5.1 RUBBER PROCESSING TECHNIQUES – II

L	T	P
4	-	6

RATIONALE

The purpose of this subject is to equip the students with the knowledge of Injection moulding, Compression moulding, Transfer moulding and Blow moulding. This subject develops the competence of the students in practical processing in industry.

DETAILED CONTENTS

1. Injection Moulding (20 hrs)

   Basic principles of operations of injection moulding machinery, types of injection moulding machines, description with detailed construction, parts and functions, general specifications, start up and shut down procedures, moulding variables, press capacity, projected areas, shot weight, optimization of cycles flow. Selection of machine: Hand operated, Semiautomatic and CNC injection moulding machines, defects in injection moulding products, their causes and remedies

2. Compression Moulding (12 hrs)

   General principles and working of compression moulding machine. Types of compression moulding machines - hand operated, automatic, single and multi daylight machines. Bulk factor, preheating of moulds, cycle time, process variables and their control. Effect of process variables on product properties

3. Transfer Moulding (12 hrs)

   Principles of transfer moulding. Types of transfer moulding machines, moulding cycle, theoretical calculation of line pressure, injection ram pressure, clamping pressure, pot capacity, compression of transfer moulding and compression moulding

4. Blow Moulding (20 hrs)

   Basic principles of blow moulding, types of blow moulding- Extrusion blow moulding, blow moulding irregular containers, production of parison by extrusion, Parison wall thickness control, Parison blowing systems, air requirement for blowing, effect of process variables on product design and properties. Parison programming, mould venting, various defects, causes and their remedies in blow moulding process, various trimming and finishing methods

LIST OF PRACTICALS

1. To draw the layout of plastic processing laboratory.
2. To produce small components on hand operated injection moulding machine (atleast 10 components each on 2/3 different moulds).
3. To study the specifications of automatic injection moulding machine.
4. To study the specifications of CNC injection moulding machine.
5. To produce small components on semi-automatic/automatic injection moulding.
6. Machine after setting process variables.
7. To produce small components on vertical hydraulic injection moulding machine.
8. To produce components on CNC injection moulding machine after programming for different components.
9. To produce small components on hand operated compression moulding machine.
10. To produce components on automatic/semi automatic compression moulding machine.
11. Production of component on hand operated blow moulding machine, using at least 3 moulds.
12. Study the specification of automatic Blow Moulding Machine.
13. Production of components on semi automatic blow machine by setting the process parameters.

INSTRUCTIONAL STRATEGY

Industrial visit should be organized.

RECOMMENDED BOOKS

1. Rubber Technology and Manufacturing by C.M. Blow
2. Rubber Technology Handbook by Werner Hoffmann
3. Introduction of Polymer Sc. & Rubber Technology, Vol I, Ed. by Dr. R. Mukhopadhyay
4. Rubber Engineering, Ed by K.S. Logonathan
5. Rubber Technology, Ed. by Maurice Morton
6. Rubber Processing: An Introduction by Peter S. Johnson

SUGGESTED DISTRIBUTION OF MARKS

Topic No.	Time Allotted (Hrs)	Marks Allotted (%)
1	20	35
2	12	20
3	12	15
4	20	30
Total	**64**	**100**

5.2 DESIGN OF RUBBER MOULDS AND DIES – I

L	T	P
4	-	4

RATIONALE

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

DETAILED CONTENTS

1. Mould design - Concept considerations and materials used for dies and moulds and their characteristics (06 hrs)

2. Impressions - 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. Mould clamping - direct, indirect (08 hrs)

3. Parting surface - Types of parting surface, selection of parting surface, Relief of parting surfaces, venting (06 hrs)

4. Feed system (08 hrs)

   - Runners - Sprue, runners and its types, balancing of runners, size of runners
   - Gates - Types of gates, size of gates

5. Ejection system - Ejector grid, ejector plate assembly, ejection techniques, ejection from fixed half, sprue pullers (06 hrs)

6. Cooling system - Cooling integer type mould plates and its types, Cooling insert bolster assembly and its types, Cooling other mold parts, Water connection and its types (06 hrs)

7. Splits - Introduction, sliding splits and types, Angled lift splits and types (05 hrs)

8. Side cores and side Cavities: Introduction, types of side core and side cavities (05 hrs)

9. Molding Internal Undercuts - Introduction, Form pin, Split core, Side core, Stripping internal undercut (06 hrs)

10. Mould for threaded component (08 hrs)

    - Introduction, Moulds for internally threaded components and its types, Moulds for externally threaded components and its types
    - Types of Moulds - Two plate mould, Three plate mould, Hot runner mould for any two rubber product

LIST OF PRACTICALS

1. Procedure for Designing an Injection Mold :- Primary positioning of inserts, the ejector system, the ejector grid, complete the top half of drawing, complete the plan view, complete the cross-section, complete the drawing.
2. To design and draw various mould parts
3. To design and draw a single impression two plate injection mould by taking suitable at least four component.
4. To design and draw a multiple impression two plate injection mould by taking suitable at least two component.
5. To design and draw a multiple impression three plate injection mould by taking suitable at least two component.
6. To design and draw a multiple impression split mould by taking suitable at least two component.
7. To design and draw a multiple impression runnerless mould by taking suitable component.

Note: Maximum 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 Published by Tata McGraw Hill Co., New Delhi.

SUGGESTED DISTRIBUTION OF MARKS

Topic No.	Time Allotted (Hrs)	Marks Allotted (%)
1	6	9
2	8	13
3	6	9
4	8	13
5	6	9
6	6	9
7	5	8
8	5	8
9	6	9
10	8	13
Total	**64**	**100**

5.3 COMPOUNDING AND FORMULATION OF RUBBER

L	T	P
4	-	4

RATIONALE

Properties of all rubbers significantly modified by judicious addition of certain additives and appropriate compounding techniques. This subject aims at giving a detailed exposure on this topic. This subject makes the students capable of preparing and formulating the right materials for processing.

DETAILED CONTENTS

1. Principles of compounding for modifying and enhancing processing and application, properties and service life of polymer (06 hrs)

2. Definition and classification of additives (22 hrs)

   Description of following additives and their functions

   - Property Modifiers - Plasticisers, Fillers, Impact modifiers, extenders
   - Processing aids - Heat stabilizers, Lubricants, solvents and diluents
   - Surface property modifiers -antistatic agents, antislip agent, antiblock/slip additives
   - Colourants: Pigments and dyes
   - Antiageing additives: - antioxidants, anti-ozonants, UV stablisers, fungicides, antitermites, bactericide additives
   - Miscellaneous additives: - blowing agent, flame retardants and mould release agents

3. Compounding equipments - Ribbon blender, High speed mixer, Banbury mixer, Two roll mill, Mixer extruder (construction and working of these equipments) (12 hrs)

4. Mixing of solids and paste (with reference to thermosets' compounding) Mixer Types (Batch mixer, Semi batch with sand mill, High performance mixer for paste, Kneaders, dispersors (construction and working) (12 hrs)

5. Compounding of rubbers tyres, tubes, conveyers belts, hoses, footwear, power transmission belt. (12 hrs)

LIST OF PRACTICALS

Demonstration/operation of the following practicals.

1. Property modification of rubber by adding any two additive.

2. Mixing of virgin rubbers with recycled rubbers.

3. Compounding of tyre, footwear.
4. Compounding of any rubber material with master batches of at least two different colour.
5. Study of Kneader and Mixers.
6. To perform an experiment on two roll mill and mixing extruder.

INSTRUCTIONAL STRATEGY

Compounding and formulation should be shown in rubber industry.

RECOMMENDED BOOKS

1. Modern Plastics Encyclopedia, Vol. 59, No. 10A, McGraw Hill, New York,
2. The Role of Additives in Plastics by L. Mascia, John Viley and Sons, New York
   Anti-Oxidants by RR Paolino, in Modern Plastics Encyclopedia (MPE), 1982

SUGGESTED DISTRIBUTION OF MARKS

Topic No.	Time Allotted (Hrs)	Marks Allotted (%)
1	6	10
2	22	40
3	12	20
4	12	15
5	12	15
Total	**64**	**100**

5. 4 RUBBER PRODUCT DESIGN

L	T	P
4	-	-

RATIONALE

Diploma holders in rubber technology are expected to prepare the design of simple rubber 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 rubber product design.

DETAILED CONTENTS

1. Preliminary Design Considerations (06 hrs)

   Design steps for rubber product, mechanical requirements

2. Materials Selection (10 hrs)

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

3. Rubber Design Features (12 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 Rubber product like belt, hose, footwear, cables, tyre and tube (10 hrs)

INSTRUCTIONAL STRATEGY

The student should have knowledge of material for a particular product.

RECOMMENDED BOOK

1. Engineered Rubber Produts: Introduction to Design, Manufacturer and Testing by John Sommer; Hanser-Gardner Publication.
2. Extrusion Dies for Plastics and Rubber, 3rd edition by Walter Michaeli; Hanser-Gardner Publication.
3. Engineering with Rubber: How to Design Rubber Components by Alan N. Gent; Hanser-Gardner Publication.

SUGGESTED DISTRIBUTION OF MARKS

Topic No.	Time Allotted (Hrs)	Marks Allotted (%)
1	6	8
2	10	15
3	12	25
4	8	12
5	18	25
6	10	15
Total	**64**	**100**

5.5 EMPLOYABILITY SKILLS – I

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 is to prepare students for employability in job market and survive in cut throat competition among professionals.

DETAILED CONTENTS

1. Writing skills (08 hrs)
   - i) Official and business correspondence
   - ii) Job application - covering letter and resume
   - iii) Report writing - key features and kinds

2. Oral Communication Skills (20 hrs)
   - i) Giving advice
   - ii) Making comparisons
   - iii) Agreeing and disagreeing
   - iv) Taking turns in conversation
   - v) Fixing and cancelling appointments

3. Generic Skills (04 hrs)
   - i) Stress management
   - ii) Time management
   - iii) Negotiations and conflict resolution
   - iv) Team work and leadership qualities

5.6 ENVIRONMENTAL EDUCATION

L	T	P
3	-	-

RATIONALE

Education about environment protection is a must for all the citizens. In addition, a diploma holder must have knowledge of different types of pollution caused by industries and construction activities so that he may help in balancing the eco system and controlling pollution by adopting pollution control measures. He should also be aware of environmental laws related to the control of pollution.

DETAILED CONTENTS

1. Definition, Scope and Importance of Environmental Education (02 hrs)

2. Basics of ecology, biodiversity, eco system and sustainable development (03 hrs)

3. Sources of pollution - natural and manmade, causes, effects and control measures of pollution (air, water, noise, soil, radioactive and nuclear) and their units of measurement (12 hrs)

4. Solid waste management – Causes, effects and control measures of urban and industrial waste (06 hrs)

5. Mining and deforestation – Causes, effects and control measures (04 hrs)

6. Environmental Legislation - Water (prevention and control of pollution) Act 1974, Air (Prevention and Control of Pollution) Act 1981 and Environmental Protection Act 1986, Role and Function of State Pollution Control Board, Environmental Impact Assessment (EIA) (10 hrs)

7. Role of Non-conventional Energy Resources (Solar Energy, Wind Energy, Bio Energy, Hydro Energy) (04 hrs)

8. Current Issues in Environmental Pollution – Global Warming, Green House Effect, Depletion of Ozone Layer, Recycling of Material, Environmental Ethics, Rain Water Harvesting, Maintenance of Groundwater, Acid Rain, Carbon Credits (07 hrs)

INSTRUCTIONAL STRATEGY

The contents will be covered through lecture cum discussion sessions. In addition, in order to have more appreciation of need for protection of environment, it is suggested that different activities pertaining to Environmental Education like video films, seminars, environmental awareness camps and expert lectures may also be organized.

RECOMMENDED BOOKS

1. Environmental Engineering and Management by Suresh K Dhameja; SK Kataria and Sons, New Delhi.
2. Environmental Science by Dr. Suresh K Dhameja; SK Kataria and Sons, New Delhi.
3. Environmental and Pollution Awareness by Sharma BR; Satya Prakashan, New Delhi.
4. Environmental Protection Law and Policy in India by Thakur Kailash; Deep and Deep Publications, New Delhi.
5. Environmental Science by Deswal and Deswal; Dhanpat Rai and Co. (P) Ltd. Delhi.
6. Engineering Chemistry by Jain and Jain; Dhanpat Rai and Co. (P) Ltd. Delhi.
7. Environmental Studies by Erach Bharucha; UGC University Press.

SUGGESTED DISTRIBUTION OF MARKS

Topic No.	Time Allotted for Lectures (Periods)	Marks Allotted (%)
1	02	04
2	03	06
3	12	24
4	06	12
5	04	10
6	10	20
7	04	10
8	07	14
Total	**48**	**100**