5.8	(Q) INDIAN CONSTITUTION	L T P
		2 - -

COURSE OBJECTIVES

1. Understand the history, principles, and key interpretations of the Indian Constitution.
2. Understand the structure and key roles of the Indian Union Government, including the President, Prime Minister, and Council of Ministers.
3. Understand the composition, powers, and functions of the Lok Sabha, Rajya Sabha, and the Supreme Court.
4. Understand the roles and powers of the Governor, Chief Minister, Council of Ministers, and the State Secretariat.
5. Understand the structure and functions of local administration, including District, Municipal, and Zila Panchayat levels.
6. Understand the structure, role, and functions of the Election Commission of India.

LEARNING OUTCOMES

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

CO1 Explain the historical background, philosophy, basic structure, fundamental rights and duties enshrined in the Indian Constitution and interpret their significance in governance.

CO2 Describe the structure, powers and functions of the Union Government including the President, Prime Minister and Council of Ministers.

CO3 Explain the composition, powers and functions of the Indian Legislature and Judiciary with special reference to Parliament and the Supreme Court of India.

CO4 Describe the structure, roles and functions of the State Government including the Governor, Chief Minister, Council of Ministers and State Secretariat.

CO5 Explain the structure and functioning of local administration in India including district administration, municipal corporations and Zila Panchayats.

CO6 Understand the structure, role and functions of the Election Commission of India and its importance in maintaining democratic governance.

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	–	–	2	–	2	–	–
CO2	3	2	–	–	2	2	1	–	–
CO3	3	2	–	–	2	–	1	–	–
CO4	3	2	–	–	2	2	1	–	–
CO5	3	2	–	–	2	–	1	–	–
CO6	3	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 – The Constitution – Introduction **(06 Periods)**

- The History of the Making of the Indian Constitution
- Preamble and the Basic Structure, and its interpretation
- Fundamental Rights and Duties and their interpretation

Unit 2 – Union Government **(06 Periods)**

- Structure of the Indian Union Government
- President – Election, Role and Power
- Prime Minister and Council of Ministers

Unit 3- Indian Legislature & Judiciary **(06 Periods)**

Composition of Lok Sabha and Rajya Sabha

- Powers & Functions of Lok Sabha and Rajya Sabha
- Structure of Supreme Court including Appointment of Judges
- Powers & Functions of Supreme Court

Unit 4 – State Government **(03 Periods)**

- Governor – Role and Power
- Chief Minister and Council of Ministers
- State Secretariat

Unit 5 – Local Administration **(04 Periods)**

- District Administration
- Municipal Corporation
- Zila Panchayat

Unit 6 – Election Commission **(03 Periods)**

- Structure of Election Commission of India
- Role and Function of Election Commission

Suggested Distribution of Books

1. Ethics and Politics of the Indian Constitution Rajeev Bhargava Oxford University Press, New Delhi, 2008
2. The Constitution of India B.L. Fadia Sahitya Bhawan; New edition (2017)
3. Introduction to the Constitution of India DD Basu Lexis Nexis; Twenty-Third 2018 edition
4. Our Constitution Subhash Chand Kashyap NBT New Delhi.

Suggested Software/Learning Websites:

a. https://www.constitution.org/cons/india/const.html
b. http://www.legislative.gov.in/constitution-of-india
c. https://www.sci.gov.in/constitution
d. https://www.toppr.com/guides/civics/the-indian-constitution/the-constitution-of-india/
e. https://ncert.nic.in/textbook.php

SUGGESTED DISTRIBUTION OF MARKS

SR No	Topic Time Allotted (periods)	Marks Allotted
1	6	20
2	6	20
3	6	20
4	3	12
5	4	16
6	3	12
TOTAL	**28**	**100**

Practicum	6.1 Process Control & Instrumentation	L T P
		2 - 4

COURSE LEARNING OBJECTIVES

The subject Automatic Process Control deals with the different types of controls in processes in chemical industries including automatic control systems. Process characteristics of first order (i.e. time constant element) and second order (i.e. oscillatory type element). Different modes of control action and closed loop in automatic control are well known. The student will be well conversant with these process control systems.

COURSEOUTCOMES

After completion of this course, the students will be able to:

CO1: Understand the working and application of temperature, pressure, level, and flow measuring instruments.
CO2: Understand basic concepts of control systems and the difference between manual and automatic control.
CO3: Analyze the behavior of first-order and second-order systems and their responses.
CO4: Understand and compare different types of controllers and their actions in feedback systems.
CO5: Understand the basic working and applications of PLC and DCS in industrial automation.

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	–	–	–	–	1	–	–
CO2	3	2	–	–	–	–	1	–	–
CO3	3	3	2	–	–	–	1	–	–
CO4	2	3	3	2	–	–	1	–	–
CO5	2	1	–	3	2	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

Unit-1: Instrumentation

1. Temperature : Types of Temperature measuring instruments, Bimetallic Thermometer , Thermocouples, RTD , Temperature Transmitter.
2. Pressure: Types of Pressure measuring instruments, Bourdon Tube gauge, U Tube Manometer, Diaphragm pressure sensor, Pressure Transmitter.
3. Level measurement: Types of Level measuring instruments, Float type Level measuring instrument, Ultrasonic Level measuring instrument, Differential Pressure Type Level measuring instrument, level transmitter.
4. Flow rate: Types of Flow rate measuring instruments, Mass flow meter

Experiments:

1. Measurement of Temperature by Thermocouple module.
2. Measurement of Temperature by of RTD module.
3. Level measurement by using Differential Pressure (DP) Transmitter.
4. Measurement of Pressure by Bourdon Pressure Transducer.

Unit-2: Introduction: Process Dynamics

Automatic control system and its significance; Manual v/s Automatic control, Physical and block diagrams of stirred tank heater system.

Elements of control System: Controller, Measuring instrument, Final control elements, Transmitter, Transducers.

Process Characteristics: Process variables, Laplace transformation, Forcing functions: step, ramp, impulse and sinusoidal function.

Unit-3: Elements of Process Dynamics

1. Ist order system - Examples of 1st order system: Naked bulb thermometer and its derivation; Stirred tank heater; Mixing process; Liquid levels (derivation excluded).
2. IInd order system- Examples of 2nd order system: Non-Interacting and Interacting system (concept only). Transfer function of 2nd order system (derivation excluded); Terms used in Underdamped system: Decay ratio, Overshoot, Response time and Rise time.

Experiments:

1. Study of ON- OFF controller using Temperature controller Trainer kit by monitoring the process in SCADA mode or Analog mode
2. Study of characteristics of control valve (Linear, Equal% and Quick opening).
3. Study the linearity of P/I and I/P converter (Transducers).
4. Study of P, PI, PD and PID controller using Pressure controller Trainer kit by monitoring the process in SCADA mode or Analog mode
5. To study the response of two tank in non-interacting liquid level system.
6. To study the response of two tank in interacting liquid level system.

Unit-4: Controller Characteristic or Modes of Control Action

Standard block diagram symbol, overall transfer function for a single loop system, Negative and positive feedback system, servo and regulatory problem, Final control elements: control valve mechanism, Elements of controller, Type of controllers: proportional control, Two positions/ON-OFF control, integral control, proportional-integral control, proportional derivative control, proportional-integral-derivative control their comparison.

Experiments:

1. To study on-off controller for temperature control.
2. To calibrate pressure gauge with the help of dead weight pressure gauge

Unit-5: Introduction to Programmable Logic Controller (PLC) and Distributed Control System (DCS)

INSTRUCTIONAL STRATEGY

The subject gives the knowledge of various process, instruments and controls to measure process parameters. So the theoretical knowledge of this subject should be properly imparted to the students with the help of practical examples. Each topic should be supplemented with examples.

MEANS OF ASSESSMENT

- Class Test
- Home Assignment
- Sessional Test

- Practical work

RECOMMENDED BOOKS

1. Industrial Instrumentation by Donald P. Eckman, Wiley Eastern Publications.
2. Process System Analysis and Control by Coughanowr and Steven LeBlanc, McGraw Hill publications.
3. Industrial Instrumentation by SK Singh, Tata McGraw Hill Publications.
4. Principles of Industrial Instrumentation by D. Patranabis; Tata McGraw Hill Company
5. Chemical Process Control: An Introduction to Theory BY George Stephanopoulos

SUGGESTED DISTRIBUTION OF MARKS

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

(Humanities) Theory	6.2 ENTREPRENEURSHIP AND START-UPS	L	T	P
		2	-	-

COURSE OBJECTIVES

Explore the Objectives of Entrepreneurship, including innovation, wealth creation, and societal impact, and learn how Entrepreneurs foster economic growth. Entrepreneurship drives the economy and is the very fundamental to all innovation and development.

LEARNING OUTCOMES

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

CO1: Understand the concepts, traits, types, and roles of entrepreneurs and differences from managers.
CO2: Identify and develop business ideas, visualize opportunities, and create a business plan.
CO3: Analyze market, competition, strategy, and risks to convert an idea into a startup.
CO4: Understand management concepts, organization structure, recruitment, and training processes.
CO5: Understand financing methods, intellectual property rights, and communicate ideas to investors.
CO6: Understand succession, dissolution, and harvesting strategies for startups.

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	–	–	–	–	1	–	–
CO2	3	2	2	–	–	2	2	–	–
CO3	3	2	3	–	–	2	2	–	–
CO4	3	2	2	–	1	2	1	–	–
CO5	3	2	2	3	2	2	2	–	–
CO6	2	2	2	–	1	2	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 CONTENT

Unit 1 - Introduction to Entrepreneurship and Start – Ups (02 Periods)

i. Definitions, Classification of Entrepreneur
ii. Traits of an Entrepreneur, Intrapreneurship, Motivation
iii. Types of Business Structures- On the Basis of size and On the basis of ownership
iv. Similarities/differences between entrepreneurs and managers

Unit 2 – Business Ideas and their implementation (06 Periods)

v. Discovering ideas and visualizing the business

vi. Activity map

vii. Business Plan (Case Study)

Unit 3 – Ideas to Start-up (06 Periods)

viii. Marketing and Accounting- Definition and Importance.

ix. Market Analysis – STP (Segmentation, Targeting, Positioning)

x. Competition evaluation and Strategy Development – Vision, Mission, Goal, Objectives.

xi. Risk analysis- SWOT Analysis.

Unit 4 – Management (04 Periods)

xii. Definition Concept and Functions of Management

xiii. Company's Organization Structure- Concept and Classification

xiv. Recruitment and Selection- Definition,

xv. Training and Development- Importance.

Unit 5 - Financing and Protection of Ideas (06 Periods)

xvi. Financing methods available for Entrepreneurship/ Startups in India (Government Scheme, Banking, NBFCs, SHG and Micro Financing).

xvii. Intellectual Property Rights- Overview of - Copyrights, Trademark, Geographical Indicators, Patenting and Licenses

xviii. Communication of Ideas to potential investors – Investor Pitch.

Unit 6: Succession, Dissolution and Harvesting strategy (04 Periods)

2 Ways of succession

1. Types of Dissolution

SUGGESTED LEARNING RESOURCES:

S. No.	Title of Book	Author	Publication
1.	The Startup Owner's Manual: The Step-by-Step Guide for Building a Great Company	Steve Blank and Bob Dorf	K & S Ranch ISBN – 978-0984999392
2.	Entrepreneurship Development (A new Venture creation)	Vasant Desai	Himalya Publication
3.	Entrepreneurship Development	Khanka S.S.	S Chand & Company Limited New Delhi
4.	Entrepreneurship Development	Gupta and Srinivsan	S Chand & Company Limited New Delhi
5	Demand: Creating What People Love Before They Know They Want It	Adrian J. Slywotzky with Karl Weber	Headline Book Publishing ISBN – 978-0755388974
6	The Lean Startup: How Today's Entrepreneurs Use Continuous Innovation to Create Radically Successful Businesses	Eric Ries	Penguin UK ISBN – 978-0670921607
7	The Innovator's Dilemma: The Revolutionary Book That Will Change the Way You Do Business	Clayton M. Christensen	Harvard busines s ISBN: 978-142219602

SUGGESTED SOFTWARE/LEARNING WEBSITES:

- https://www.fundable.com/learn/resources/guides/startup
- https://corporatefinanceinstitute.com/resources/knowledge/finance/corporate-structure/
- https://www.finder.com/small-business-finance-tips
- https://www.profitbooks.net/funding-options-to-raise-startup-capital-for-your-business/
- NPTEL Course on Entrepreneurship https://onlinecourses.nptel.ac.in/noc23_mg74/preview
- National Geographic Channel you tube Video on "GI Tag Crafts of Bharat"

SUGGESTED DISTRIBUTION OF MARKS

Topic No.	Time Allotted (Periods)	Marks Allotted (%)
1	2	17
2	6	14
3	6	20
4	4	17
5	6	21
6	4	11
Total	**28**	**100**

6.3 IN HOUSE PROJECT

In House Project Work aims at developing innovative skills in the students whereby they apply in totality the knowledge and skills gained through the course work in the solution of particular problem or by undertaking a project. The individual students have different aptitudes and strengths. Project work, therefore, should match the strengths of students. For this purpose, students should be asked to identify the type of project work, they would like to execute. It is also essential that the faculty of the respective department may have a brainstorming to identify suitable project assignments for their students. The project assignment can be individual assignment or a group assignment. There should not be more than 3 students if the project work is given to a group. The students should identify themselves or accept the given project assignment at least two to three months in advance. The project work identified in collaboration with industry should be preferred. Each teacher is expected to guide the project work of 5–6 students. The project assignments may consist of:

- Programming customer based applications
- Web page designing (Only dynamic)
- Database applications
- Software Development

LEARNING OUTCOMES

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

• Use effectively oral, written and visual communication
• Demonstrate skill and knowledge of current information and technological tools and techniques specific to the professional field of study.
• Identify, analyze and solve problems creatively through sustainment critical investigation.
• Develop, leadership abilities.
• Apply fundamental and disciplinary concepts and methods in ways appropriate to their areas of study.

OPEN ELECTIVE-3

Theory	6.4.1 ECONOMIC POLICIES IN INDIA OE 3.1	L	T	P
		2	-	-

Course Objectives:
The objective of this course is to familiarize the students of different streams with the basic concepts, structure, problems and issues concerning Indian economy.

Learning outcomes:
At the end of the course, the student will be able to:
CO1: Understand the basic features, demographic aspects, and major economic problems of India such as poverty, unemployment, inflation, and income inequality.
CO2: Understand the sectoral composition of Indian economy, focusing on agriculture, land reforms, Green Revolution, and agricultural policies.
CO3: Understand industrial development, including small-scale and cottage industries, public sector, industrial policies, and service sector growth.
CO4: Understand economic policies, including planning, monetary and fiscal policies, Centre–State financial relations, and LPG reforms.
CO5: Understand India's external sector, foreign trade, balance of payments, FDI, globalization impact, and WTO relations.

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	–	–
CO2	3	2	–	–	2	–	1	–	–
CO3	3	2	1	–	2	–	1	–	–
CO4	3	3	2	–	2	1	1	–	–
CO5	3	3	2	–	3	–	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 Content

UNIT-I: (06 PERIODS)
Basic features and problems of Indian Economy: Economic History of India; Nature of Indian Economy, demographic features and Human Development Index, Problems of Poverty, Unemployment, Inflation, income inequality, Black money in India.

UNIT-II: (06 PERIODS)
Sectoral composition of Indian Economy: Issues in Agriculture sector in India, land reforms Green Revolution and agriculture policies of India,

UNIT-III: (06 PERIODS)
Industrial development, small scale and cottage industries, industrial Policy, Public sector in India, service sector in India.

UNIT-IV: (05 PERIODS)

Economic Policies: Economic Planning in India, Planning commission v/s NITI Aayog, Five Year Plans, monetary policy in India, Fiscal Policy in India, Centre state Finance Relations, Finance commission in India. LPG policy in India

UNIT-V: (05 PERIODS)

External sector in India: - India's foreign trade value composition and direction, India Balance of payment since 1991, FDI in India, Impact of Globalization on Indian Economy, WTO and India.

Reference Books:

1. Dutt Rudder and K.P.M Sunderam (2017). Indian Economy. S Chand & Co. Ltd. New Delhi.
2. Mishra S.K & V.K Puri (2017). Indian Economy and –Its Development Experience. Himalaya Publishing House.
3. Singh, Ramesh, (2016): Indian Economy, Tata-McGraw Hill Publications, New Delhi.
4. Dhingra, I.C., (2017): March of the Indian Economy, Heed Publications Pvt. Ltd.
5. Karam Singh Gill, (1978): Evolution of the Indian Economy, NCERT, New Delhi
6. Kaushik Basu (2007): The Oxford Companion to Economics of India, Oxford University Press.

SUGGESTED DISTRIBUTION OF MARKS

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

Open Elective -3

or

OPEN ELECTIVE	6.4.2 DISASTER MANAGEMENT	L	T	P
		2	-	-

COURSE OBJECTIVES

Disaster management aims to reduce, or avoid the potential losses from hazards, assure prompt and appropriate assistance to victims of disaster, and achieve rapid and effective recovery.

COURSE OUTCOMES:

After competing this course, student will be:

CO1: Understand the basic concepts, definitions, and principles of disaster, hazard, vulnerability, risk, and disaster management.

CO2: Identify and analyze various types of disasters, their causes, consequences, trends, and emerging risks.

CO3: Understand the disaster management cycle, including prevention, preparedness, response, and recovery strategies.

CO4: Understand the institutional, legal, and policy framework for disaster management in India, including the role of government and agencies.

CO5: Apply science and technology tools, such as GIS, RS, GPS, early warning systems, and disaster-safe planning for disaster management.

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	–	–
CO2	3	2	2	–	2	–	1	–	–
CO3	3	3	2	2	2	2	2	–	–
CO4	3	2	2	–	2	2	1	–	–
CO5	3	2	3	2	3	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 CONTENT

Unit – I: Understanding Disaster (4 Periods)

Understanding the Concepts and definitions of Disaster, Hazard, Vulnerability, Risk, Capacity Disaster and Development, and disaster management.

Unit – II: Types, Trends, Causes, Consequences and Control of Disasters (6 Periods)

Geological Disasters (earthquakes, landslides, tsunami, mining); Hydro-Meteorological Disasters (floods, cyclones,

lightning, thunder-storms, hail storms, avalanches, droughts, cold and heat waves) Biological Disasters (epidemics, pest attacks, forest fire);

Technological Disasters (chemical, industrial, radiological, nuclear) and Manmade Disasters (building collapse, rural and urban fire, road and rail accidents, nuclear, radiological, chemicals and biological disasters) Global Disaster Trends – Emerging Risks of Disasters – Climate Change and Urban Disasters.

Unit- III: Disaster Management Cycle and Framework (6 Periods)

Disaster Management Cycle – Paradigm Shift in Disaster Management.

Pre-Disaster – Risk Assessment and Analysis, Risk Mapping, zonation and Micro zonation, Prevention and Mitigation of Disasters, Early Warning System; Preparedness, Capacity Development; Awareness.

During Disaster – Evacuation – Disaster Communication – Search and Rescue – Emergency Operation Centre – Incident Command System – Relief and Rehabilitation –

Post-disaster – Damage and Needs Assessment, Restoration of Critical Infrastructure – Early Recovery – Reconstruction and Redevelopment; IDNDR, Yokohama Strategy, Hyogo Frame- work of Action.

Unit– IV: Disaster Management in India (6 Periods)

Disaster Profile of India – Mega Disasters of India and Lessons Learnt.

Disaster Management Act 2005 – Institutional and Financial Mechanism,

National Policy on Disaster Management, National Guidelines and Plans on Disaster Management; Role of Government (local, state and national), Non-Government and Inter Governmental Agencies

Unit- V: Applications of Science and Technology for Disaster Management (6 Periods)

Geo-informatics in Disaster Management (RS, GIS, GPS and RS).

Disaster Communication System (Early Warning and Its Dissemination).

Land Use Planning and Development Regulations, Disaster Safe Designs and Constructions, Structural and Non-Structural Mitigation of Disasters

S&T Institutions for Disaster Management in India

References

1. Publications of National Disaster Management Authority (NDMA) on Various Templates and Guidelines for Disaster Management
2. Bhandani, R. K., An overview on natural & man-made disasters and their reduction, CSIR, New Delhi
3. Srivastava, H. N., and Gupta G. D., Management of Natural Disasters in developing countries, Daya Publishers, Delhi
4. Alexander, David, Natural Disasters, Kluwer Academic London
5. Ghosh, G. K., Disaster Management, A P H Publishing Corporation
6. Murthy, D. B. N., Disaster Management: Text & Case Studies, Deep & Deep Pvt. Ltd.

SUGGESTED DISTRIBUTION OF MARKS

SR No	Topic Time Allotted (periods)	Marks Allotted
1	4	17
2	6	22
3	6	22
4	6	22
5	6	17
TOTAL	**28**	**100**

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-

1- 15 Marks for general behaviour and discipline
(by HODs in consultation with all the teachers of the department)

2- 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

3- *** Even Semester:**

25 Marks maximum for Sports/NCC/Cultural/Co-curricular/NSSactivities as per following: (by In-charge Sports/NCC/Cultural/Co-curricular/NSS)

a) State/National Level participation
b) Participation in two of above activities
c) Inter-Polytechnic level participation

****Odd Semester:**

25 Marks maximum

a) Language Lab Practices / foreign language practices
b) Group Discussion and Personality Development
c) Industrial Visits/Industrial Talks
d) Power Point Presentations and Resume Making
e) Development of Aptitude and Reasoning Skills
f) Participation in the technical Exhibitions, Symposiums, Seminars, Workshops at the Institute /District/State/National Level.

LIST OF INSTRUMENTS

RUBBER LATEX TECHNOLOGY

Sl No	Name of Equipment	Nos Required	Approx Cost
01	Hot Air Oven	01	20000
02	Stirer Set	02	5000
03	Titration Stand	05	1000
04	pH Meter	02	500
05	Baloon Mould	02	15000
06	Latex Extrusion Set	01	--
07	Electronic weighing Balance with density kit	01	40000

RUBBER PRODUCT MANUFACTURING

Sl No	Name of Equipment	Nos Required	Approx Cost
01	Two-roll mill	01	100000
02	Internal mixer (lab scale)	01	500000
03	Hydraulic press (for molding)	01	200000
04	Autoclave unit	01	75000
05	Rotocure or belt-curing machine	01	150000
06	Tensile testing machine	01	700000
07	Shore A durometer	01	10000
08	Abrasion tester	01	50000
09	Mooney viscometer	01	800000

LIST OF EXPERTS

The following experts participated in various workshop for Developing the Curriculum's Structure and Contents of **Chemical Technology (Rubber & Plastic)** at I.R.D.T. Kanpur.

1. Mr. Rakesh Kumar, Head of Department (Chemical), Government Polytechnic, Kanpur
2. Dr. Shivcharan Prajapati, Lecturer (Paint Technology), Government Polytechnic, Bindki, Fatehpur
3. Mr. Vinod Prasad Sharma, Lecturer (Paint Technology), Government Polytechnic, Kanpur
4. Mr. Satyaveer Singh, Lecturer (Chemical), Government Polytechnic, Kotwan, Mathura
5. Dr. Shashi Bala Gautam, Lecturer (Chemical), Government Polytechnic, Kanpur
6. Mr. Mausam Kumar, Lecturer (P.M.T.), Government Polytechnic, Kanpur
7. Mr. Devesh Srivastava, Lecturer (Chemical), Government Polytechnic, Bindki, Fatehpur
8. Mrs. Kanchan Kushwaha, Lecturer (Petro-Chemical), Government Polytechnic, Kotwan, Mathura
9. Shri Shyam Lal, Text Book Officer, IRDT, Kanpur .
10. Shri Monit Kumar, Research/Technical Assistant IRDT, Kanpur.

7-Evaluation Method

ANNEXURE- 1

1. EVALUATION METHOD for THEORY

	Internal Assessment (40 marks)				External Assessment (60 marks)
	IA 1	**IA 2**	**IA 3**	**IA 4**	
Mode	**Written Test**	**Written Test**	**Attendance and Assignments**	**Pre – Semester Examination**	**End Semester Examination**
Portion	2 units	2 units	Regularly	All units	All units
Duration1hr	1hr	1hr	-	3hrs	3hrs
Exam Marks	20	20	20	60	60
Converted to	10	10	15	15	60
Tentative Schedule	5^{th} Week	10^{th} Week	Regularly	12^{th} -13^{th} Week	

IA1 and IA2: A written assessment test worth 20 marks should be conducted for two units. The marks earned (20 marks) will be converted to 10 marks. The best of the two assessments will be evaluated for an internal 10-mark assessment.
IA3: Assignments given after the completion of each unit, along with attendance throughout the semester, will be assessed for a total of 15 marks.
IA4: The pre-semester examination should follow the end-semester examination question pattern. The marks should be adjusted to 15 for internal assessment.

2. EVALUATION METHOD for PRACTICAL

	Internal Assessment (60 marks)				External Assessment (40 marks)
	IA 1	**IA 2**	**IA 3**	**IA 4**	
Mode	**Practical Test**	**Practical Test**	**Attendance and Practical Documentation**	**Practical Test and Quiz – Viva Voce**	**Practical Examination**
Portion	50% Practical	50% practical	All practical	All practical	All practical
Duration	3hrs	3 hrs	Regularly	3 hrs	3hrs
Exam Marks	20	20	20	20	40
Tentative Schedule	5th Week	10th Week	Regularly	12th -13th Week	

IA1 and IA2: Complete all exercises and experiments as outlined and retain them for the practical test. The test should be conducted in accordance with the evaluation scheme. The best of the two practical tests will be internally evaluated for a total of 20 marks.

IA3: Maintain a practical file for each exercise while ensuring attendance throughout the semester. Submit the required documents for the practical file, quiz, and practical test along with a valid certificate (Progress Card). This will be assessed for 20 marks.

IA4: The pre-semester practical examination, quiz, and viva-voce should follow the end-semester practical examination pattern, with marks adjusted to 20 for internal assessment.

SUGGESTED DISTRIBUTION OF MARKS FOR **INTERNAL** EVALUATION

Part	Description	Marks Allotted
A.	Objective	**5**
B.	Diagram	**5**
C.	Procedure	**10**
D.	Observation Table and Calculation	**10**
E.	Result and its Discussion, Conclusion	**10**
F.	Practical Test	**20**
	Total	**60**

SUGGESTED DISTRIBUTION OF MARKS FOR **EXTERNAL** EVALUATION

Part	Description	Marks Allotted
A.	Objective	**5**
B.	Diagram	**5**
C.	Procedure	**5**
D.	Observation Table and Calculation	**5**
E.	Result and its Discussion, Conclusion	**10**
F.	Viva-Voce	**10**
	Total	**40**

3. EVALUATION METHOD for PRACTICUM (End Exam-Practical)

	Internal Assessment (60 marks)				External Assessment (40 marks)
	IA 1	**IA 2**	**IA 3**	**IA 4**	
Mode	**Practical Test**	**Practical Test**	**Attendance and Practical Documentation**	**Micro Project**	**Practical Examination**
Portion	50% practical	50% practical	All practical	All practical	All practical
Duration	3hrs	3 hrs	Regularly	Regularly	3hrs
Exam Marks	20	20	20	20	40
Tentative Schedule	5th Week	10th Week	Regularly	12th -13th Week	

- **IA1 and IA2:** Complete all exercises and experiments as instructed and retain them for the practical test. The test should be conducted according to the evaluation scheme. The best of the two practical tests will be internally assessed for a total of 20 marks.
- **IA3:** Maintain a practical file for each exercise, ensuring attendance throughout the semester. Submit the required documents for the practical file, quiz, practical test, and end-semester examination, along with a valid certificate (Progress Card). This will be evaluated by 20 marks.
- **IA4:** Submit a micro-project report along with a fabrication model or analysis report. The performance of each student in the group will be assessed by both the laboratory supervisor and an internal examiner. This evaluation will contribute 20 marks.

SUGGESTED DISTRIBUTION OF MARKS FOR **INTERNAL** EVALUATION

Part	Description	Marks Allotted
A.	Objective	**5**
B.	Diagram	**5**
C.	Procedure	**10**
D.	Observation Table and Calculation	**10**
E.	Result and its Discussion, Conclusion	**10**
F.	Mini Project	**20**
	Total	**60**

SUGGESTED DISTRIBUTION OF MARKS FOR **EXTERNAL** EVALUATION

Part	Description	Marks Allotted
A.	Objective	**5**
B.	Diagram	**5**
C.	Procedure	**5**
D.	Observation Table and Calculation	**5**
E.	Result and its Discussion, Conclusion	**10**
F.	Viva-Voce	**10**
	Total	**40**

4. EVALUATION METHOD for <u>PRACTICUM (End Exam-Theory)</u>

	Internal Assessment (40 marks)						External Assessment (60marks)
	IA 1		IA 2		IA 3	IA 4	
Mode	**Written Test**	**Practical Test**	**Written Test**	**Practical Test**	**Attendance and Practical Documentation**	**Pre Semester Examination and Micro Project**	**End Semester Examination**
Portion	2 units	Practical related to the units	2 units	Practical related to the units	All unit	All Practical	All unit
Duration	1hr	3hrs	1hr	3 hrs	3hrs	Regularly	3hrs
Exam Marks	10	20	10	20	60	60	60
	30		30				
Converted to	10		10		15	15	60
Tentative Schedule	5th Week		10th Week		Regularly	12th -13th Week	

IA1 and IA2: A written assessment test worth 10 marks should be conducted for two **UNIT**s. Complete all exercises and experiments as outlined and retain them for the practical test worth 20 marks. The practical test should be conducted in accordance with the evaluation scheme. The total marks earned (30 marks) will be converted to 10 marks. The best of the two assessments will be internally evaluated for a total of 10 marks.

IA3: Attendance and the pre-semester examination should follow the end-semester examination question paper pattern. The marks should be adjusted to 15 for internal assessment.

IA4: Maintain a practical file for each exercise. Submit the required documents for the practical file, quiz/viva-voice, practical test, and end-semester examination, along with a valid certificate (Progress Card). This will be assessed for 40 marks. Additionally, submit a micro-project report along with a fabrication model or analysis report. The performance of each student in the group will be evaluated by both the laboratory supervisor and an internal examiner. The total of 60 marks will be converted to 15 marks.

(ANNEXURE-I)

PROCEDURES / FORMATS FOR ORGANIZING INTERNSHIPS.

STUDENT INTERNSHIP PROGRAM APPLICATION

Complete and submit to the TPO/ Internship Program Coordinator.

1. Student Name:		Enroll. No.:	
2. Campus Address:		Phone:	
3. Home Address:		Phone:	
4. Student email address:			
5. Branch:		6. Internship Semester: _____	
7. Internship Preferences			
	Company/Industry	Core Area	Location
Preferance-1			
Preferance-2			
Preferance-3			
Faculty mentor Signature: _____Date_____.			
Student Signature: _____Date_____. Signature confirms that the student agrees to the terms, conditions, and requirements of the Internship Program			

Signature with seal
HOD/Principal

(ANNEXURE-I)

REQUEST LETTER FROM INSTITUTE TO INTERNSHIP/INDUSTRIAL TRAINING PROVIDER

Ref. No.: _____ Date: _____

To,
The HR Manager/Training Coordinator
……
……

Subject: Request for Internship/Industrial Training for Diploma Students

Sir/Madam,

We are pleased to introduce……., a premier institution affiliated with Board of Technical Education, Uttar Pradesh, offering diploma programs in various diploma disciplines.

As a part of the curriculum, our students are required to undergo Internship/Industrial Training to gain practical exposure and enhance their technical competencies. Therefore, we kindly request your esteemed organization to provide Internship/Training opportunities to our students during the period from …….. to ……..

S. No.	Name	Enroll. No.	Semester/Year	Discipline

Yours sincerely,

(Head of Department/Principal)

(ANNEXURE-II)

PROFORMA FOR EVALUATION OF INTERNSHIP BY INDUSTRY

Student Name: ……Evaluation Date: ……

Industry Supervisor Name: ……

Company/Organization: ……

Title of the Project: ……

Dates of Internship: ……..

to ……..……

Please evaluate your intern by indicating the frequency with which you observed the following behaviors:

Parameters	Max. Marks	Marks Given
Attendance and Punctuality	20	
Discipline and Professional Behavior	20	
Technical Knowledge and Understanding of Processes	30	
Practical Skills and Quality of Work	20	
Ability to Apply Theoretical Knowledge	20	
Problem Solving and Analytical Ability	10	
Communication and Interpersonal Skills	20	
Teamwork and Collaboration	10	
Internship Report/Documentation	20	
Presentation and Viva-Voce	30	
Total Marks	200	

Additional comments, if any:

Signature with seal of Industry supervisor HR Manager

(ANNEXURE-II)

INTERNSHIP REPORT

STUDENT'S DIARY/ DAILY LOG

The main purpose of writing daily diary is to cultivate the habit of documenting and to encourage the students to search for details. It develops the students' thought process and reasoning abilities. The students should record in the daily training diary the day to day account of the observations, impressions, information gathered and suggestions given, if any. It should contain the sketches & drawings related to the observations made by the students.

The daily training diary should be signed after every day by the supervisor/ in charge of the section where the student has been working. The diary should also be shown to the Faculty Mentor visiting the industry from time to time and got ratified on the day of his visit.

Student's Diary and Internship Report should be submitted by the students along with attendance record and an evaluation sheet duly signed and stamped by the industry to the Institute immediately after the completion of the training. It will be evaluated on the basis of the following criteria:

- Regularity in maintenance of the diary.
- Adequacy & quality of information recorded.
- Drawings, sketches and data recorded.
- Thought process and recording techniques used.
- Organization of the information.

INTERNSHIP REPORT

After completion of Internship, the student should prepare a comprehensive report to indicate what he has observed and learnt in the training period. The student may contact Industrial Supervisor/ Faculty Mentor/TPO for assigning special topics and problems and should prepare the final report on the assigned topics. Daily diary will also help to a great extent in writing the industrial report since much of the information has already been incorporated by the student into the daily diary. The training report should be signed by the Internship Supervisor, TPO and Faculty Mentor. The Internship report will be evaluated on the basis of following criteria:

i. Originality.

ii. Adequacy and purposeful write-up.

iii. Organization, format, drawings, sketches, style, language etc.

iv. Variety and relevance of learning experience.

v. Practical applications, relationships with basic theory and concepts taught in the course.

(ANNEXURE-II)

MONITORING & EVALUATION OF INTERNSHIP

The industrial training of the students will be evaluated in three stages:

1. Evaluation by Industry.
2. Evaluation by faculty supervisor of Industry.
3. Evaluation through seminar presentation/viva-voce at the Institute.

1. EVALUATION BY INDUSTRY

The industry will evaluate the students based on the Punctuality, eagerness to learn, Maintenance of Daily Diary and skill test in addition to any remarks.

2. MONITORING/ SURPRISE VISIT BY TPO/ STAFF/ FACULTY MENTOR

TPO/Staff/ Faculty Mentor of the institutes will make a surprise visit to the internship site, to check the student's presence physically, if the student is found absent without prior intimation to the T & P Cell, entire training will be cancelled. Students should inform the TPO, faculty mentor as well as the industry supervisor at least one day prior to availing leave by email. Students are eligible to avail 1-day leave in 4 weeks and 2 days leave in 6 weeks of the internship period apart from holidays and weekly offs.

3. EVALUATION THROUGH SEMINAR PRESENTATION/VIVA-VOCE AT THE INSTITUTE

The student will give a seminar based on his training report, before an expert committee constituted by the concerned department as per norms of the institute. The evaluation will be based on the following criteria:

- Quality of content presented.
- Proper planning for presentation.
- Effectiveness of presentation.
- Depth of knowledge and skills.
- Attendance record, daily diary, departmental reports shall also be analyzed along with the Internship Report.

Seminar presentation will enable sharing knowledge & experience amongst students & teachers and build communication skills and confidence in students.