**DEPARTMENT OF TECHNICAL EDUCATION (DIPLOMA SECTOR)**
**UTTAR PRADESH**

# NEP-2020 ALIGNED CURRICULUM FOR DIPLOMA PROGRAMME IN PLASTIC MOULD TECHNOLOGY (3rd to 4th Semester)

**==========**
**Semester System**
**==========**

**(EFFECTIVE FROM YEAR 2025-26)**

**Prepared By:**

**INSTITUTE OF RESEARCH, DEVELOPMENT & TRAINING, U.P., KANPUR**
**DEPARTMENT OF TECHNICAL EDUCATION**
**UTTAR PRADESH**

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**THIRD SEMESTER**



**FOURTH SEMESTER**

## PREFACE

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

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

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

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

Director

Institute of Research Development &Training.

Kanpur

**ACKNOWLEDGMENTS**

We gratefully acknowledge the guidance and contribution received from the following persons:

1. Additional Chief Secretary, Technical Education Department, U.P. Govt.

2. Special Secretary, Technical Education Department, U.P. Govt.

3. Director, Technical Education, Kanpur Uttar Pradesh.

4. Director, I.R.D.T., Kanpur U.P. , for taking keen interest in the review of this curriculum.

5. Faculty/Subject Experts from U.P. Government polytechnics

6. All the participants from industry/field organizations, engineering colleges, polytechnics, and other technical institutions for their professional inputs during curriculum workshops.

Coordinator

Institute of Research Development & Training,

Kanpur, U.P.

## 1. SALIENT FEATURES

- Name of the Programme: Diploma Programme Plastic Mould Technology
- Duration of the Programme: Three years (Six Semesters)
- Entry Qualification: Matriculation or as Prescribed by State BTE, UP
- Intake: As prescribed by the Board
- Pattern of the Programme: Semester Pattern
- Ratio between theory and Practical: 40:60 (Approx.)

## 2. EMPLOYMENT OPPORTUNITIES FOR DIPLOMA HOLDERS IN PLASTIC MOULD TECHNOLOGY

The following are the major employment opportunities for diploma holders in Plastic Mould Technology:

- In manufacturing industry primarily in private sector and to some extent in public sector
- In service sector like Railways, Hospitals, Military Engineering Services, Boards and Corporations, Construction Companies, Transportation Telecommunication, PWD and Rural Development Agencies.
- In marketing sector for sales and after- sales services
- As an entrepreneur Departments,

Though the diploma holders in Plastic Mould Technology find placement in all functional areas like R&D, planning, shop floor production, quality control, inventory management but majority of them find employment in shop floor management.

**PROGRAM OUTCOMES (POs)**

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

**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 PLASTIC MOULD TECHNOLOGY**
**THIRD SEMESTER**

| SR. NO. | SUBJECTS | COURSE TYPE AND CATEGORY | STUDY SCHEME PERIODS/WEEK | | | CREDITS | MARKS IN EVALUATION SCHEME | | | | | | | | TOTAL MARKS OF INTERNAL & EXTERNAL |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | INTERNAL ASSESSMENT | | | EXTERNAL ASSESSMENT | | | | | |
| | | | L | T | P | | TH | PR | TOT | TH | HRS | PR | HRS | TOT | |
| 3.1 | Fundamental Of Polymers | Program Core (Theory) | 3 | - | - | 3 | 40 | - | 40 | 60 | 3 | - | - | 60 | 100 |
| 3.2 | Plastics Processing Techniques- I | Program Core (Theory ) | 3 | - | - | 3 | 40 | - | 40 | 60 | 3 | - | - | 60 | 100 |
| 3.3 | Material Science & Engineering | Program Core (Theory) | 3 | - | - | 3 | 40 | - | 40 | 60 | 3 | - | - | 60 | 100 |
| 3.4 | Metrology & Measuring Instruments | Program Core (Practicum) | 2 | - | 2 | 3 | - | 60 | 60 | - | - | 40 | 3 | 40 | 100 |
| 3.5 | Hydraulic & Pneumatic System | Program Core (Practicum) | 2 | - | 2 | 3 | - | 60 | 60 | - | - | 40 | 3 | 40 | 100 |
| 3.6 | Plastics Processing Techniques- I Lab | Program Core (Practical) | - | - | 5 | 2 | - | 60 | 60 | - | - | 40 | 3 | 40 | 100 |
| 3.7 | Open Elective-I: 3.7.1 Economic | Open Elective-1 | 2 | - | - | 2 | 50 | - | 50 | - | - | - | - | - | Qualifying |

| | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Policies in India<br>3.7.2 Project Management | | | | | | | | | | | | | | |
| | Advanced Skill Certification- I | | - | - | - | | - | - | - | - | - | - | - | - | |
| 3.8 | **Summar Internship-I | | - | - | 2 | 1 | - | 50 | 50 | - | - | - | - | - | 50 |
| #Student Centered Activities | | | - | - | 10 | - | - | 50 | 50 | - | - | - | - | - | 50 |
| **TOTAL** | | | **15** | **-** | **21** | **20** | **120** | **280** | **400** | **180** | **-** | **120** | **-** | **300** | **700** |

****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. SCA periods can also be utilized for completing the syllabus in respective semester.**

**STUDY AND EVALUATION SCHEME FOR PLASTIC MOULD TECHNOLOGY**
**FOURTH SEMESTER**

| . | SUBJECTS | COURSE TYPE AND CATEGORY | STUDY SCHEME PERIODS/WEEK | | | CREDITS | MARKS IN EVALUATION SCHEME | | | | | | | | TOTAL MARKS OF INTERNAL & EXTERNAL |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | INTERNAL ASSESSMENT | | | EXTERNAL ASSESSMENT | | | | | |
| | | | L | T | P | | TH | PR | TOT | TH | HRS | PR | HRS | TOT | |
| 4.1 | Plastic Materials | Program Core (Theory) | 3 | - | - | 3 | 40 | - | 40 | 60 | 3 | - | - | 60 | 100 |
| 4.2 | Basics of Moulds & Dies | Program Core (Theory) | 3 | - | - | 3 | 40 | - | 40 | 60 | 3 | - | - | 60 | 100 |
| 4.3 | Mould Manufacturing | Program Core (Theory) | 3 | - | - | 3 | 40 | - | 40 | 60 | 3 | - | - | 60 | 100 |
| 4.4 | Plastics Testing-I | Program Core (Practicum) | 2 | - | 4 | 4 | - | 60 | 60 | - | - | 40 | 3 | 40 | 100 |
| 4.5 | Plastics Processing Techniques-II | Program Core (Practicum) | 2 | - | 4 | 4 | - | 60 | 60 | - | - | 40 | 3 | 40 | 100 |
| 4.6 | Moulds & Dies Design Lab | Program Core (Practical) | - | - | 3 | 1 | - | 60 | 60 | - | - | 40 | 3 | 40 | 100 |
| 4.7 | Open Elective-II<br>4.7.1 Industrial Robotics & Automation<br>4.7.2 Internet of things | Open Elective-II | 2 | - | - | 2 | 50 | - | 50 | - | - | - | - | - | Qualifying |
| | Advanced Skill Certification-II | | - | - | - | | - | - | - | - | - | - | - | - | |
| 4.8 | **Essence Of Indian Knowledge and Tradition (Q) | Audit Course | 2 | - | - | - | 50 | - | 50 | - | - | - | - | - | Qualifying |
| #Student Centered Activities | | | - | - | 8 | - | - | 50 | 50 | - | - | - | - | - | 50 |
| **TOTAL** | | | **17** | **-** | **19** | **20** | **120** | **230** | **350** | **180** | **-** | **120** | **-** | **300** | **650** |

**#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 etc. SCA periods can also be utilized for completing the syllabus in respective semester.**

**Industrial Training**
**(Summar Internship-II) of 4-6 Weeks after 4th Semester, Evaluation will be done in 5th Semester.**

**OPEN ELECTIVE-1**

| SR. NO. | SUBJECT NAME |
|---|---|
| 1. | Economic policies in India |
| 2. | Project Management |
| 3. | Any Course Of Minimum 02 Credit From<br>• NPTEL<br>• MOOCS THROUGH SWAYAM<br>• AICTE-ELIS AND CENTRALLY FUNDED TECHNICAL INSTITUTES<br>• C-DAC<br>• CERTIFICATES CONDUCTED BY THE INSTITUTE OF NATIONAL IMPORTANCE (IIT, NIT, IIIT ETC.)<br>• ISRO E-LEARNING<br>• OTHER RELEVANT GOVERNMENT, INTERNATIONAL/NATIONAL PLATFORMS OF REPUTE, NEILIT COURSE RUN BY TATA TECHNOLOGY ESTABLISHED IN GOVERNMENT POLYTECHNICS. **(Annexure: 1)** |

**Remark: A minimum of 40% of the total enrolled students must choose a single subject for it to be offered as an open elective.**

**OPEN ELECTIVE-2**

| SR. NO. | SUBJECT NAME |
|---|---|
| 1 | Industrial Robotics & Automation |
| 2 | Internet Of Things |
| 3 | ANY COURSE OF MINIMUM 02 CREDIT FROM |

| | |
|---|---|
| | • NPTEL<br>• MOOCS THROUGH SWAYAM<br>• AICTE-ELIS AND CENTRALLY FUNDED TECHNICAL INSTITUTES<br>• C-DAC<br>• CERTIFICATES CONDUCTED BY THE INSTITUTE OF NATIONAL IMPORTANCE (IIT, NIT, IIT ETC.)<br>• ISRO E-LEARNING<br>• OTHER RELEVANT GOVERNMENT, INTERNATIONAL/NATIONAL PLATFORMS OF REPUTE, NEILIT COURSE RUN BY TATA TECHNOLOGY ESTABLISHED IN GOVERNMENT POLYTECHNICS. (**Annexure: 1**) |

## 4. GUIDELINES FOR ASSESSMENT OF STUDENT CENTRED ACTIVITIES (SCA)

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

i. 10 Marks for general behaviour and discipline
(by HODs in consultation with all the teachers of the department)

ii. 10 Marks for attendance as per following:
(by HODs in consultation with all the teachers of the department)

a) 75 - 80% 8 Marks
b) 80 - 85% 9 Marks
c) Above 85% 10 Marks

iii. 30 Marks maximum for Sports/ NCC/ Cultural/ Co-curricular/ NSS activities as per following:

(by In-charge Sports/NCC/Cultural/Co-curricular/NSS)

a) 30 - State/National Level participation
b) 25 - Participation in two of above activities
c) 15 - Inter-Polytechnic level participation

| 3.1 | FUNDAMENTAL OF POLYMERS | L | T | P | C |
|---|---|---|---|---|---|
| THEORY | | 3 | 0 | 0 | 3 |

**COURSE OBJECTIVE**

"THE LIFE WITHOUT POLYMER IS VERY DIFFICULT. IT MAKES OUR LIVES VERY EASY." The Purpose of this Paper is to acquaint the students with primary knowledge of polymers i.e. different Polymers, their properties, Reactions, Polymerization Techniques, Classification, Molecular weight, Distribution of Molecular weight and their applications in different era of life.

**COURSE OUTCOMES:**

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

1. Understand the fundamentals of polymers.
2. Understand the classification of polymers.
3. Understand the polymerization mechanism.
4. Understand the polymerization reactions.
5. Understand the polymerization techniques.
6. Understand chain growth polymerization/step growth polymerization.
7. Analyse polymerization components for determination of molecular weight and molecular weight distribution of polymers, copolymers, etc.
8. Understand the different properties of polymer.
9. Understand the Identification and characterization of polymer.

**DETAILED CONTENTS**

**Unit – I Introduction** (06 Periods)

Genesis and source, Definitions- monomers, oligomers, & polymers, Definition of polymerisation, Functionality of Plastics, characteristics of polymers.

**Unit-II-classification of polymers:** (12 Periods)

Origin based- Natural, synthetic, Thermal based, Thermoplastic and Thermosetting, Line Structure based, Linear, branched and crosslinked, Tacticity- Isotactic, syndiotactic, Atactic, Crystallinity based- crystalline, semicrystalline, Amorphous. Chemistry based - Addition polymers and condensation polymers. Application based- Elastomers, Plastics and fibres. Homo polymers and copolymers - Random, Block and graft copolymer.

**Unit-III Polymerization:** (08 Periods)

Chain growth (Addition Polymerisation)- Initiation, Propogation, Termination. Step growth (Condensation) Polymerisation. Degree of Polymerisation. Polymerisation Techniques- Bulk, solution, suspension, emulsion.

**Unit- IV Structure and Properties:-** (10 Periods)

Structure -property relationship - Molecular weight, Molecular weight distribution and its effect on Properties and processing of polymers - Poly Dispersity index (PDI) - Thermal transition -Tg and Tm. Crystallinity-factors affecting crystallinity.

**Unit V : Natural Polymers** (06 Periods)

Sources of Polymers – natural and synthetic source, Bio derived Polymers- Plysaccharide and Starch based etc. Biodegradation of Polymers & its derivatives .

**INSTRUCTIONAL STRATEGY**

Fundamentals of Polymer Science being a basic subject, the teacher is expected to emphasize on the basics of chemistry and then polymer chemistry. As this subject is a part of chemistry, teachers are expected to cover different aspects of chemical bonding, reactions, reaction mechanism etc. For identification Purposes students should also be made aware of different plastic identification techniques.

**MEANS OF ASSESSMENT**

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

**RECOMMENDED BOOKS**


1. Polymer Science – Gowariker V.R. & others.
2. Text book of Polymer Science – Billmeyer F.W.
3. Polymer Chemistry- Raymond B. Seymour and Charles E. Carraher Jr.
4. Polymer Science and Technology- Joel R. Fried
5. Fundamentals of Polymer Science- Paul C. Painter and Michael M. Coleman
6. Introduction to Polymers- Robert J. Young
7. Principles of Polymer Science- P. Bahadur
8. E-books/e-tools/relevant software to be used as recommended by AICTE/ SWAYAM/BTE/ NITTTR, Chandigarh.

## SUGGESTED DISTRIBUTION OF MARKS

| Topic No. | Time Allotted (Hrs) | Marks Allotted (%) |
|---|---|---|
| 1 | 06 | 15 |
| 2 | 12 | 25 |
| 3 | 08 | 20 |
| 4 | 10 | 25 |
| 5 | 06 | 15 |
| **Total** | **42** | **100** |

| 3.2 | PLASTICS PROCESSING TECHNIQUES-I | L | T | P | C |
|---|---|---|---|---|---|
| THEORY | | 3 | 0 | 0 | 3 |

**COURSE OBJECTIVE**

The purpose of this subject is to equip the students with the knowledge of processes utilized in Injection molding, extrusion and blow moulding. This subject develops the competence of the students in major industrially practiced processing techniques.

**LEARNING OUTCOME**

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

1. Explain injection moulding process
2. Understand process of extrusion, classifications, & the performance of extruder.
3. Understand the Knowledge of printing techniques.
4. Understand process of blow moulding and the associated products

**DETAILED CONTENTS**

**A) INJECTION** ( 15Periods)

Basic concept of injection moulding: Hand injection, Semi automatic injection (vertical and horizontal) and features of machine. Automatic injection moulding machine: Various machine parts like; hopper, screw, barrel, heating devices, clamping unit etc. Injection moulding process and process control, machine parameter, shot capacity, injection pressure, injection speed, day light, limit switch etc., Basic concept of injection cycle, Faults and remedies in injection moulding process like: Short shot, shrink mark, weld line, parting line, flash etc.

**B) EXTRUSION** (15 Periods)

1.Introduction

Introduction to extrusion process, different types of extruders:- single screw and twin screw extruder, vented barrel extruder, general principles of operation, die swell, function of various parts i.e. barrel, screw, screenpack, die, breaker plate.

2. Types of screws in use for processing different plastics, Feed, Compression and Metering zone, Die zone, L/D ratio and its significance.

3. Blown film extrusion (Nip rolls, bubble casing, winding equipment, cutting devices, stretching and orientation)

4. Extrusion of pipes.

5. Wires and cables extrusion.

6. Sheets and Filaments extrusion.

7. Printing techniques , flexographic printing, gravure printing, pad printing, screen printing, hot stamping.

8. Faults and remedies in Extrusion process.

**C) BLOW MOULDING** (12 Periods)

1. Basic principles of blow moulding, Types of blow moulding :- Extrusion blow moulding, injection blow moulding. Blow molding irregular containers.
2. Materials for blow moulding.

3. Production of parison by extrusion & injection process. Parison wall thickness control.

4. Newer concepts including extrusion- stretch blow moulding, injection stretch blow moulding, multi layer moulding etc.

5. Faults and remedies in Blow moulding process.

**INSTRUCTONAL STRATEGY**

This subjects should be taught with the aids available. The students should be visited a unit having Injection molding, extrusion & Blow molding operations of various injection moulding machine, extrusion machine and blow moulding machine.

**MEANS OF ASSESSMENT**

- Assignments and Quiz/Class Tests
- Mid-term and End-term
- Written Tests

**RECOMMENDED BOOKS**


1 Injection Moulding theory & practice-Rubin, Irvin
2 Plastics Processing Technology by Edward A. Muccio.
3 Plastic Materials & Processing , Brent Strong
4 Plastic Engineering Hand Book- Society of Plastic Industry Inc.
5 Plastic Processing data Hand Book- D.V. Rasato
6 E-books/e-tools/relevant software to be used as recommended by AICTE/ SWAYAM/BTE/ NITTTR, Chandigarh.

## SUGGESTED DISTRIBUTION OF MARKS

| Topic | Time Allotted (Periods) | Marks Allotted (%) |
|---|---|---|
| A | 15 | 35 |
| B | 15 | 35 |
| C | 12 | 30 |
| **Total** | **42** | **100** |

| 3.3 | MATERIAL SCIENCE & ENGINEERING | L | T | P | C |
|---|---|---|---|---|---|
| THEORY | | 3 | 0 | 0 | 3 |

**COURSE OBJECTIVE :**

This course provides an in-depth understanding of the structure, properties, and applications of various engineering materials with a special focus on rubbers and polymers. Students will learn how to relate material properties to their structure and processing behaviour, with practical applications in rubber product manufacturing and design.

**COURSE OUTCOMES:**

1. Understand the structure-property relationships of metals, polymers, ceramics, and composites.
2. Gain knowledge of crystalline and amorphous structures in materials.
3. Learn about mechanical, thermal, and electrical behaviours of rubber and polymer materials.
4. Identify the causes of material degradation and how to select appropriate materials for applications.
5. Apply testing methods to evaluate and compare the performance of materials.

**DETAILED CONTENT**

**UNIT-I: INTRODUCTION & STRUCTURE OF METALS** (Periods-12)

Scope of Material Science, Overview of different engineering materials and applications, Classification of materials, Thermal, Chemical, Electrical, Mechanical properties of various materials Crystallography Fundamentals: Crystal, Unit Cell, Space Lattice, Arrangement of atoms in Simple Cubic Crystals, BCC, FCC and HCP Crystals, Number of atoms per unit Cell, Atomic Packing Factor. Deformation: Overview of deformation behaviour and its mechanism, behaviour of material under load control and strain control. Failure Mechanisms: Overview of failure modes, fracture, fatigue and creep.

**UNIT-II NON-METALS & ADVANCED MATERIALS** (Periods-10)

Inorganic materials: Ceramics, Glass and refractories - organic materials: wood, plastics, and rubber. Advanced materials: Biomaterials, nano-materials and Metal Matrix composites. Ceramics-Classification, properties, applications- Adhesives: Classification, properties and applications, Smart materials - properties and applications.

**UNIT-III HEAT TREATMENT:** (Periods-10)

Purpose of heat treatment, Solid solutions and their types, Formation and decomposition of Austenite, Martensite Transformation – Simplified Transformation Cooling Curves. Various heat treatment processes- hardening, tempering, annealing, normalising, case hardening, and surface hardening. Hardenability of steels, Selection of case carburising and induction hardening steels. Types of heat treatment furnaces (only basic idea)

**UNIT IV: MATERIALS SELECTION AND APPLICATIONS** (Periods-10)

Selection Criteria: Design considerations, environmental and economic factors. Applications: Materials used in aerospace, automotive, electronics, and biomedical fields. Smart Materials

**INSTRUCTONAL 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**

**Textbooks:**


1. Materials Science and Engineering – V. Raghavan
2. Callister's Materials Science and Engineering – William D. Callister
3. Polymer Science – V.R. Gowariker
4. Introduction to Rubber Technology – Maurice Morton


**References:**


1. Rubber Technologist's Handbook – S. Blow
2. Essentials of Materials Science and Engineering – Donald R. Askeland
3. Engineering Materials – Kenneth G. Budinski & Michael K. Budinski

## SUGGESTED DISTRIBUTION OF MARKS

| Topic No. | Time Allotted (Periods) | Marks Allotted (%) |
|---|---|---|
| 1 | 12 | 30 |
| 2 | 10 | 25 |
| 3 | 10 | 25 |
| 4 | 10 | 20 |
| Total | 42 | 100 |

| 3.4 | METROLOGY & MEASURING INSTRUMENTS | L | T | P | C |
|---|---|---|---|---|---|
| PRACTICUM | | 2 | 0 | 2 | 3 |

**COURSE OBJECTIVE**

Metrology is the science of measurement, Diploma holders in this course are responsible for ensuring process and quality control by making measurements and carrying out inspection of various parameters. For this purpose, knowledge and skills about various measuring instruments are required. The aim of this subject is to develop knowledge and skills regarding various measuring instruments amongst the students.

**LEARNING OUTCOME**

After undergoing the subject, students will be able to :

- use vernier calliper, micro meter, Height gauge for linear internal and external measurement.
- use bore gauge, radius gauge, taper gauge, plug gauge, ring gauge, snap gauge for measurements.
- use bevel protector, sine bar, slip gauge, dial indictor, angle deckor, poppy dial for angular measurements.
- measure spur gear characteristics using gear tooth vernier, outside diameter over dovel pins.
- use tool makers microscope
- measure surface roughness parameters.
- use profile projector, auto colli meter, angle deckor.
- select and measure variables using electrical and electronics comparators and measuring instrument, sensors, transducers.
- select and use non destructive testing methods.
- explain the use of coordinate measuring machine.
- use the concept of limits, fits and tolerance in assembly of components

**DETAILED CONTENTS**

**UNIT-I**

**INTRODUCTION** (07 Periods)

1.1 Definition of metrology.

1.2 Standard of measurement.

1.3 Types of Errors - Controllable and random errors.

1.4 Precision, accuracy, sensitivity, hysteresis, response time.

1.5 Standardization and standardizing organizations.

**PRACTICALS**

1. To Study and sketch of vernier callipers.
2. To study and sketch of micrometer.
3. To study and measurement of precision and accuracy.
4. To study the errors during the measurement of object.

**UNIT-II**

**LINEAR AND ANGULAR MEASUREMENT** (07 Periods)

2.1 Construction features and use of instruments for non precision linear measurement: steel rule, callipers, surface plate, angle plate, V-block.

2.2 Construction features and use of instruments for precision measurements : vernier calipers, vernier height and depth gauges, micrometers.

2.3 Slip gauges, Indian standards of slip gauges, sets of slip gauges, use of slip gauges.

**PRACTICALS**

1. Internal measurement with vernier callipers.
2. Internal measurement with micrometer.
3. External measurement with vernier calliper.
4. External measurement with micrometer.

**UNIT-III**

**MEASUREMENT OF SURFACE FINISH** (07 Periods)

3.1 Terminology of surface roughness.

3.2 Concept of primary texture and secondary texture.

3.3 Factors affecting surface finish.

3.4 Limits, Fits and Tolerance

**PRACTICALS**

1. Measurement of flatness, concentricity with dial indicator.
2. Measurement of surface roughness using surface roughness tester.
3. To study the factors affecting surface finish
4. To study Limits, Fits and Tolerance

**UNIT-IV** (07 Periods)

4.1 Measurements of Screw threads and Gauges

Measurement of screw threads- Introduction, measurements of external and core diameters, checking of pitch and angle of threads with gauges.

4.2 Various types of temperature measuring instruments such as thermometers, Thermistor, Bimetallic strip, Pyrometers

**PRACTICALS**

1. To study and use of screw threads and gauges.
2. Measurement of thread parameters by using tool maker's microscope.
3. Determination of temperature of thermocouple, pyrometer, Infrared thermometer.
4. To determine the temperature of given material.

**INSTRUCTONAL STRATEGY**

1. Charts and illustrations of controllable vs random errors
2. Conduct repeated measurements; compare with standard values
3. Compare machined vs hand-finished surfaces
4. Models or 3D images of thread profiles, pitch gauges demonstration

**MEANS OF ASSESSMENT**

- Assignments and Quiz/Class Tests
- Mid-term and End-term
- Written Tests

**RECOMMENDED BOOKS**

- A.K. Jain – Engineering Metrology, Khanna Publishers
- R.K. Jain – Engineering Metrology and Measurements, Khanna Publishers
- D.S. Kumar – Mechanical Measurements and Control, Metropolitan Book Co.
- S.K. Singh – Industrial Instrumentation and Control, Tata McGraw-Hill
- T. R. Banga & S.C. Sharma – Industrial Engineering and Production Management, Khanna Publishers
- A Textbook of Metrology Laboratory Manual by S.C. Sharma
  Measurement and Metrology Lab Manual by Laxmi Publications

**WEBSITE REFERENCES**

- https://nptel.ac.in
- www.bis.gov.in

**SUGGESTED DISTRIBUTION OF MARKS**

| Topic No. | Time Allotted (Periods) | Marks Allotted (%) |
|---|---|---|
| 1 | 07 | 30 |
| 2 | 07 | 25 |
| 3 | 07 | 25 |
| 4 | 07 | 20 |
| Total | 28 | 100 |

| 3.5 | HYDRAULIC & PNEUMATIC SYSTEM | L | T | P | C |
|---|---|---|---|---|---|
| PRACTICUM | | 2 | 0 | 2 | 3 |

**COURSE OBJECTIVE**

Diploma holders in this course are required to deal with problems of fluid and use of hydraulics and pneumatics in power generation. For this purpose, knowledge and skills about fluid mechanics and machinery, hydraulics and pneumatics systems are required to be imparted for enabling them to perform above functions.

**COURSE OUTCOMES:**

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

- Explain fluid properties, their units and conversion.
- Measure different types of pressures.
- Maintain different types of pressure gauges.
- Calculate flow and discharge of various liquids.
- Apply Bernoulli's theorem for calculating pipe diameter and height of pipe from ground.
- Calculate pipe friction and losses in pipelines.
- Specify hydraulic machines for different applications.
- Apply Pascal's law in practical applications.
- Explain the functions of various components used in hydraulic and pneumatic system.
- Maintain hydraulic and pneumatic system.

**DETAILED CONTENTS**

1. **INTRODUCTION** (05 Periods)

Fluid, types of fluid; properties of fluid viz mass density, weight density (specific weight), specific volume, capillarity, specific gravity, viscosity, compressibility, surface tension, kinematic viscosity and dynamic viscosity and their units.

**PRACTICALS**

1. 1. Measurement of pressure head by employing.
   i) Piezometer tube
2. Measurement of pressure head by employing.
   i) Single and double column manometer
3. To find out the value of coefficient of discharge for a venturimeter
4. Measurement of flow by using venturimeter.

2. **Pressure and its Measurement** (05 Periods)

2.1 Concept of pressure (Atmospheric Pressure, gauge pressure, absolute pressure)

2.2 Pressure measuring devices: peizometer tube manometers - simple U-tube, differential single column, inverted U-tube, micromanometer including simple problems

2.3 Bourdon pressure gauge, Diaphragm pressure gauge, dead weight pressure gauge

**PRACTICALS**

1. To study hydraulic circuit of an automobile brake and hydraulic ram.
2. To study the concept of pressure
3. To study the micromanometer
4. To study the diaphragm pressure gauge

3. **HYDRAULIC SYSTEM** (06 Periods)

Description, operation and application of hydraulic systems – hydraulic ram, hydraulic jack, hydraulic brake, hydraulic accumulator, hydraulic door closer, hydraulic press.

**PRACTICALS**

1.To study the hydraulic system
2.To study and measurement of pressure using hydraulic press
3. To study the operation and application of hudraulic system
4. to study the hudraulic brake

4. **COMPONENTS OF HYDRAULIC SYSTEMS** (06 Periods)

4.1 Basic components of hydraulic system, function of each component in a hydraulic circuit.

4.2 Oil reservoirs, couplings, motors and pumps – definition and functions of the parts,

4.3 Filters- definition and purpose, classification

4.4 Seals and packing- classification of seals, sealing materials.

**PRACTICALS**

1. To Study The Basic Component Of Hudraulic System
2. To Study The Function Of Each Component In A Hydraulic Circuit
3. To Study The Working Of Motors And Pumps
4. To Study The Seals And Sealing Materials

5. **COMPONENTS OF PNEUMATIC SYSTEMS** (06 Periods)

5.1 Basic components – function of each component

5.2 Air compressors – Introduction

5.3 Air filter, regulator and lubricator – their necessity in pneumatic circuit.
5.4 Installation, maintenance and application of air compressor.

**PRACTICALS**

1. To study the basic component
2. To study the air compressors
3. To study the air filter
4. To study the installation & maintenance of air compressor

**INSTRUCTIONAL STRATEGY**

1. Use computer based learning aids for effective teaching-learning
2. Expose students to real life problems
3. Plan assignments so as to promote problem solving abilities and develop continued learning skills

**RECOMMENDED BOOKS**


1. Fluid Mechanics by KL Kumar; S Chand and Co Ltd., Ram Nagar, New Delhi.
2. Hydraulics and Fluid Mechanics Machine by RS Khurmi ; S.Chand & Co. Ltd., New Delhi.
3. Fluid Mechanics through Problems by RJ Garde; Wiley Eastern Ltd., New Delhi.
4. Fluid Mechanics by Dr AK Jain, Khanna Publishers, New Delhi.
5. Hydraulic and Pneumatic Control by K Shammuga Sundaram, S. Chand & Co. Ltd., New Delhi
6. Hydraulics and Hydraulic Machinery by Dr. Jagadish Lal; Metropolitan Book Company Ltd., Delhi.
7. Hydraulic and Pneumatic Power and Control Design, Performance and Application by Yeaple, McGraw Hill, New York..
8. Pneumatic Controls by Festo Didactic; Bangalore.
9. Pneumatics Control: An Introduction to the Principles by Werner Deppert and Kurt Stoll; Vogel – Verlag.
10. e-books/e-tools/relevant software to be used as recommended by AICTE/UBTE/NITTTR, Chandigarh.


**WEBSITE REFERENCES**

http://swayam.gov.in

**SUGGESTED DISTRIBUTION OF MARKS**

| Topic No. | Time Allotted (Hrs) | Marks Allotted (%) |
|---|---|---|
| 1 | 05 | 15 |
| 2 | 05 | 15 |
| 3 | 06 | 24 |
| 4 | 06 | 24 |

| | | |
|---|---|---|
| 5 | 06 | 22 |
| **Total** | **28** | **100** |

| **3.6** | **PLASTICS PROCESSING TECHNIQUES-I LAB** | **L** | **T** | **P** | **C** |
|---|---|---|---|---|---|
| **PRACTICAL** | | **0** | **0** | **5** | **2** |

**COURSE OBJECTIVE**

The course aims to provide hands-on experience and foundational knowledge in the operation, specifications, and applications of various plastic processing and printing machines including injection molding, extrusion, and blow molding, along with gravure and pad printing. The objective is to equip students with practical skills relevant to the plastic manufacturing industry.

**COURSE OUTCOMES:**

- Understand the working principles and operational procedures of injection molding machines.
- Identify and interpret the specifications of different types of extrusion and blow molding machines.
- Operate an extruder to produce plastic pipes of various diameters.
- Differentiate between extrusion blow, injection blow, and stretch blow molding processes.
- Explain the process and equipment used in gravure and pad printing of plastic components.
- Demonstrate safety precautions and operational best practices while working with polymer machinery.

**LIST OF PRACTICALS**

1. To study & operation of Injection Moulding machine.
2. To study the specification of extruder available in the lab.
3. To produce pipe of different diameters on extruder.
4. To study the specification of Extrusion Blow Moulding Machine.
5. To study the specification of Injection Blow Moulding Machine.
6. To study the specification of Stretch Blow Moulding Machine.
7. To study gravure printing machines.
8. To do printing with pad printing machines.

**INSTRUCTIONAL STRATEGY**

- Demonstration: Start with safety procedures, control panel, raw material feeding.

- Classroom: Teach screw design (L/D ratio, compression zones).
- Objective: Run extrusion trials with different dies.
- Visit Machine: Understand parison formation and mould closure.
- Sketch: Internal schematic with key labels.
- Assessment: Specification table filling + diagram identification.
- Explanation: Injection of preform → transfer → blow.
- Lab Work: Compare with extrusion blow moulding.
- Assessment: Match-making type quiz (process vs product).
- Video Analysis: Show slow-motion of preform heating and stretching.
- Assessment: Q&A on importance of orientation and tensile strength.
- Demonstration: Show engraved cylinder, doctor blade, ink system.
- Activity: Print on flexible plastic sample.
- Assessment: Labelling diagram, ink transfer sequence.
- Lab Exercise: Print logo/design using silicone pad on 3D item.
- Discussion: Why pad printing suits uneven surfaces.
- Assessment: Identify defects, list machine components

**RECOMMENDED BOOKS**


- Plastic Processing Technology, National Institute of Industrial Research (NIIR Board), Asia Pacific Business Press
- Polymer Science and Technology, Premamoy Ghosh, Tata McGraw-Hill
- Handbook of Plastic Processes, Charles Harper
- Plastics Engineering, R.J. Crawford Butterworth-Heinemann
- Printing Technology, J.A. Cormack / Sharma & Mathur (for Hindi medium),Oxford & Vikas Publishing


**WEBSITE REFERENCES**

- https://plastics101.com
- https://www.rtsplastics.com
- https://www.plastemart.com
- https://www.rpmachinery.net
- https://www.packaginginsights.com

| 3.7 | OPEN ELECTIVE-I/ ADVANCED SKILL CERTIFICATION-I | | | | |
|---|---|---|---|---|---|
| 3.7.1 | ECONOMIC POLICIES IN INDIA | L | T | P | C |
| OPEN ELECTIVE-I | | 2 | 0 | - | 2 |

**Course Learning 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.

**Course Content:**

**UNIT-I:** 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:** Sectoral composition of Indian Economy: Issues in Agriculture sector in India, land reforms Green Revolution and agriculture policies of India,

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

**UNIT-IV:** 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:** 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.

| 3.7.2 | PROJECT MANAGEMENT | L | T | P | C |
|---|---|---|---|---|---|
| OPEN ELECTIVE-I | | 2 | 0 | - | 2 |

**Course Learning Objectives:**

• To develop the idea of project plan, from defining and confirming the project goals and objectives,

identifying tasks and how goals will be achieved.

• To develop an understanding of key project management skills and strategies.

**Course Content**

**UNIT-I: Concept of a project**: Classification of projects- importance of project management- The

project life cycle- establishing project priorities (scope-cost-time)project priority matrix- work

break down structure.

**UNIT-II: Capital budgeting process:** Planning- Analysis-Selection-Financing-Implementation-Review. Generation and screening of project ideas- market and demand analysis- Demand forecasting

techniques. Market planning and marketing research process- Technical analysis

**UNIT-III: Financial estimates and projections:** Cost of projects-means of financing-estimates of

sales and production-cost of production-working capital requirement and its financing-profitability

projected cash flow statement and balance sheet. Break even analysis.

**UNIT-IV: Basic techniques in capital budgeting**: Non discounting and discounting methods- payback

period- Accounting rate of return-net present value-Benefit cost ratio-internal rate of return.

Project risk. Social cost benefit analysis and economic rate of return. Non-financial justification of

projects**.**

**UNIT-V: Project administration**: progress payments, expenditure planning, project scheduling and

network planning, use of Critical Path Method (CPM), schedule of payments and physical progress,

time-cost trade off. Concepts and uses of PERT cost as a function of time, Project Evaluation and Review Techniques/cost mechanisms. Determination of least cost duration. Post project evaluation. Introduction to various Project management softwares.

**Reference Books:**

1. Project planning, analysis, selection, implementation and review – Prasannachandra – Tata McGraw Hill

2. Project Management – the Managerial Process – Clifford F. Gray & Erik W. Larson – McGraw Hill

3. Project management - David I Cleland - Mcgraw Hill International Edition, 1999

4. Project Management – Gopala krishnan – Mcmillan India Ltd.

5. Project Management-Harry-Maylor-Peason Publication

## ADVANCED SKILL CERTIFICATION-I

To fulfill the requirements for Advanced Skill Development, a minimum of 20 hours of skill certification is necessary. This certification must be obtained from a recognized national or international agency or institute. The assessment and certification process will be conducted by the respective agency or institute. Students must present their certificate to earn 02 credits for this subject.

| 3.8 | SUMMER INTERNSHIP-I | L | T | P | C |
|---|---|---|---|---|---|
| | | - | - | 2 | 1 |

**AIM OF THE SUMMER TRAINING**

The aim of the summer training in Plastic Mould Technology is to provide diploma students with hands-on experience and practical exposure to mould design, processing techniques, and manufacturing practices involved in the plastic industry. The training bridges the gap between theoretical knowledge and industrial practices, preparing students for real-world applications and enhancing their employability in the polymer and plastic sector.

**COURSE OBJECTIVES :**

By the end of this summer training, students will be able to:

- Understand the fundamental principles of plastic moulding processes.
- Gain practical skills in handling moulding machines (e.g., injection, compression, blow moulding).
- Learn the basics of mould design and the role of CAD/CAM in mould making.
- Familiarize themselves with different types of polymers and their processing behavior.
- Develop an understanding of quality control and testing methods for plastic products.
- Enhance problem-solving skills by working on industry-based mini-projects or case studies.
- Observe and participate in the industrial workflow of a plastic moulding unit.

**COURSE OUTCOMES**

- Upon successful completion of the training, students will be able to:
- Demonstrate understanding of plastic moulding processes including injection, blow, and compression moulding.
- Operate and troubleshoot basic plastic processing equipment safely and efficiently.
- Interpret and use mould design drawings for practical applications.
- Select appropriate materials and moulding processes for given product requirements.
- Apply quality inspection techniques to evaluate plastic moulded components.

- Integrate knowledge of plastic technology with industrial practices for better decision-making.
- Prepare technical reports and presentations based on industrial exposure and project work.

| 4.1 | PLASTIC MATERIALS | L | T | P | C |
|---|---|---|---|---|---|
| THEORY | | 3 | 0 | 0 | 3 |

**COURSE OBJECTIVE ::**

1. To understand the structural characteristics of various plastic materials and their influence on material properties.
2. To develop the ability to select appropriate plastic materials for specific applications based on performance criteria.
3. To distinguish between different categories of plastics, including their classification and defining features and processing
4. To explore the diverse industrial and commercial applications of plastic materials.
5. To identify and differentiate between thermoplastics and thermosetting, and bio polymers.

**COURSE OUTCOMES:**

1. To understand different types of plastics and their widely used abbreviations.
2. Explain the relationship between the structure and properties of different plastic materials, and the synthesis and manufacturing of common engineering plastics and their properties for a variety of applications
3. Identify and classify plastics into thermoplastics and thermosets with reference to their characteristics and applications.
4. Understand the concept and characteristics of speciality plastics and their applications
5. Evaluate the suitability of various plastics based on their performance under different environmental and operational conditions

## DETAIL CONTENTS

**UNIT I :**

**COMMODITY PLASTICS** (Periods-12)

General characteristics and properties & applications of Low Density Polyethylene (LDPE), Linear Low Density Polyethylene (LLDPE), High Density Polyethylene (HDPE), High Molecular weight High Density Polyethylene (HMWHDPE), Polypropylene (PP)-Homo & Copolymer, Poly Vinyl Chloride (PVC) & UPVC, CPVC.

**UNIT- II :**

**ENGINEERING PLASTICS** (Periods-12)

Plastics-Definition and Classifications-Abbreviations. Structure, Properties and applications of PS, SAN, ABS, HIPS , Polyamides (Nylon 6 & Nylon 6,6 (only), PET, PBT, ABS, PMMA, Polyacetals, PC, High Performance poly ethylene–XLPE, UHMWHDPE.

**UNIT III :**

**SPECIALITY PLASTICS** (Periods-12)

Structure, Properties and applications of PPO, PPS, Polysulphides, PEEK, Fluoropolymers PTFE, LCP Liquid Crystal Polymer, Polyaniline and Polypyrole.

**UNIT IV :**

**THERMOSETTING PLASTICS** (Periods-06)

Difference between Thermoplastics & Thermosetting plastics. Kevlar structure, properties and applications of PF, UF, Epoxy and Unsaturated Polyester resin.

**INSTRUCTONAL STRATEGY**

This subjects should be taught with molecular models to explain polymer structures (e.g., amorphous vs crystalline). Explain with block diagrams the behavior of high-performance polymers under heat/stress. Discussion on environmental impact and need for bio-alternatives.

**MEANS OF ASSESSMENT**

- Assignments and Quiz/Class Tests
- Mid-term and End-term
- Written Tests

**RECOMMENDED BOOKS**

**Text Books:**


1. David Plackett, "Biopolymers – New Materials for Sustainable films and Coatings", John Wiley & Sons Ltd, 2011
2. V.R.Gowarikar, N.V.Viswanathan & Jayadev Sridhar - Polymer Science - New age international publishers - 1986.
3. Fred W.Billmeyer - Text Book of Polymer Science - Wiley Interscience - 1971.
4. P.Ghosh – Polymer science and Technology – Tata McGraw Hill, New Delhi,
5. Irvin.I. Rubin, "Hand Book of Plastic Materials and Technology", Wiley Interscience, NY,1990.


**References:**


1. Anilkumar & S.K.Gupta -Fundamentals of Polymer Science - Tata McGraw Hill Pub. Co. 1978.
2. Odian.G - Principles of Polymerisation – McGraw-Hill, New York – 1970
3. Plastics Material, J A Brydson (Author)7th Edition, Butterworth-Heinemann, 26 October 1999
4. Olagoke Olabisi, "Hand Book of Thermoplastics", Marcel Decker, inc., 1997


**WEBSITE REFERENCES**

- https://www.polymerdatabase.com
- https://omnexus.specialchem.com
- https://www.matweb.com
- https://www.sciencedirect.com/topics/chemical-engineering/thermosetting-polymer
- https://plastics.tulip.co
- https://www.bioplasticsmagazine.com
- https://www.european-bioplastics.org
- https://www.nature.com

**SUGGESTED DISTRIBUTION OF MARKS**

| Topic No. | Time Allotted (Periods) | Marks Allotted (%) |
|---|---|---|
| 1 | 12 | 30 |
| 2 | 12 | 30 |
| 3 | 12 | 30 |
| 4 | 06 | 10 |

| | | |
|---|---|---|
| Total | 42 | 100 |

| 4.2 | BASICS OF MOULDS & DIES | L | T | P | C |
|---|---|---|---|---|---|
| THEORY | | 3 | 0 | 0 | 3 |

**COURSE OBJECTIVE :**

- Understand the basic concepts, types, and functions of moulds used in plastic processing.
- Learn the design elements and components of injection, compression, and blow moulds.
- Understand the construction and working principles of extrusion dies for various profiles.
- Identify the materials used for moulds and dies and their selection criteria.
- Gain insight into cooling, heating, ejection, and gating systems in moulds.
- Become familiar with mould/die manufacturing methods, assembly, and maintenance practices.
- Interpret basic mould/die drawings and develop an understanding of tolerance and fits

**COURSE OUTCOMES:**

- Explain the classification and purpose of various types of moulds used in plastic processing.
- Identify and describe the function of mould components such as core, cavity, runner, gate, ejector, etc.
- Describe the working principles of different types of extrusion dies (pipe, sheet, film, profile).
- Select appropriate materials for moulds and dies based on application, temperature, and pressure conditions.
- Illustrate the layout of a simple injection mould or extrusion die with dimensional specifications.
- Analyze common moulding defects caused due to die design and suggest corrective actions.
- Demonstrate awareness of maintenance practices, polishing, and fitting techniques used in tool rooms.

**DETAIL CONTENTS**

**MOULDS**

**UNIT-I:** (Periods-06)

Basic concept of moulds, shrinkage, flash, taper and draft, Ribs and bosses. General design considerations for various types of moulds. Materials used for moulds and their characteristics, types of injection moulds.

**UNIT- II:** (Periods-08)

Core and cavity, types of cavity and core, their advantages and disadvantages. Bolster plate and its types, guide pillar, guide bush, register ring and their types, Parting

surface, Mould clamping and their types. Parting surface significance in mould design and their type.

**UNIT-III:** (Periods-06)

Feed system -Sprue, runner, gate & its types, 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, cooling circuits for an integer and insert core cavity Moulds e.g. U-type, rectangular and Z-type

**UNIT-IV** (Periods-06)

Compression mould- design consideration of compression mould, types of compression mould,

Transfer mould -definition, pot and plunger and types transfer mould , Blow mould - design consideration of blow mould and their types

**EXTRUSION DIES**

**Unit-V:** (Periods-08)

Extrusion Dies- Definition, features and their types, general design features of extrusion dies, Design consideration of extrusion dies, Design features of extrusion dies, Die geometry- Approach section and Land section, die swell, Die materials, Viscosity, Polymer melt flow, Melt viscosity, Effect of temperature and pressure on viscosity, Die Maintenance and cleaning.
Heating system and temperature control-heating mechanism, types of heater-Band heater, Cartridge heater, Tubular heater, Cast heater etc. temperature control devices.

**UNIT-VI:** (Periods-08)

Machining methods:-Conventional and non conventional method, general introduction to EDM and their type, wire cut EDM, CNC wire cut and basics of part programming.

**INSTRUCTONAL STRATEGY**

Introduce key concepts such as types of moulds (injection, compression, blow) and extrusion dies (pipe, film, profile). Use board diagrams and charts to explain components like core, cavity, runner, gate, die lips, mandrels, etc.Encourage Q&A sessions to reinforce learning

**MEANS OF ASSESSMENT**

- Assignments and Quiz/Class Tests
- Mid-term and End-term

- Written Tests

**RECOMMENDED BOOKS:**


1. Handbook of Mould, tool & Die repairing, S. Thompson
2. SP. S Handbook of plastics by J. Frados
3. Mould Making Hand Book, Stoeckert.
4. Plastics Moulds and Dies, Sors.
5. Injection Moulds, V.D.L.
6. Injection Mould Design-PyeR.G.W.
7. Production Technology – Er.R.K.Jain
8. Production Technology P.C. Sharma Pub: S. Chand and Co.


**WEBSITE REFERENCES**

- Website: https://www.ptonline.com
- https://www.injectionmouldingonline.com
- https://extrusion.world
- https://www.toolingu.com

**SUGGESTED DISTRIBUTION OF MARKS**

| Topic No. | Time Allotted (Periods) | Marks Allotted (%) |
|---|---|---|
| 1 | 6 | 10 |
| 2 | 8 | 20 |
| 3 | 6 | 15 |
| 4 | 6 | 15 |
| 5 | 8 | 20 |
| 6 | 8 | 20 |
| Total | 42 | 100 |

| 4.3 | MOULD MANUFACTURING | L | T | P | C |
|---|---|---|---|---|---|
| THEORY | | 3 | 0 | 0 | 3 |

**COURSE OBJECTIVE :**

- Understand the fundamentals of mould manufacturing and the role of moulds in plastic processing techniques such as injection, compression, and blow moulding.
- Gain knowledge of mould components, their functions, and interrelationship in complete mould assemblies.
- Identify appropriate materials for different mould parts considering mechanical, thermal, and wear properties.
- Develop skills in interpreting technical drawings of mould components and assemblies including tolerances and surface finish specifications.
- Understand the procedures for mould fitting, polishing, and assembly, and their impact on product quality and cycle time.
- Acquire knowledge of mould maintenance practices, including preventive and breakdown maintenance, and safety considerations in tool rooms.

**COURSE OUTCOMES:**

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

- Understand the mould making materials.
- Understand the different mechanical operations used in mould making.
- Understand the different techniques/tools used in mould making.
- Understand the mould policing and finishing operations.
- Understand the scope of mould maintenance and its method.

**DETAILED CONTENTS**

**UNIT – I: MATERIAL FOR MOULDS** (10 Periods)

Mould Steel Requirement, Characteristics, Alloying Elements, Material Selection for Different Parts of the Mould, Non Ferrous Materials, Aluminum, Copper, Bronze, Beryllium Copper, heat treatment and its significance in Mould manufacturing.

**UNIT – II: MOULD MAKING TECHNIQUES-CONVENTIONAL METHODS** (10 Periods)

Introduction of mould parts and manufacturing, Different types of machines used, Cutting Tools-Tool Materials. Study of various machining operations -Turning, Shaping, Planning, Drilling, Grinding (Surface, Cylindrical), Milling (Horizontal / Vertical). Manufacturing of various mould elements.

**UNIT – III: MOULD POLISHING & ASSEMBLY** (10 Periods)

Polishing Technology in Mold Making-Definition of Surface Roughness, Basics of Polishing Technology, Effect of Mold Materials on Polish ability, Types of Polishing Tools, Principles of Electro Deposition in Damaged Molding Surfaces / Protective Coating. Mould Assembly-Check list for Mould Assembly-Fitting and Assembly of various Mould Elements- Core Insert, Cavity Insert, Sprue Bush-Ejection System Assembly.

**UNIT – IV: MOULD MAINTENANCE** (12 Periods)

Mould Maintenance, Purpose, Scope, Responsibility-Aspects of Upkeep and Maintenance of Moulds- Specification sheets-History sheets-Instruction Manual- Factors for Physical Mould Life-Maintenance Frequency-Break Down Maintenance-Suggested Tools available for proper tool maintenance- Maintenance list- Preventive maintenance-Mould Removing, Cleaning and Storage.

**INSTRUCTIONAL STRATEGY**

This subject should be taught from mould introduction . Exposure of special machine tools should be physically there. Instructors are required to pay special focus in maintenance of moulds. The content of this subject are very important to the students. The teachers should acknowledge different aspect of materials used for the mold making and explain the same to the students.

**MEANS OF ASSESSMENT**

- Assignments and Quiz/Class Tests
- Mid-term and End-term
- Written Tests

**RECOMMENDED BOOKS**


1 Mould Making Hand Book, Stoeckert.
2 Plastics Moulds and Dies, Sors.
3 Injection Moulds, V.D.I.
4 Injection Mould Design ,Pye R.G.W.
5 Production Technology - Er.R.K. Jain.
6 Production Technology - P.C. Sharma Pub: S. Chand and Co.
7 Workshop Technology, Volume I & II , W.A.J Chapman.
8 Elements of Workshop Technology-S.K.Hajra Choudhury & A.K Hajra Choudhury.
9 E-books/e-tools/relevant software to be used as recommended by AICTE/ BTE/ NITTTR, Chandigarh.

**WEBSITE REFERENCES**

- https://www.ptonline.com
- https://www.toolingu.com
- https://www.moldmakingtechnology.com
- https://omnexus.specialchem.com
- https://www.matweb.com
- https://www.autodesk.com/solutions/moldflow

**SUGGESTED DISTRIBUTION OF MARKS**

| Topic | Time Allotted (Periods) | Marks Allotted (%) |
|---|---|---|
| 1 | 10 | 25 |
| 2 | 10 | 25 |
| 3 | 10 | 25 |
| 4 | 12 | 25 |
| **Total** | **42** | **100** |

| 4.4 | PLASTICS TESTING-I | L | T | P | C |
|---|---|---|---|---|---|
| PRACTICUM | | 2 | 0 | 4 | 4 |

**COURSE OBJECTIVE :**

This course provides essential knowledge and practical skills for evaluating the basic concept of testing mechanical, thermal, rheological, . Accurate testing is vital for material selection, quality control, and product development. By understanding standard test methods and equipment, students are prepared to meet industry demands in polymer processing and application.

**COURSE OUTCOMES :**

1. To gain knowledge on how the plastic materials are tested for their mechanical, thermal, and rheology properties.
2. Evaluation of mechanical properties of polymers, including tensile, flexural, and compression, using appropriate testing instruments and procedures
3. Able to identify the plastic materials for some specified applications based on their properties.
4. Analyse Melt Flow Index characteristics and viscosity of Plastics
5. Analyse the Thermal characteristics of plastics
6. To understand the mechanical properties
7. To know the rheological characteristics.
8. To understand the thermal characteristics

**DETAILED CONTENTS**

**UNIT I: BASIC CONCEPT AND IDENTIFICATION** (10 Periods)

Basic concept of Testing, Destructive & Non destructive testing, National and International Standards, Sample preparation, Sample conditioning, Test atmosphere, Environmental conditions for testing, Basic precaution for testing, identification techniques- Visual, drop, flame, Density measurement by displacement method, Particle size by sieve analysis, Melting Point by simple method, Solubility Test. Brief description about characterization by simple spectroscopic method.

**EXPERIMENT**

1. Identification of Plastics by Simple Methods
2. Density measurement of Plastics using the Displacement method
3. To Identify the melting point of plastic materials

**UNIT II: MECHANICAL PROPERTIES OF POLYMER** (10 PERIODS)

Stress-strain behaviour, Polymer fracture, Polymer toughness, Tensile strength, Percentage elongation, Flexural & compressive strength, Tear Resistance, Impact strength- Izod & Charpy, Falling dart method, Abrasion resistance, Hardness Testing By Shore A and D, Stress Relaxation and Creep.

**EXPERIMENT**

1. Determination of Hardness using Shore A & D
2. Determination of Tensile strength of plastic products
3. Determination of Percentage elongation of plastic products
4. Determination of Izod impact strength

**UNIT III: RHEOLOGICAL PROPERTIES OF POLYMER** (10 Periods)

Rheological Properties: Melt Flow Index (MFI), Viscosity– Intrinsic viscosity (IV) by Ubelohde viscometer, K Value, Dynamic Viscosity (Brook Filed Viscometer), Cup & Spiral Flow Test, Apparent (Bulk) Density, Bulk Factor

**EXPERIMENT**

1. Determination of Melt flow index
2. Determination of intrinsic viscosity (IV)
3. Determination of K Value

**UNIT IV: THERMAL PROPERTIES OF POLYMER** (10 Periods)

Thermal properties: Heat distortion Temperature (HDT), Vicat Softening Point (VSP), Thermal Expansion. Brittleness temperature, Reversion test of Pipe. Linear Shrinkage and Shrinkage on Transverse. Brief description about thermal analysis by DSC, TGA & DMA method.

**EXPERIMENT**

1. Determination of Heat Deflection Temperature
2. Determination of Reversion of Pipe

**INSTRUCTIONAL STRATEGY**

The teacher should give small assignments to the students. Give industrial-based practical problems for material and energy calculations.

**MEANS OF ASSESSMENT**

- Assignments and Quiz/Class Tests
- Mid-term and End-term
- Written Tests

**RECOMMENDED BOOKS**

Text Book

1. Textbook on Fundamentals of Plastics Testing - Prof. (Dr.) S.K..Nayak
2. Handbook of Plastics Testing Technology (Society of Plastics Engineers Monographs),Vishu Shah (Author) 2nd Revised edition, Wiley–Blackwell **18 November 1998**

Reference

1. Simple Methods for Identification of Plastics, Dietrich Braun (Author)4th Revised ed., Carl Hanser Verlag GmbH & Co **4 April 2013**

**WEBSITE REFERENCES**

- https://www.astm.org
- https://www.matweb.com
- https://www.intertek.com/polymers/testing/
- https://www.instron.com

- https://www.ptonline.com
- https://www.iso.org

## SUGGESTED DISTRIBUTION OF MARKS

| Topic | Time Allotted (Periods) | Marks Allotted (%) |
|---|---|---|
| 1 | 10 | 25 |
| 2 | 12 | 35 |
| 3 | 10 | 20 |
| 4 | 10 | 20 |
| **Total** | **42** | **100** |

| 4.5 | PLASTICS PROCESSING TECHNIQUES-II | L | T | P | C |
|---|---|---|---|---|---|
| PRACTICUM | | 2 | 0 | 4 | 4 |

**COURSE OBJECTIVE**

After fabrication of the product post processing operations are necessary to make the product commercially presentable. Finishing and other decorating and printing operations are instrumental in enhancing the aesthetics and visual appeal of the product. The emphasis is given especially on printing, lamination, coating techniques, compression and transfer moulding and rotational moulding.

**COURSE OUTCOME**

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

1. Explain compression moulding, transfer moulding process and different parameters of these techniques.
2. Understand pultrusion and hand lay-up techniques.
3. Gain knowledge of rotational molding process.

**DETAILED CONTENTS**

**1. COMPRESSION MOULDING:** (06 Periods)

Introduction: General principle and working of compression moulding. Types of compound used in compression moulding (SMC & DMC compounds). Types of mould used in compression moulding. Application of Compression moulding.

**PRACTICALS**

1. To produce small components on hand compression moulding machine
2. To study the compound used in compression moulding machine
3. To study the SMC & DMC compound
4. To study the application of compression moulding

**2. TRANSFER MOULDING:** (06 Periods)

Introduction : General principle and working of transfer moulding. Types of mould used in transfer moulding. Difference between Compression & transfer moulding. Application of transfer moulding.

**PRACTICALS**

1. To study the working principle of transfer moulding
2. To study types of mould used in transfer moulding
3. To study application of transfer moulding

**3. PULTRUSION & HAND LAY UP TECHNIQUE:** (06 Periods)

Introduction to Pultrusion & hand lay-up techniques & their application for fibre reinforced plastic fabrication. Study of Pultrusion machine and their specification.

**PRACTICALS**

1. To study the process of pultrusion
2. To study the process of hand lay-up technique
3. To study the application of FRP

**4. THERMOFORMING:** (06 Periods)

Introduction: Basic principles & various methods of thermoforming – straight forming, free forming, plug assist forming, drape forming, matched die forming, reverse draw forming, Limitations and advantages of thermoforming, General materials used for thermoforming. Application of thermoforming.

**PRACTICALS**

1. To study the method of straight forming
2. To study the method of plug assist forming
3. To study the method of reverse draw forming

**5. CASTING & CALENDARING:** (06 Periods)

Introduction: General principle of casting process. Types of Casting Processes & material used in casting, Applications of casting. Introduction to calendaring, types of calendars, advantages, limitations of calendaring and major applications.

**PRACTICALS**

1. To study the principal of casting process
2. To study the principal of calendaring process
3. To study the application of calendaring process

**6. ROTATIONAL MOULDING:** (06 Periods)

The basic principle of rotational molding process and material used in rotational moulding, Types of rotational molding machines. Application of rotational molding. Faults & Their Remedies in rotational molding process.

**PRACTICALS**

1. To study the operation of rotational moulding
2. To study the materials used for rotational moulding
3. To study the applications of rotational moulding

**7. FOAM MOULDING:** (06 Periods)

The basic principle of foam molding process. Application of foaming process. Faults and their remedies in foaming process, Blowing agents used in foam moulding.

**PRACTICALS**

To study the working principal of foam moulding
To study the application of foaming process

**INSTRUCTIONAL STRATEGY**

Students should be trained to operate various concerned machinery regarding different plastic processes. Students should visit a plastic processing workshop for physical observation the processing unit for deep understanding of the machine and process.

**MEANS OF ASSESSMENT**

- Assignments and Quiz/Class Tests
- Mid-term and End-term
- Written Test

**RECOMMENDED BOOKS**


1 Basic Engineering Handbook by Michael L Bernis
2 Process of Plastic by A.S. Athalye
3 Plastic Materials, Plastic Processing, Plastic Mould Design Volume I & II by Dr. S.K Nayak
4 Plastic Engineering Handbook (SPI), by Frados
5 Plastic materials and processes (a concise encyclopedia), by Charles Harper
6 Injection and Compression Moulding Fundamentals, by Isayev.
7 Encyclopedia of Polymer Science and Technology Vol. 1-23, by Mark &Overberger.
8 Practical Thermoforming Principles & Applications, by J. Florian
9 E-books/e-tools/relevant software to be used as recommended by AICTE/ BTE/ NITTTR, Chandigarh.


**SUGGESTED DISTRIBUTION OF MARKS**

| Topic | Time Allotted (Periods) | Marks Allotted (%) |
|---|---|---|
| 1 | 06 | 14 |
| 2 | 06 | 15 |
| 3 | 06 | 14 |
| 4 | 06 | 15 |
| 5 | 06 | 14 |
| 6 | 06 | 15 |
| 7 | 06 | 13 |
| **Total** | **42** | **100** |

| 4.6 | MOULDS & DIES DESIGN LAB | L | T | P | C |
|---|---|---|---|---|---|
| PRACTICAL | | 0 | 0 | 3 | 1 |

**COURSE OBJECTIVES:**

1. To understand the principles and components of different types of moulds.
2. To apply standard practices in designing and detailing moulds for various applications.
3. To develop the ability to produce technical drawings and 3D models of moulds and dies using CAD tools.
4. To prepare students for practical mould design tasks in manufacturing industries.

**COURSE OUTCOMES:**

The students will be able to:

1. Design and draw components of moulds such as core, cavity, runner, gate, and ejector systems.
2. Design and develop a two-plate injection mould including parting line, sprue, runner, and gate system.
3. Design and develop a three-plate injection mould with proper feed system and ejection mechanism.
4. Create design and drawing for split moulds used in complex part geometries.
5. Develop a runner-less (hot runner) mould system and understand its advantages and applications.
6. Design and produce technical drawings for a single impression compression mould.
7. Design and draw a multi-impression compression mould for mass production.
8. Design a transfer mould, integrating pot, plunger, and flow path.
9. Create design and drawings for a blow mould, used in hollow plastic products.
10. Design and draw a die for pipe extrusion, understanding die land and flow balancing.

**LIST OF PRACTICALS**

1. To design and draw various mould parts
2. To design and draw a two-plate injection mould
3. To design and draw a three-plate injection mould
4. To design and draw a split mould

5. To design and draw a runner less mould
6. To design and draw a single impression compression mould
7. Design and drawing of a multi-impression compression mould
8. Design and drawing of a transfer mould
9. Design and drawing of blow mould
10. Design and drawing of a die for pipe.

**Note: Minimum 4 to 5 sheets will be prepared by the students**

**INSTRUCTIONAL STRATEGY**

Introduce key concepts such as types of moulds (injection, compression, blow) and extrusion dies (pipe, film, profile). Use board diagrams and charts to explain components like core, cavity, runner, gate, die lips, mandrels, etc.Encourage Q&A sessions to reinforce learning

**MEANS OF ASSESSMENT**

- Assignments and Quiz/Class Tests
- Mid-term and End-term
- Written Tests

**RECOMMENDED BOOKS:**


1. Handbook of Mould, tool & Die repairing, S. Thompson
2. SP. S Handbook of plastics by J. Frados
3. Mould Making Hand Book, Stoeckert.
4. Plastics Moulds and Dies, Sors.
5. Injection Moulds, V.D.L.
6. Injection Mould Design-PyeR.G.W.
7. Production Technology – Er.R.K.Jain
8. Production Technology P.C. Sharma Pub: S. Chand and Co.


**WEBSITE REFERENCES**

- Website: https://www.ptonline.com
- https://www.injectionmouldingonline.com
- https://extrusion.world
- https://www.toolingu.com

| 4.7.1 | OPEN ELECTIVE-II/ ADVANCED SKILL CERTIFICATION-II | L | T | P | C |
|---|---|---|---|---|---|
| OPEN ELECTIVE-II | INDUSTRIAL ROBOTICS & AUTOMATION | 2 | 0 | - | 2 |

**RATIONALE**

Industrial Robotics & Automation is essential for mechanical engineering diploma students as it prepares them for the automation-driven industries of today. It equips them with practical skills to operate and maintain robotic systems, improving their employability in sectors like manufacturing and automotive. By understanding automation, students can contribute to optimizing production processes, enhancing efficiency and precision. Additionally, the subject provides a foundation for future studies in advanced fields like robotics and mechatronics, ensuring they stay competitive in a rapidly evolving technological landscape.

**LEARNING OUTCOMES:**

- Explain the robot anatomy, classification, characteristics of robot, advantages and disadvantages.
- Explain the various robotic actuators on hydraulic, pneumatic and electrical drives.
- Explain about various types of sensors and concepts on robot vision system.
- Explain the concepts of robot programming languages and various methods of robot programming.
- Explain the various applications of robots.

**DETAILED CONTENT**

**UNIT-I: Fundamentals of Robotics:** Introduction; Definition; Robot anatomy (parts) and its working; Robot Components: Manipulator, End effectors; Construction of links, Types of joints; Classification of robots; Cartesian, Cylindrical, Spherical, Scara, Vertical articulated; Structural Characteristics of robots; Mechanical rigidity; Effects of structure on control work envelope and work Volume; Robot work Volumes, comparison; Advantages and disadvantages of robots.

**Unit-II: Robotic Drive System and Controller:** Actuators; Hydraulic, Pneumatic and Electrical drives; Linear actuator; Rotary drives; AC servo motor; DC servo motors and Stepper motors; Conversion between linear and rotary motion; Feedback devices; Potentiometers; Optical encoders; DC tachometers; Robot controller; Level of

Controller; Open loop and Closed loop controller; Robot path control: Point to point, Continuous path control and Sensor based path control;

**Unit-III: Sensors:** Requirements of a sensor; Principles and Applications of the following types of sensors: Position sensors (Encoders, Resolvers, Piezo Electric); Range sensors (Triangulation Principle, Structured lighting approach); Proximity sensing; Force and torque sensing. Introduction to Machine Vision: Robot vision system (scanning and digitizing image data); Image processing and analysis; Cameras (Acquisition of images); Vidicon camera (Working principle & construction); Applications of Robot vision system: Inspection, Identification, Navigation & serving.

**Unit-IV: Robot kinematics and Robot Programming:** Forward Kinematics; Inverse Kinematics and Differences; Forward Kinematics and Reverse Kinematics of Manipulators with Two Degrees of Freedom (In 2 Dimensional); Robot programming Languages; VAL Programming; Motion Commands; Sensor Commands; End effector commands; and Simple programs

**Unit-V: Automation:** Basic elements of automated system, advanced automation functions, levels of automation. Industrial Applications: Application of robots in machining; welding; assembly and material handling.

**INSTRUCTIONAL STRATEGY**

To effectively teach Industrial Robotics & Automation, start with lectures that cover key concepts, using visual aids like diagrams and videos. Incorporate hands-on virtual lab sessions where students can program robots and operate various actuators and sensors. Use problem-based learning (PBL) to present real-world scenarios, encouraging collaborative projects to design automation systems.

**MEANS OF ASSEESSMENT**

- Assignments and quiz/class tests
- Sessional test
- Small projects
- Viva-voce

**REFERENCE BOOKS/ ONLINE RESOURCES**

1. Introduction to Robotics: Analysis, Systems, Applications – Saeed B. Niku, Pearson Education Inc. New Delhi 2006.

2. Industrial Robotics: Technology, Programming and Applications – M.P. Groover, Tata McGraw Hill Co, 2001.

3. Robotics Control, Sensing, Vision and Intelligence – Fu.K.S. Gonzalz.R.C and Lee C.S.G, McGraw Hill Book Co, 1987.

4. Robotics for Engineers – Yoram Koren, McGraw Hill Book Co, 1992.

5. A Text book on Industrial Robotics – Ganesh S. Hedge, Laxmi Publications Pvt. Ltd., New Delhi, 2008.

6. Robotics Technology and Flexible Automation – S.R. Deb & Sankha Deb, Tata McGraw-Hill, 2010.

7. Elements of Robotics Process Automation, Mukherjee, Khanna Publishing House, Delhi, 2018

| 4.7.2 | INTERNET OF THINGS | L | T | P | C |
|---|---|---|---|---|---|
| OPEN ELECTIVE-II | | 2 | 0 | 0 | 2 |

**Course Content:**

**Unit I- Introduction to Internet of Things**

• Define the term "Internet of Things"

• State the technological trends which have led to IoT.

• Describe the impact of IoT on society.

**Unit II- Design consideration of IoT**

• Enumerate and describe the components of an embedded system.

• Describe the interactions of embedded systems with the physical world.

• Name the core hardware components most commonly used in IoT devices.

**Unit III- Interfacing by IoT devices**

• Describe the interaction between software and hardware in an IoT device.

• Explain the use of networking and basic networking hardware.

• Describe the structure of the Internet.

**SUGGESTED LEARNING RESOURCES:**

1 Internet of Things Raj Kamal McGraw Hill Education; First edition (10 March 2017) ISBN 978-9352605224

2. Internet of Things: A Hands-On Approach Arsheep Bahge and Vijay Madisetti Orient Blackswan Private Limited - New Delhi; First edition (2015) ISBN : 978-8173719547

**SUGGESTED SOFTWARE/LEARNING WEBSITES:**

1. https://www.raspberrypi.org/blog/getting-started-with-iot/
2. https://www.arduino.cc/en/IoT/HomePage
3. https://www.microchip.com/design-centers/internet-of-things
4. https://learn.adafruit.com/category/internet-of-things-iot
5. http://esp32.net/

## ADVANCED SKILL CERTIFICATION-II

To fulfill the requirements for Advanced Skill Development, a minimum of 20 hours of skill certification is necessary. This certification must be obtained from a recognized national or international agency or institute. The assessment and certification process will be conducted by the respective agency or institute. Students must present their certificate to earn 02 credits for this subject.

| 4.8 | ESSENCE OF INDIAN KNOWLEDGE AND TRADITION | L | T | P | C |
|---|---|---|---|---|---|
| AUDIT COURSE | | 4 | 0 | 0 | 0 |

**COURSE OBJECTIVE:**

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

**COURSE OUTCOMES:**

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

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

**COURSE CONTENTS**

**Unit 1: Introduction to Indian Knowledge System** (16 Periods)

Overview of Indian Knowledge System

Importance and relevance

- Introduction to the Vedas
- Upavedas
- Vedangas
- Upangas

**Unit 2: Modern Science and Indian Knowledge System** (06 Periods)

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

**Unit 3: Yoga and Holistic Healthcare** (04 Periods)

- Basic principles of Yoga
- Benefits of holistic healthcare practices
- Integration with modern healthcare

**Unit 4: Case Studies / Assignment** (02 Periods)

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

**Assessment**

Viva -Voce Exam

| | Summer Internship-II | L | T | P | C |
|---|---|---|---|---|---|
| | (4-6 weeks) after IVth Semester | 0 | 0 | 0 | 2 |

**RATIONALE**

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

**DETAILED CONTENT**

This document includes guided and supervised industrial/summer training of 4-6 weeks duration to be organised during the semester break starting after first 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 a training schedule may be drawn for each student before starting of the training in consultation with the training providers. Students should also be briefed in advance about the organizational setup, product range, manufacturing process, important machines and materials used in the training organization.

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

An Internal & External assessment of 60 & 40 marks has been provided in the study and evaluation scheme of 5th Semester. Evaluation of summer training report through viva-voce/presentation aims at assessing students understanding of materials, industrial process, practices in industry/field organization and their ability to engage in activities related to problem solving in industrial setup as well as understanding of application of knowledge and skills learnt in real life situations.

Teachers and students are requested to see the footnote below the study and evaluation scheme of 2nd 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% |

## RESOURCE REQUIREMENT

### PHYSICAL RESOURCES

### (A) Space requirement

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

### (B) Equipment requirement:

Following Laboratories are required for Diploma Programme in Plastic Mould Technology

**EQUIPMENT REQUIREMENT FOR PLASTIC MOULD TECHNOLOGY**

| Sr. No. | Description | Qty | Total Price (Rs) |
|---|---|---|---|
| **COMMUNICATION LABORATORY/Language Lab ( As per the DTE Specification)** | | | |
| 1. | Computer Server | 01 | 1,28,000 |
| 2. | Headphone With Mic | 01 | |
| 3. | Webcam: HD | 01 | |
| 4. | Server OS; Windows/Linux | 01 | |
| 5. | Monitor | 01 | |
| 6. | Desktop Computer | 30 | 13,20,000 |
| 7. | UPS 5KVA Online (At Least 30 Min. backup) | 01 | 1,25,000 |
| 8. | Computer Chair and Table | 30 | 2,40,000 |
| 9. | AC | 02 | 80,000 |
| 10 | Laser Printer | 01 | 10,000 |
| 11 | LAN Setup | - | 20,000 |
| 12 | Language lab Software License/ Open Source | 01 | 1,00,000 |
| 13 | Misc. Items | - | 10,000 |
| APPLIED PHYSICS LABORATORY | | | |
| 1. | Vernier calipers<br>Working length 160 mm, Internal and external dia with locking arrangement | 12 | 2,000 |
| 2. | Screw Gauges<br>Working length 15 mm, pitch 0.5 mm, least count .005 mm | 12 | 2,000 |
| 3. | Spherometers<br>Distance between legs 2.5 mm, pitch 0.5 mm, least count .005 mm. | 12 | 2,000 |

| | | | |
|---|---|---|---|
| 4. | Mirrors (convex, concave) | 5 Each | 1,500 |
| 5. | Pendulum Setup | 02 | 4,000 |
| 6. | Gravesand's Apparatus | 02 | 3,000 |
| 7. | Inclined Plane Setup | 02 | 2,000 |
| 8. | Flywheel Setup | 02 | 4,000 |
| 9. | Prism | 05 | 1,500 |
| 10. | Spectrometer | 02 | 25,000 |
| 11. | DC Ammeters<br>Moving coil weston-type ammeter with ebonite stand | 10 | 3,500 |
| 12. | DC Miliammeters | 2 | 1,000 |
| 13. | DC Microammeters | 2 | 700 |
| 14. | DC voltmeters | 10 | 700 |
| 15. | DC Millivoltmeters | 10 | 2,000 |
| 16. | Sensitivity Galvanometer | 2 | 800 |
| 17 | Student Galvanometers | 10 | 4,000 |
| 18. | Demonstration type DC Ammeters<br>Range; 0 to 1 Amp. | 2 | 1,000 |
| 19. | D type DC Voltmeter<br>Range : 0 to 1 Volt | 2 | 1,000 |
| 20. | D type Galvanometers<br>Sensitivity : 20 microamperes per scale division, | 8 | 8,000 |
| 21. | Resistance boxes (dial type) assorted | 8 | 8,000 |
| 22. | Rheostats | 10 | 4.000 |
| 23. | Miscellaneous items (Spring, Pan, Glycerine, Optic fibre, Ferromagnetic material) | LS | 2,000 |
| 24. | Fortin's Barometer (Wall type) | 2 | 20,000 |
| 25. | Stoke's Apparatus | 2 | 10,000 |
| 26. | Gumther's Apparatus | 2 | 16,000 |
| 27. | Resonance Tube Apparatus with accessories and Tuning fork set | 2 | 14,000 |
| 28. | Sodium Lamp setup with Biprism | 2 | 10,000 |
| 29. | Ohmic resistance coil | 10 | 5,00 |
| 30. | Slide wire bridge | 2 | 8,000 |
| 31. | PN Junction diode Apparatus | 2 | 10,000 |
| 32. | Laser (as per requirement) | 1 | 1,00,000 |

| | | | |
|---|---|---|---|
| 33. | Numerical aperture setup | 1 | 25,000 |
| 34. | Miscellaneous | LS | 3,000 |
| **APPLIED CHEMISTRY LABORATORY** | | | |
| 9. | Digital Balance | 1 | 80,000 |
| 10 | Burette 50ml | 30 | 3,000 |
| 11 | Pipette 25ml | 60 | 4,000 |
| 12 | Beakers 100ml | 60 | 4,000 |
| 13 | Burette stand | 30 | 30,000 |
| 14 | Glazed tile | 30 | 1,000 |
| 15 | Conical flask 50ml (Titration flask) | 60 | 4,000 |
| 16 | Standard (Measuring) flask (to prepare standard solution) 250ml/100ml | 30 | 6,000 |
| 17 | Able's Flash Point apparatus | 2 | 10,000 |
| 18 | (1/10)°C thermometer | 06 | 6,000 |
| 19 | Candles | 20 | 100 |
| 20 | Crucible with lid | 06 | 2,000 |
| 21 | Muffle furnace | 1 | 18,000 |
| 22 | Decicators | 06 | 8,000 |
| 23 | Pair of tongue (small and big) | 24 (small) 2 (big) | 2,000 |
| 24 | Chemicals<br>• EDTA-1 kg<br>• Eriochrome Black-T(solochrome black T)-200g<br>• Buffer solution ($NH_3$ - 2.5 ltr, $NH_4Cl$ – 1 kg)<br>• Zinc sulphate- 500g<br>• $H_2SO_4$- 2.5 ltr<br>• Phenolphthalein indicator (as per requirement)<br>• Methyl orange indicator (as per requirement)<br>• Charcoal (as per requirement)<br>• Kerosene- 1 ltr | LS | 20,000 |
| 25 | Miscellaneous | LS | 2,000 |

| | | | |
|---|---|---|---|
| **ENGINEERING DRAWING** | | | |
| 1. | Drawing Boards (700 x 500mm) | 60 | 25,000 |
| 2. | Draughtsman Tables | 60 | 1,80,000 |
| 3. | Draughtsman Stools | 60 | 40,000 |
| 4. | Computer Aided Drawing (CAD) Software | 30 User | 5,00,000 |
| 5. | Model of different wooder joints | 1 | 1,000 |
| 6. | Model of different screw threads | 1 | 1,000 |
| 7. | Model of various locking devices | 1 | 1,000 |
| 8. | Model of various joints | 1 | 1,000 |
| 9. | Cut section Model of various couplings | 1 | 3,000 |
| 10. | Miscellaneous | LS | 5,000 |
| **APPLIED MECHANICS LABORATORY** | | | |
| 1. | Polygon law of forces apparatus | 1 | 2,000 |
| 2. | Jib crane | 1 | 4,000 |
| 3. | Apparatus for reaction at supports | 1 | 5,000 |
| 4. | Inclined plane and friction apparatus | 1 | 2,500 |
| 5. | Screw jack | 1 | 1,000 |
| 6. | Worm and worm wheel | 1 | 3,500 |
| 7. | Single Purchase Winch Crab | 1 | 4,000 |
| 8. | Miscellaneous | LS | 1,000 |
| **BASICS OF IT LABORATORY/COMPUTER LABORATORY** | | | |
| 1. | Computer System with latest configuration | 30 | 8,00,000 |
| 2 | Printer (MFP) | 1 | 25,000 |
| 3 | Printer (Laser) | 1 | 35,000 |

| | | | |
|---|---|---|---|
| 4. | Plotter | 1 | 75,000 |
| 5. | Digitiser | 1 | 50,000 |
| 6. | Antivirus Software | LS | 10,000 |
| 7. | Internet Facility on Computers | LS | 2,00,000 |
| 8. | AutoCAD/Solid Works/Unigraphics/Pro-C (any one software) | 30 user | 5,00, 000 |
| 9. | LCD Projector | 1 | 35,000 |
| 10. | UPS | 60 | 1,20,000 |
| 11. | Software (latest windows, latest MS Office) | 1 | 1,00,000 |
| 12. | Scanner | 1 | 10,000 |
| 13. | Miscellaneous | LS | 5,000 |
| **CARPENTRY SHOP** | | | |
| 1 | Work benches fitted with carpenter vices | 5 | 20,000 |
| 2. | Circular saw grinder | 1 | 6,000 |
| 3. | Wood cutting band saw-vertical | 1 | 10,000 |
| 4. | Bench grinder | 1 | 5,000 |
| 5. | Drilling machine | 1 | 8,000 |
| 6. | Wood turning lathe | 1 | 40,000 |
| 7. | Wood Planner | 1 | 20,000 |
| 8. | Tool accessories measuring and marking Instruments | 25 | 25,000 |
| 9. | Band saw blade brazing unit | 1 | 10,000 |
| 10. | Miscellaneous | LS | 1,500 |

| | | | |
|---|---|---|---|
| **PAINTING AND POLISHING SHOP** | | | |
| 1. | Spray gun with hose pipe | 1 | 1,000 |
| 2. | Paint brushes | 20 | 2,000 |
| 3. | Paint/Varnish | LS | 2,000 |
| 4. | Air Compressor with 2 hp motor | 1 set | 10,000 |
| 5. | Miscellaneous | LS | 2,000 |
| **ELECTRICAL SHOP** | | | |
| 1. | Tool kit (Plier, Srew driver, Knife, Steel rule, hammer, sciber, pincer steel tape etc.) | 20 | 20,000 |
| 2. | Fuses, Switches, Plugs, Sockets, Ceiling rose, Wires, cleats, Clamps, Test lamp, Tester.( as per requirement) | | 8,000 |
| 3. | Electric Iron | 1 | 1,500 |
| 4. | Electric kettle | 1 | 1,500 |
| 5. | Ceiling fan/table fan | 1 | 2,500 |
| 6. | Desert cooler | 1 | 5,000 |
| 7. | Lead acid battery | 2 | 8,000 |
| 8. | Battery Charger | 1 | 6,000 |
| 9. | Miscellaneous | | 3,000 |

| **Sr. No.** | Description | **Qty** | **Total Price (Rs)** |
|---|---|---|---|
| **SMITHY SHOP** | | | |
| 1. | Black smithy forge (with open hearths, accessories to match the forge) | 20 | 40,000 |
| 2. | Wrought iron anvils | 20 | 20,000 |
| 3. | Swage blocks | 4 | 8,000 |
| 4. | Blower with accessories, motor switch etc | 1 | 6,000 |
| 5. | Work benches with vices | 2 | 6,000 |
| 6. | Power hammer | 1 | 20,000 |

| | | | |
|---|---|---|---|
| 7. | Tools and accessories – hammers, swages, tongs, pokers, pullers etc | 20 | 10,000 |
| 8. | Miscellaneous | LS | 1,500 |
| **FITTING AND PLUMBING SHOP** | | | |
| 1. | Work benches with vices (4 vices on each bench) | 5 | 30,000 |
| 2. | Marking tables with scribers | 4 | 24,000 |
| 3. | Surface plates | 5 | 20,000 |
| 4. | Accessories like calipers, V blocks, height, gauges steel rules and scribers | 25 | 50,000 |
| 5. | Tool kits – taps, dies, drills | 25 | 40,000 |
| 6. | Tool kits – chiesels, hammers, files, hacksaw | 25 | 25,000 |
| 7. | Drilling machine | 2 | 12,000 |
| 8. | Pipe vice | 4 | 1,000 |
| 9. | Chain wrenches | 5 | 1,250 |
| 10. | Ring spanner set | 5 | 600 |
| 11. | Pipe die set 2” | 2 set | 1,000 |
| 12. | Pipe bending device | 1 | 5,000 |
| 13. | Various plumbing fittings | LS | 2,000 |
| 14. | Miscellaneous | LS | 1,500 |
| **SHEET METAL** | | | |
| 1. | Hammers | 8 | 3,000 |
| 2. | Mallets (Hard & Soft) | 5 | 2,000 |
| 3. | Sheet and wire Ganges | LS | 8,00 |
| 4. | Shearing Machine | 1 | 20,000 |
| 5. | Bar folding Machine | 1 | 20,000 |
| 6. | Burring machine | 1 | 10,000 |
| 7. | Various sheet (black plain, galvanized iron, corrugated, Aluminium) | 1 Each | 1,000 |
| 8. | Hand Shears/Snippers | 4 | 2,000 |
| 9. | Nuts, Bolts, Rivets, Screw | LS | 5,00 |
| 10. | Miscellaneous | LS | 1,000 |

| | | | |
|---|---|---|---|
| **WELDING SHOP** | | | |
| 1. | Electrical welding transformer set with accessories | 3 | 30,000 |
| 2. | Gas Cutting Unit | 1 | 3,000 |
| 3. | Work benches with vices | 3 | 5,000 |
| 4. | Welding generator set | 1 | 10,000 |
| 5. | Oxy acetylene welding set with accessories | 1 | 7,000 |
| 6. | Acetylene generating set | 1 | 6,000 |
| 7. | Electric welder tool kit | 10 | 10,000 |
| 8. | Projection welding machine | 1 | 15,000 |
| 9. | Brazing equipment with accessories | 1 | 10,000 |
| 10. | Soldering irons | 3 | 1,000 |
| 11. | Pedestal grinder | 1 | 10,000 |
| 12. | Metal spraying gun | 1 | 10,000 |
| 13. | Spot welder | 1 | 25,000 |
| 14. | TIG welding set | 1 | 1,00,000 |
| 15. | MIG welding set | 1 | 1,00,000 |
| 16. | Welding Partition Screen | 5 | 2,500 |
| 17. | Miscellaneous | LS | 3,000 |

| | | | |
|---|---|---|---|
| **FOUNDRY SHOP** | | | |
| 1. | Moulding boxes | 40 | 8,000 |
| 2. | Ladles | 5 | 2,000 |
| 3. | Tool Kits | 10 set | 5,000 |
| 4. | Quenching tanks | 2 | 5,000 |
| 5. | Portable grinder | 1 | 3,000 |
| 6. | Pit furnace with blower | 1 | 10,000 |
| 7. | Miscellaneous | LS | 1,000 |
| **MACHINE SHOP** | | | |
| 1. | Centre lathes | 10 | 6,00,000 |
| 2. | Grinder | 1 | 10,000 |

| | | | |
|---|---|---|---|
| 3. | Universal milling machine | 1 | 1,25,000 |
| 4. | Shaper | 2 | 1,20,000 |
| 5. | Plainer | 2 | 1,20,000 |
| 6. | Work bench | 3 | 10,000 |
| 7. | Precision instruments | 1 | 10,000 |
| 8. | Hand tools and accessories | 2 | 8,000 |
| 9. | CNC trainer lathe | 1 | 4,00,000 |
| 10. | Miscellaneous | LS | 5,000 |

| | | | |
|---|---|---|---|
| **HYDRAULIC & PNEUMATIC LABORATORY** | | | |
| 1. | Piezometer tube | 2 | 100 |
| 2. | U tube differential manometer | 2 | 2,000 |
| 3. | Bourdon's Tube pressure gauge | 1 | 1,000 |
| 5. | Hydraulic jack | 1 | 4,000 |
| 6. | Hydraulic press Working Model | 1 | 5,000 |
| 7. | Bernoulli's apparatus | 1 | 15,000 |
| 8. | Venturimeter apparatus with differential manometer | 1 | 10,000 |
| 9. | Pipe friction apparatus | 1 | 15,000 |
| 10. | Reciprocating pump- Cut Section Model | 1 | 20,000 |
| 11. | Centrifugal pump | 1 | 25,000 |
| 12 | Working Model of Pelton Wheel Turbine | 1 | 20,000 |
| 13 | Working Model of Francis Turbine | 1 | 20,000 |
| 14 | Working Model of Kaplan Turbine | 1 | 20,000 |
| 15 | Hydraulic Circuit Trainer Kit | 1 | 50,000 |
| 16 | Pneumatic Circuit Trainer Kit | 1 | 50,000 |
| 17 | Working Model of Hydraulic Brake system | 1 | 50,000 |
| 18 | Working Model of Hydraulic Ram | 1 | 5,000 |
| **METROLOGY & MEASURING INSTRUMENTS LABORATORY** | | | |
| 1. | Digital vernier calliper | 3 | 5,000 |
| 2. | Digital micrometer | 3 | 5,000 |
| 3. | Height gauge | 2 | 1,500 |

| | | | |
|---|---|---|---|
| 4. | Depth gauge | 2 | 1,000 |
| 5. | Combination set | 1 | 1,000 |
| 6. | Bevel protractor | 1 | 1,000 |
| 7. | Sine bar | 1 | 1,000 |
| 8. | Precision balls and rollers | 1 | 500 |
| 9. | Surface plate | 2 | 15,000 |
| 10. | Slip gauges set | 1 | 10,000 |
| 11. | Comparator – Mechanical , Pneumatic | 2 | 40,000 |
| 12. | Gear tooth vernier | 1 | 2,000 |
| 13. | Snap and ring gauges | 1 | 1,500 |
| 14. | Feeler gauge, radius gauge | 1 | 1,000 |
| 15. | Angle plate | 1 | 1,000 |
| 16. | Tool makers microscope | 1 | 40,000 |
| 17. | Profile projector | 1 | 75,000 |
| 18. | Surface roughness tester | 1 | 60,000 |

**PLASTIC PROCESSING LAB-I & II**

| **Sr. No.** | **Description** | **Qty** | **Total Price (Rs)** |
|---|---|---|---|
| | Hand injection moulding Machine With heaters and(15gm/20gm./25gm.) Temp. controllers. | 3 | 105000 |
| | Hand blow moulding machine (15gm./30gm.) | 2 | 100000 |
| | Semi-automatic moulding Blow moulding machine(15gm.) | 1 | 500000 |
| | Hand compression moulding | 1 | 60000 |
| | Automatic compression Moulding machine-(30ton) | 1 | 500000 |
| | Vacuum forming m/c (smallest size)single chamber | 1 | 200000 |

| | | | |
|---|---|---|---|
| | Scrap grinding m/c(small) | 1 | 100000 |
| | PVC Welding m/c/hot welding Machine | 1 | 80000 |
| | Different moulds for all Machines. | 1/Each | 30000/moulds. |
| | Extruder machine(one inch) | 1 | 1500000 |
| | Gravure printing m/c | 1 | 3000000 |
| | Pad printing m/c | 1 | 150000 |

**PLASTIC TESTING LAB**

| Sr. No. | Description | Qty | Total Price (Rs) |
|---|---|---|---|
| | Restivity test equipment | 1 | 300000 |
| | U.T.M m/c(2ton) | 1 | 600000 |
| | Impact testing machine | 1 | 100000 |
| | Hardness testing machine ( Shore A & Shore D) | 2 | 60000 |
| | Film dart Impact testing machine | 1 | 100000 |
| | Melt flow machine | 1 | 80000 |
| | HDT machine | 1 | 80000 |
| | Software's as per requirements | one | 500000 |

**Computer Aided Mould Design Lab Equipment**

| **Sr. No.** | **Description** | **Qty** | **Total Price (Rs)** |
|---|---|---|---|
| **5** | Open Source/Freeware Software for Mould Design | - | - |
| **6** | Computer System (Intel i5/AMD Ryzen 5 latest generation or higher, 8GB RAM, 1TB HDD or 512 SSD, 19.5 Inch Monitor, Window 10 pro or latest) | 35 | 35,00,000/- |
| **7** | Printer (All in one Ink Tank Printer -01 No., All in One laser Printer-01 No.) | 02 | 70,000/- |
| **8** | Anti Virus (3 Years License) | 10 | 25,000/- |

| | | | |
|---|---|---|---|
| **9** | Online UPS(5KVA) with Battery and stand<br><br>Warranty on UPS: 03 Years, Warranty on Batteries: 02 Years) | 01 | 1,25,000/- |

**Note:**

1. The specifications and price of equipment mentioned above used as broad guidelines for purchase of equipment.
2. Any other items not mentioned in the lit of equipment can be purchased as provision has been made for purchase under the item miscellaneous for each lab/shop.
3. Any additional equipment, already available in the institute, may be used for demonstration to the students.

**NOTE:**

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

### (C) Furniture Requirement

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

### 10.2 Human Resources Development:

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

## 11. EVALUATION STRATEGY

### 11.1 INTRODUCTION

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

The purpose of student evaluation is to determine the extent to which the general and the specific objectives of curriculum have been achieved. Student evaluation is also important from the point of view of ascertaining the quality of

instructional processes and to get feedback for curriculum improvement. It helps the teachers in determining the level of appropriateness of teaching experiences provided to learners to meet their individual and professional needs. Evaluation also helps in diagnosing learning difficulties of the students. Evaluation is of two types: Formative and Summative (Internal and External Evaluation)

**Formative Evaluation**

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

**Summative Evaluation**

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

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

## 11.2 STUDENTS' EVALUATION AREAS

The student evaluation is carried out for the following areas:

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

### A. Theory

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

**Section-I**

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

**Section-II**

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

**Section-III**

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

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

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

## B. Practical Work

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

## C. Project Work

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

## D. Professional Industrial Training

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

## 12. RECOMMENDATIONS FOR EFFECTIVE CURRICULUM IMPLEMENTATION

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

The document so prepared is now ready for its implementation. It is the faculty of polytechnics who have to play a vital role in planning instructional experiences for the courses in four different environments viz. class-room, laboratory, library and field and execute them in right perspective. It is emphasized that a proper mix of different teaching methods in all these places of instruction only can bring the changes in stipulated students behaviour as in the curriculum document. It is important for the teachers to understand curriculum document holistically and further be aware of intricacies of teaching-learning process (T-L) for achieving curriculum objectives. Given below are certain suggestions which may help the teachers in planning and designing learning experiences effectively. These are indicative in nature and teachers using their creativity can further develop/refine them. The designers of the programme suggest every teacher to read them carefully, comprehend and start using them.

### (A) Broad Suggestions:

1. Curriculum implementation takes place at programme, course and class-room level respectively and synchronization among them is required for its success. The first step towards achieving synchronization is to read curriculum document holistically and understand its COURSE OBJECTIVE :and philosophy.

2. An academic plan needs to be prepared and made available to all polytechnics well in advance. The Principals have a great role to play in its dissemination and, percolation upto grass-root level. Polytechnics, in turn are supposed to prepare institutional academic plan.

3. HOD of every Programme Department along with HODs and incharges of other departments are required to prepare academic plan at department level referring to institutional academic plan.

4. All lecturers/Senior lecturers are required to prepare course level and class level lesson plans referring departmental academic plan.

### (B) Course Level Suggestions

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

Polytechnic teachers are required to plan various instructional experiences viz. theory lecture, expert lectures, lab/workshop practicals, guided library

exercises, field visits, study tours, camps etc. In addition, they have to carry out progressive assessment of theory, assignments, library, practicals and field experiences. Teachers are also required to do all these activities within a stipulated period of time. It is essential for them to use the given time judiciously by planning all above activities properly and ensure execution of the plan effectively.

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

1. Teachers are required to prepare a course plan, taking into account departmental academic plan, number of weeks available and courses to be taught.

2. Teachers are required to prepare lesson plan for every theory class. This plan may comprise of contents to be covered, learning material for execution of a lesson plan. They may follow steps for preparing lesson plan e.g. drawing attention, state instructional objectives, help in recalling pre-requisite knowledge, deliver planned subject content, check desired learning outcomes and reinforce learning etc.

3. Teachers are required to plan for expert lectures from field/industry. Necessary steps are to plan in advance, identify field experts, make correspondence to invite them, take necessary budgetary approval etc.

4. Teachers are required to plan for guided library exercises by identification of course specific experience requirement, setting time, assessment, etc. The assignments and seminars can be thought of as terminal outcome of library experiences.

5. Concept and content based field visits may be planned and executed for such content of course which is abstract in nature and no other requisite resources are readily available in institute to impart them effectively.

6. There is a dire need for planning practical experiences in right perspective. These slots in a course are the avenues to use problem based learning/activity learning/ experiential learning approach effectively. The development of lab instruction sheets for the course is a good beginning to provide lab experiences effectively.

7. Planning of progressive assessment encompasses periodical assessment in a semester, preparation of proper quality question paper, assessment of answer sheets immediately and giving constructive feed back to every student

8. The student centred activities may be used to develop generic skills like task management, problem solving, managing self, collaborating with others etc.

9. Where ever possible, it is essential to use activity based learning rather than relying on delivery based conventional teaching all the time.

10. Teachers may take initiative in establishing liaison with industries and field organizations for imparting field experiences to their students.

11. Students be made aware about issues related to ecology and environment, safety, concern for wastage of energy and other resources etc.

12. Students may be given relevant and well thought out project assignments, which are purposeful and develop practical skills. This will help students in developing creativity and confidence for their gainful employment.

13. A Project bank may be developed by the concerned department of the polytechnics in consultation with related Industry, research institutes and other relevant field organizations in the state.

## List of Participants:

The following experts have participated /contributed in workshop for Developing the Curriculum scheme/competency profile according to AICTE and NEP-2020 of Three Year Diploma Course in Plastic Mould Technology at I.R.D.T., U.P., Kanpur

1. Sanjay Kumar Patel, Lecturer Plastic Mould Technology, Government Polytechnic, Lucknow.
2. Sunil Kumar Patel, Lecturer Plastic Mould Technology, Government Polytechnic, Lucknow.
3. Mausam Kumar, Lecturer Plastic Mould Technology, Government Polytechnic, Kanpur.
4. Ranvir Rawat Lecturer Plastic Mould Technology, Government Polytechnic, Kanpur.
5. Shubham Gupta, Lecturer Plastic Mould Technology, MMIT Auraiya
6. Gaurav Kishor Kanaujiya, Assistant Professor/Course Co-Ordinator, IRDT U.P. Kanpur.

## Annexure: 1

**Proposed Courses by TATA Technology (Advance Skill Certification)**

| S. No. | Course Name |
|---|---|
| 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 |