## 6.1 PLASTICS PROCESSING TECHNIQUES - III

| L | T | P |
|---|---|---|
| 4 | - | 4 |

**RATIONALE**

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.

**DETAILED CONTENTS**

1. Compression Molding (12 hrs)

   General principles and working of compression molding machine. Types of compression molding machine – hand operated, automatic, single and multi daylight machines, bulk factor, preheating of molds, cycle time ,process variables and their control. Effect of process variables on product properties, compression molding of Semiconductor and DMC compound and composites, common faults and their remedies.

2. Transfer Molding (10 hrs)

   Principles of transfer molding. Types of transfer molding machines, molding cycle, theoretical calculation of line pressure, injection ram pressure, clamping pressure, pot capacity, heating requirements, faults: causes and remedies, spray up technique, resin transfer molding, filament winding.

3. Introduction to Pultrusion, hand lay up technique, Importance of Pultrusion (04 hrs)

4. Forming (08 hrs)

   Basic principles, method of forming – straight forming, free forming, plug assist forming, drape forming, matched mold forming, slip forming, snap back forming, reverse draw forming, thermo forming and vacuum forming, limitations and advantages of forming, materials for forming, types of heating systems, faults: causes and their remedies

5. Casting (06 hrs)

   Introduction, casting of PMMA, unsaturated polyesters and phenolic resins, casting of Biopolymers

6. Calendering (06 hrs)

Introduction to calendering, types of calenders, advantages, limitations of calendering over other techniques and major applications of calendaring, coating of calendaring, surface finishing.

7. Rotational Molding of Large Containers (06 hrs)

Basic principle, material selection, types of machine, process variables, charge size, wall thickness control, heating and cooling system, application of rotational moulding, ejection and finishing, fault – causes and remedies

8. Foam Molding (06 hrs)

Definition of molding, processes, blowing agents, applications

9. Finishing of Plastics (06 hrs)

Cutting, turning, drilling, sanding, polishing different types of welding

**LIST OF PRACTICALS**

1. To produce small components on hand operated compression molding machine
2. To produce components on automatic/semi automatic compression molding machine
3. To produce articles on vacuum forming machine
4. To do casting of polyester resin
5. To do casting of PMMA
6. Exercises on high frequency PVC welding machine
7. Preparation of FRP sheet by hand lay up technique
8. To study various parts and operating conditions of transfer moulding machine

**INSTRUCTIONAL STRATEGY**

Industry visits should be organized.

**RECOMMENDED BOOKS**

1. Basic Engineering Handbook by Michael L Berins
2. Plastic Processing Data Handbook by Rosato and Rosato
3. Moulding of Plastics by N M Bekalis

**SUGGESTED DISTRIBUTION OF MARKS**

| Topic No. | Time Allotted (Hrs) | Marks Allotted (%) |
|---|---|---|
| 1 | 12 | 20 |
| 2 | 10 | 15 |
| 3 | 04 | 05 |
| 4 | 08 | 10 |
| 5 | 06 | 10 |
| 6 | 06 | 10 |
| 7 | 06 | 10 |
| 8 | 06 | 10 |
| 9 | 06 | 10 |
| **Total** | **64** | **100** |

## 6.2 DESIGN OF DIES AND MOULDS – II

| L | T | P |
|---|---|---|
| 3 | - | 4 |

**RATIONALE**

A diploma holder is engaged in manufacturing plastic components for which design of moulds and dies is essential. This subject will impart them requisite knowledge and skills in design of moulds and dies.

**DETAILED CONTENTS**

1. Dies (22 hrs)

- General features of extrusion dies
- Die materials
- Design features dies - Polymer melt flow, die geometry, material of construction, ease of maintenance and cleaning. Die land, die swell
- Heating system and temperature control
- Types of dies
- Dies for rod, flexible tube, wire coating

2. Compression Mould and Transfer Moulds (14 hrs)

- Types of compression moulds - positive, semi-positive, flash and landed positive type
- Calculation of clamp pressure, ram pressure, platen size, no. of impressions. Selection of compression moulding machine
- Principles of transfer moulding, pot capacity, design of sprue, runner and gates

3. Blow Moulds (12 hrs)

- Materials for Blow moulds
- Extrusion blow moulds - cavity and pinch off
- Injection blow moulds - neck design, mandrel design, parison thickness control
- Mould cooling

## LIST OF PRACTICALS

1. Design and drawing of a single impression compression mould
2. Design and drawing of a multi-impression compression mould
3. Design and drawing of a transfer mould
4. Design and drawing of a blow mould
5. Design and drawing of a die for pipe/tubing

**Note**: Minimum 10 sheets will be prepared by the students on computer using AutoCAD software or latest design software

## INSTRUCTIONAL STRATEGY

Students should practically make injection moulds for household, medical equipment and auto parts.

## RECOMMENDED BOOKS


1. Injection Mould Design by R.C.W Pye; Longman Scientific and Technical Publication
2. Published by Tata McGraw Hill Co., New Delhi.
3. Plastic Mould Engineering Hand Book by J. Harry Don Bose and Mayne I pribble, Van Nostrand Reinhold Company Publication, Published by Tata McGraw Hill Co., New Delhi.
4. Injection Moulding Handbook by Dominick V Rosato and Donald V Rosato, Published by Tata McGraw Hill Co., New Delhi.
5. Plastic Engineering Handbook by Joel Frados; Van Nostrand Reinhold Company Publication,
6. Published by Tata McGraw Hill Co., New Delhi.
7. Plastic Engineering by RJ Crawford; Maxwell Macmillan International edition Publication,
8. Published by Tata McGraw Hill Co., New Delhi.


## SUGGESTED DISTRIBUTION OF MARKS

| Topic No. | Time Allotted (Hrs) | Marks Allotted (%) |
|---|---|---|
| 1 | 22 | 50 |
| 2 | 14 | 30 |
| 3 | 12 | 20 |
| **Total** | **48** | **100** |

## 6.3 PLASTIC PRODUCT DESIGN

| L | T | P |
|---|---|---|
| 4 | - | - |

**RATIONALE**

Diploma holders in plastic technology are expected to prepare the design of simple plastic products leading to development and its manufacturing. For doing this, they have to decide about material, process, machinery and testing procedures to manufacture quality products. This subject will impart requisite skills for plastic r product design.

**DETAILED CONTENTS**

1. Preliminary design considerations (06 hrs)

   Design steps for plastic product, mechanical requirements.

2. Materials Selection (12 hrs)

   - Various materials and selection of material for particular application. Cost economics
   - Various processing limitations with Plastic product design, effects of environmental exposure

3. Product Design Features (14 hrs)

   - Surface finish
   - Texturing
   - Shape
   - Positioning of holes
   - Ribs
   - Fillets and rounds
   - Wall thickness

4. Design Activities (08 hrs)

   - Stages of product development
   - Feasibility study and product life cycle

5. Method of joining and machining such as welding, riveting, cementing and adhesion, cutting, sampling, drilling (18 hrs)

   - Assembly methods
   - Inside sharp corners
   - Weld lines

- Draft angles
- Gate side and location
- Moulded inserts
- Internal plastics threads
- Undercuts
- Tolerance
- Functional surfaces and Letters and alphabets

6. Case study of statically and dynamically loaded plastic product like Gears, Spring etc. (06 hrs)

**INSTRUCTIONAL STRATEGY**

Diploma students should do practical to design injection moulds types two plate and three plate moulds for automatic and semi-automatic machines**.**

**RECOMMENDED BOOKS**

1. Plastic product Design, Vol. 1 by RD Beck, Van Nostrand Reinhdol Co. Publication
2. Plastic product Design, Vol. 1I by RD Beck, Van Nostrand Reinhdol Co. Publication
3. Plastic Engineering Handhook by Brydson
4. Plastics Engineering Handbook by J. Frados, International Thomas Publishing
5. Plastics : Materials and Processing by A Brent Strong, Prentice Hall of India, New Delhi
6. Plastic Product Design Handbook by Edward Miller, Marcel Dekker Publications
7. Plastics Technology : Theory, Design and Manufacture by William J.Patton

**SUGGESTED DISTRIBUTION OF MARKS**

| Topic No. | Time Allotted (Hrs) | Marks Allotted (%) |
|---|---|---|
| 1 | 6 | 10 |
| 2 | 12 | 18 |
| 3 | 14 | 20 |
| 4 | 8 | 12 |
| 5 | 18 | 30 |
| 6 | 6 | 10 |
| **Total** | **64** | **100** |

## 6.4 POLLUTION CONTROL IN PLASTIC INDUSTRY

| L | T | P |
|---|---|---|
| 3 | - | 2 |

**RATIONALE**

The objective of this subject is to create awareness in the students about the pollution aspects related to the plastic solid waste disposal, air pollution by plastics waste, incineration, reusability and reprocessing of plastics and bio-degradation of plastics.

**DETAILED CONTENTS**

1. Environment (06 hrs)

   Environment and its components; water, soil, air and living things. Ecosystems, ecological balance, interaction of environment with humans. Cause of ecological imbalance

2. Classification of Plastic Materials (08 hrs)

   Natural and synthetic polymer and their compatibility with surroundings (starch and proteins, silicons and other man made fabrics). Life expectancy of different plastics in environment and thermal degradation, biodegradation and photo degradation. Agents for increasing life expectancy of polymers

3. Pollution and Hazards related to Plastics (06 hrs)

   Pollution caused by plastics, loading of toxic chemicals from plastics into soil and water (including additives, flame retardants, chonnated additives etc.)

   ISI Standards regarding limits of these chemicals in effluents

4. Reusability and Reprocessing of Plastics (04 hrs)

   Need and importance of reprocessing, Stages in recycling (primary, secondary and tertiary), Advantages and disadvantages of recycling

5. Plastic Waste Management (03 hrs)

   Public awareness regarding hazards caused by indiscriminate use of plastics, Proper disposal of plastics, Collection of recyclable plastics, Landfill, Incineration of plastics

6. Use of Plastics in Conservation of Natural Resources (06 hrs)

Mulching, waste water recovery by membrane separation, use of plastics in rain water harvesting, plastic pipes for transportation of potable water (as compared to iron pipes) and canal lining.

7. Disaster Management (15 hrs)

Definition of disaster - natural and manmade, type of disaster management, how disaster forms, destructive power, causes and hazards, case study of Tsunami Disaster, National Environment Policy, need for central intervention, State Disaster Authority - duties and powers, case studies of various Disaster in the country, meaning and benefit of vulnerability reduction, factor promoting vulnerability reduction and mitigation, emergency support function plan. main feature and function of National Disaster Management Frame Work, Disaster mitigation and prevention, Legal Policy Frame Work, early warning system, Human Resource Development and Function, Information dissemination and communication

**LIST OF PRACTICALS**

1. To conduct recyclability test
2. Collection of different plastic wastes and their segregation in various groups
3. Conversion of collected samples into plastic granules
4. Property modification of plastic granules by adding natural material like cellulose
5. Determination of BOD and COD of given samples of effluents of plastic industry
6. Mixing of virgin polymers with recycled polymers (both by melt method and solvent method)
7. To carry out plastic waste management of at least one department/section of the polytechnic

**INSTRUCTIONAL STRATEGY**

Visit to various industries/environment awareness camp/talk should be organized by experts.

**RECOMMENDED BOOKS**

1. Natural Resource and Conservation by Oliver's Owen and Chisal
2. Living in the Environment by T.S. Miller
3. Environmental Science by Cumminghan Saigo
4. Ecology of Natural Resource by Ramma Dey
5. Environmental and Plastics by AK Dey; New Age Publication

## SUGGESTED DISTRIBUTION OF MARKS

| Topic No. | Time Allotted (Hrs) | Marks Allotted (%) |
|---|---|---|
| 1 | 6 | 15 |
| 2 | 8 | 15 |
| 3 | 6 | 15 |
| 4 | 4 | 10 |
| 5 | 3 | 05 |
| 6 | 6 | 10 |
| 7 | 15 | 30 |
| **Total** | **48** | **100** |

## 6.5 EMPLOYABILITY SKILLS – II

| L | T | P |
|---|---|---|
| - | - | 2 |

**RATIONALE**

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

**DETAILED CONTENTS**

1. Oral Practice

| | | |
|---|---|---|
| i) | Mock interview | (05 hrs) |
| ii) | Preparing for meeting | (05 hrs) |
| iii) | Group discussion | (05 hrs) |
| iv) | Seminar presentation | (05 hrs) |
| v) | Making a presentation | (12 hrs) |

a) Elements of good presentation
b) Structure and tools of presentation
c) Paper reading
d) Power point presentation

## 6.6 ENTREPRENEURSHIP DEVELOPMENT AND MANAGEMENT

| L | T | P |
|---|---|---|
| 3 | - | - |

**RATIONALE**

In the present day scenario, it has become imperative to impart entrepreneurship and management concepts to students so that a significant percentage of them can be directed towards setting up and managing their own small enterprises. This subject focuses on imparting the necessary competencies and skills of enterprise set up and its management.

**DETAILED CONTENTS**

**SECTION – A ENTREPRENEURSHIP**

1. Introduction (14 hrs)

- Concept /Meaning and its need
- Qualities and functions of entrepreneur and barriers in entrepreneurship
- Sole proprietorship and partnership forms of business organisations
- Schemes of assistance by entrepreneurial support agencies at National, State, District level: NSIC, NRDC, DC:MSME, SIDBI, NABARD, Commercial Banks, SFC's TCO, KVIB, DIC, Technology Business Incubator (TBI) and Science and Technology Entrepreneur Parks (STEP).

2. Market Survey and Opportunity Identification (10 hrs)

- Scanning of business environment
- Salient features of National and State industrial policies and resultant business opportunities
- Types and conduct of market survey
- Assessment of demand and supply in potential areas of growth
- Identifying business opportunity
- Considerations in product selection

3. Project report Preparation (08 hrs)

- Preliminary project report
- Detailed project report including technical, economic and market feasibility
- Common errors in project report preparations
- Exercises on preparation of project report

**SECTION –B MANAGEMENT**

4. Introduction to Management (04 hrs)

- Definitions and importance of management
- Functions of management: Importance and Process of planning, organising, staffing, directing and controlling
- Principles of management (Henri Fayol, F.W. Taylor)
- Concept and structure of an organisation
- Types of industrial organisations

a) Line organisation
b) Line and staff organisation
c) Functional Organisation

5. Leadership and Motivation (03 hrs)

a) Leadership

- Definition and Need
- Qualities and functions of a leader
- Manager Vs leader
- Types of leadership

b) Motivation

- Definitions and characteristics
- Factors affecting motivation
- Theories of motivation (Maslow, Herzberg, McGregor)

6. Management Scope in Different Areas (06 hrs)

a) Human Resource Management

- Introduction and objective
- Introduction to Man power planning, recruitment and selection
- Introduction to performance appraisal methods

b) Material and Store Management

- Introduction functions, and objectives
- ABC Analysis and EOQ

c) Marketing and sales

- Introduction, importance, and its functions
- Physical distribution
- Introduction to promotion mix
- Sales promotion

d) Financial Management

- Introductions, importance and its functions
- Elementary knowledge of income tax, sales tax, excise duty, custom duty and VAT

7. Miscellaneous Topics (03 hrs)

a) Customer Relation Management (CRM)

- Definition and need
- Types of CRM

b) Total Quality Management (TQM)

- Statistical process control
- Total employees Involvement
- Just in time (JIT)

c) Intellectual Property Right (IPR)

- Introductions, definition and its importance
- Infringement related to patents, copy right, trade mark

**Note:** In addition, different activities like conduct of entrepreneurship awareness camp extension lecturers by outside experts, interactions sessions with entrepreneurs and industrial visits may also be organised.

**INSTRUCTIONAL STRATEGY**

Some of the topics may be taught using question/answer, assignment or seminar method. The teacher will discuss stories and case studies with students, which in turn will develop appropriate managerial and entrepreneurial qualities in the students. In addition, expert lecturers may also be arranged from outside experts and students may be taken to nearby industrial organisations on visit. Approach extracted reading and handouts may be provided.

**RECOMMENDED BOOKS**

1. A Handbook of Entrepreneurship, Edited by BS Rathore and Dr JS Saini; Aapga Publications, Panchkula (Haryana)

2. Entrepreneurship Development published by Tata McGraw Hill Publishing Company Ltd., New Delhi

3. Entrepreneurship Development in India by CB Gupta and P Srinivasan; Sultan Chand and Sons, New Delhi

4. Entrepreneurship Development - Small Business Enterprises by Poornima M Charantimath; Pearson Education, New Delhi

5. Entrepreneurship : New Venture Creation by David H Holt; Prentice Hall of India Pvt. Ltd., New Delhi

6. Handbook of Small Scale Industry by PM Bhandari

7. Principles and Practice of Management by L M Prasad; Sultan Chand & Sons, New Delhi

**SUGGESTED DISTRIBUTION OF MARKS**

| Topic No. | Time Allotted (Hrs) | Marks Allotted (%) |
|---|---|---|
| 1 | 14 | 28 |
| 2 | 10 | 20 |
| 3 | 08 | 16 |
| 4 | 04 | 10 |
| 5 | 03 | 06 |
| 6 | 06 | 14 |
| 7 | 03 | 06 |
| **Total** | **48** | **100** |

## 6.6 PROJECT WORK

| L | T | P |
|---|---|---|
| - | - | 5 |

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

Each teacher is expected to guide the project work of 5-6 students.

- Projects related to designing new dies, moulds, jigs and fixtures
- Projects related to increasing productivity
- Projects related to quality assurance
- Projects related to estimation and economics of production
- Projects connected with repair and maintenance of plant and equipment
- Projects related to identification of raw material thereby reducing the wastage
- Projects related to suggesting substitutes of the polymer being used
- Any other related problems of interest of host industry

A suggestive criteria for assessing student performance by the external (personnel from industry) and internal (teacher) examiner is given in table below:

| **Sr. No.** | **Performance criteria** | **Max.** marks** | **Rating Scale** | | | | |
|---|---|---|---|---|---|---|---|
| | | | **Excellent** | **Very good** | **Good** | **Fair** | **Poor** |
| 1. | Selection of project assignment | 10 | 10 | 8 | 6 | 4 | 2 |
| 2. | Planning and execution of considerations | 10 | 10 | 8 | 6 | 4 | 2 |
| 3. | Quality of performance | 20 | 20 | 16 | 12 | 8 | 4 |
| 4. | Providing solution of the problems or production of final product | 20 | 20 | 16 | 12 | 8 | 4 |
| 5. | Sense of responsibility | 10 | 10 | 8 | 6 | 4 | 2 |
| 6. | Self expression/ communication skills | 5 | 5 | 4 | 3 | 2 | 1 |
| 7. | Interpersonal skills/human relations | 5 | 5 | 4 | 3 | 2 | 1 |
| 8. | Report writing skills | 10 | 10 | 8 | 6 | 4 | 2 |
| 9. | Viva voce | 10 | 10 | 8 | 6 | 4 | 2 |
| **Total marks** | | **100** | **100** | **80** | **60** | **40** | **20** |

The overall grading of the practical training shall be made as per following table

| | Range of maximum marks | Overall grade |
|---|---|---|
| i) | More than 80 | Excellent |
| ii) | 79 <> 65 | Very good |
| iii) | 64 <> 50 | Good |
| iv) | 49 <> 40 | Fair |
| v) | Less than 40 | Poor |

In order to qualify for the diploma, students must get "Overall Good grade" failing which the students may be given one more chance of undergoing 8 -10 weeks of project oriented professional training in the same industry and re-evaluated before being disqualified and declared "not eligible to receive diploma ". It is also important to note that the students must get more than six "goods" or above "good" grade in different performance criteria items in order to get "Overall Good" grade.

**Important Notes**

1. **This criteria must be followed by the internal and external examiner and they should see the daily, weekly and monthly reports while awarding marks as per the above criteria.**

2. **The criteria for evaluation of the students have been worked out for 100 maximum marks. The internal and external examiners will evaluate students separately and give marks as per the study and evaluation scheme of examination.**

3. **The external examiner, preferably, a person from industry/organization, who has been associated with the project-oriented professional training of the students, should evaluate the students performance as per the above criteria.**

4. **It is also proposed that two students or two projects which are rated best be given merit certificate at the time of annual day of the institute. It would be better if specific nearby industries are approached for instituting such awards.**

The teachers are free to evolve another criteria of assessment, depending upon the type of project work.

It is proposed that the institute may organize an annual exhibition of the project work done by the students and invite leading Industrial organisations in such an exhibition. It is also proposed that two students or two projects which are rated best be given merit certificate at the time of annual day of the institute. It would be better if specific industries are approached for instituting such awards.