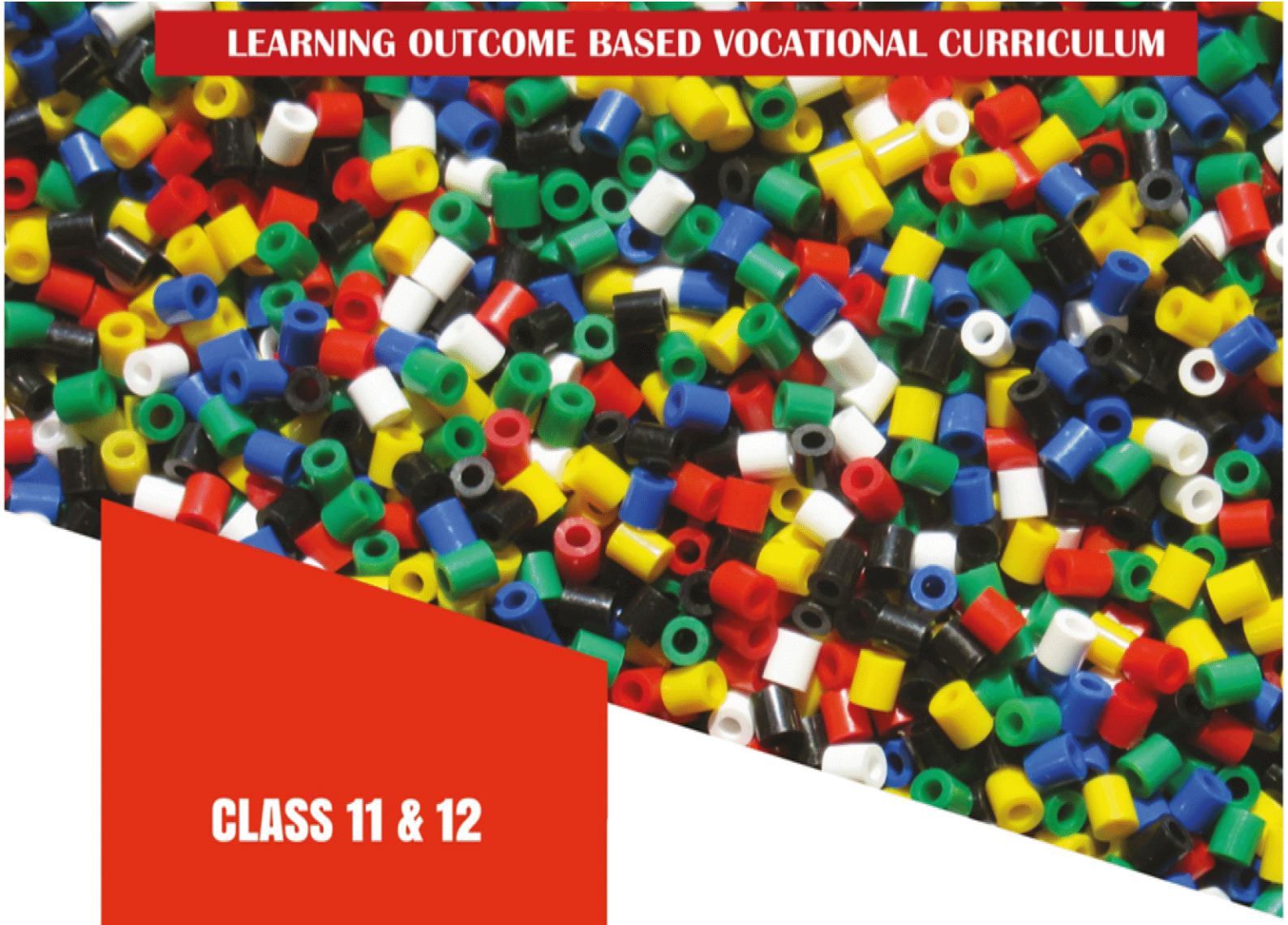
LEARNING OUTCOME BASED VOCATIONAL CURRICULUM



CLASS 11 & 12

SECTOR:
RUBBER

JOB ROLE
MACHINE OPERATOR ASSISTANT - PLASTIC PROCESSING

(QUALIFICATION PACK: REF. ID. RSC/Q4801)

State Council of Educational Research & Training (SCERT) Kerala
(Department of General Education, Government of Kerala)
Vidhya Bhavan, Poojappura, Thiruvananthapuram

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www.scert.kerala.gov.in

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April 2021

http://www.scert.kerala.gov.in

PUBLISHED BY

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FOREWORD

A collaborative initiative for developing learning outcome based vocational curriculum and courseware aimed at integrating both vocational and general qualifications has been implemented by the State Council of Educational Research and Training (SCERT) Kerala and the PSSCIVE Bhopal. This is intended to open up pathways of career progression for students and the SCERT Kerala is developing curricula under the project as an integral part of Vocationalisation of Education under Samagra Shiksha, approved by the Government of Kerala. Decisive improvement in the teaching-learning process and working competencies through learning outcomes that have been judiciously embedded in the vocational subject is expected to be the major impact that will be brought about by the learning outcome based vocational curriculum.

It is a matter of great pleasure to introduce this learning outcome based vocational curriculum as part of the vocational training package for the job role of Machine Operator Assistant – Plastic Processing (RSC/Q4801).The curriculum has been developed for the higher secondary students of vocational education and is aligned to the National Occupation Standards (NOSs) of a job role identified and approved under the National Skill Qualification Framework (NSQF).

The key aim of the curriculum will be to provide children with employability and vocational skills that would in turn aid occupational mobility and lifelong learning. A major transformation in the teaching process is also aimed at, which will be brought about through interactive sessions in classrooms, practical activities in laboratories and workshops, projects, field visits, and professional experiences.

The curriculum has been meticulously developed and judiciously reviewed by a group of experts and their much-valued contributions are immensely acknowledged. The imminent utility of the curriculum will without doubt, be adjudged by the qualitative improvement that it brings about in teaching-learning. The feedback and suggestions on the content by the teachers and other stakeholders will be of immense value to us in bringing about further enhancement and augmentation to this document.

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ACKNOWLEDGEMENTS

We are grateful to the Director, National Council of Educational Research & Training (NCERT) and Prof. Rajesh P Khambayat, Ph.D., Joint Director, PSSCIVE Bhopal for their support and guidance. We also acknowledge the contributions of the officials at the Technical Support Group of Samagra Shiksha, Ministry of Education, National Skill Development Agency (NSDA) and National Skill Development Corporation (NSDC) and Rubber Skill Development Council (RSDC) for their support and cooperation.

We are extremely thankful to Dr. RVG Menon, Chairperson, High Power Committee for the implementation of NSQF in Kerala, Dr. Sukesh Kumar, Former Principal, Government Engineering College Palakkad and Sri. G S Unnikrishnan Nair, Former Director State Agricultural Management and Extension Training Institute (SAMETI), Thiruvananthapuram for their mentorship in the process of developing this document. The contributions made by Dr. Vinay Swarup Mehrotra, Professor and Head, Curriculum Development and Evaluation Centre (CDEC), PSSCIVE Bhopal in development of the curriculum are duly acknowledged.

We are grateful to the experts for their earnest efforts and contributions in the development of this learning outcome based vocational curriculum. Their names are acknowledged in the list of contributors.

We are grateful to the Vocational Higher Secondary wing of the Directorate of General Education (DGE) Kerala for extending the support to develop this curriculum document on time by providing the service of its teaching staff.

CONTENTS

1. COURSE OVERVIEW

COURSE TITLE: MACHINE OPERATOR ASSISTANT – PLASTIC PROCESSING

GENERAL OBJECTIVES

Plastics, due to its versatility have found applications in almost all fields touching human life, namely; automotive, agriculture, construction, electronics, healthcare, textiles, FMCG etc. As India is poised to become the third consumer market in the world, the demand for plastic products is going to grow exponentially. The main objective of the course Machine Operator Assistant – Plastic Processing, is to create skilled labour to carry out injection moulding, blow moulding, extrusion, and other plastic production processes in the growing plastic industry.

On successful completion of this course the learners are expected to develop skills;

- to identify the different types of plastic materials
- to identify the different plastic processing techniques
- to identify the tools and equipment used in plastic processing
- to arrange all materials related to the production of plastic products
- to setup plastic processing machines under supervision
- to operate plastic processing machines like injection moulding machine, blow moulding machine, extrusion moulding machine etc. under supervision
- to perform finishing operations and inspection of plastic products

COURSE OUTCOMES

On completion of the course, students should be able to;

- apply effective oral and written communication skills to interact with people and customers;
- identify the principal components of a computer system;
- demonstrate the basic skills of using computer;
- demonstrate self-management skills;
- demonstrate the ability to provide a self-analysis in context of entrepreneurial skills and abilities;
- demonstrate the knowledge of the importance of green skills in meeting the challenges of sustainable development and environment protection;
- explain the basic concepts of plastics
- identify the different types of plastic materials
- explain the different plastic processing techniques
- identify tools and equipment used in plastic processing.
- demonstrate the use of basic measuring equipment and hand tools.
- arrange all materials/ tools related to plastic processing

- assist operator to set up Injection moulding machine, Blow moulding machine, and extrusion machine
- perform pre moulding operation and operate ancillary equipment.
- demonstrate the injection Moulding operation of plastics
- demonstrate the extrusion operation of plastics
- demonstrate the Blow moulding operation of plastics
- perform finishing operation and inspection of plastic products
- follow basic health and safety practices at work place
- comply with the production process and maintain process related documents

COURSE REQUIREMENTS

The learner should have the basic knowledge of science.

COURSE DURATION: 600 hrs

Class 11 Class 12	300hrs **300hrs**
Total	**600 hrs**

2. SCHEME OF UNITS

The unit-wise distribution of hours and scores for Class 11 is as follows:

CLASS 11			
	Units	**No. of Hours for Theory and Practical = 300**	**Max. scores for Theory and Practical =100**
Part A	**Employability Skills**		
1.	Communication Skills – III	25	**10**
2.	Self-management Skills – III	25	
3.	Information and Communication Technology Skills – III	20	
4.	Entrepreneurial Skills – III	25	
5.	Green Skills – III	15	
	Total	**110**	**10**
Part B	**Vocational Skills**		
6.	Introduction to plastic processing	20	40
7.	Basic fittings and measurements	40	
8.	Plastic Materials	35	
9.	Injection Moulding	50	
10.	Production process and documentation	20	
	Total	**165**	**40**
Part C	**Practical Work**		
	Practical Examination	06	15
	Written Test	01	10
	Viva Voce	03	10
	Total	**10**	**35**

Part D	**Project Work/Field Visit/ OJT**		
	Practical File/Student Portfolio	10	10
	Viva Voce	05	05
	Total	**15**	**15**
	Grand Total	**300**	**100**

The unit-wise distribution of hours and scores for Class 12 is as follows:

CLASS 12			
	Units	**No. of Hours for Theory and Practical =300**	**Max. scores for Theory and Practical = 100**
Part A	**Employability Skills**		
1.	Communication Skills – IV	25	**10**
2.	Self-management Skills – IV	25	
3.	Information and Communication Technology Skills – IV	20	
4.	Entrepreneurial Skills – IV	25	
5.	Green Skills – IV	15	
	Total	**110**	**10**
Part B	**Vocational Skills**		
6.	Extrusion	50	40
7.	Blow moulding	45	
8.	Auxiliary equipment in plastic processing	20	
9	Safety concepts and practice	40	
10	Maintenance of Machine Moulds and dies	10	
	Total	**165**	**40**
Part C	**Practical Work**		
	Practical Examination	06	15
	Written Test	01	10
	Viva Voce	03	10
	Total	**10**	**35**
Part D	**Project Work/Field Visit/OJT**		
	Practical File/Student Portfolio	10	10
	Viva Voce	05	05
	Total	**15**	**15**
	Grand Total	**300**	**100**

3. LEARNING OUTCOME BASED ACTIVITIES

Classroom, Laboratory/workshop and field are the key spots where teaching and learning take place. Classroom and laboratory-based teaching and learning facilitate knowledge creation whereas field visits open venues for free interaction with experts and also helps acquaint learners with various tools, materials, equipment procedures and operations in the workplace. While considering these intensified ways of knowledge acquisition, emphasis should also be laid on the occupational safety, health and hygiene of the participants.

Classroom activities

Classroom activities are mainly interactive lecture sessions, followed by discussions and doubt clarifications. Classes are handled by trained vocational teachers and this is considered as an

integral part of the course. The most attractive feature of the class is that the classes are in tune with the outcome-based curriculum. Teaching learning processes are well planned and implemented. Teaching learning materials such as audio-visual materials, colour slides, charts, diagrams, models, exhibits, handouts, on-line teaching materials etc., have been incorporated in accordance with the topic and this may help the teachers to impart the content in an effective manner.

Practical work in Laboratory / Workshop

Practical work is usually performed to enhance the skills of the learners which are indeed essential for them to become specialized technicians. Practical sessions may include hands on training, simulation training, role-play, case-based studies and exercises. Equipment and other appliances are available for use in abundance. Trained personnel teach and exercise specialized techniques. Practical classes involving laboratory/workshop are well planned with tools, equipment, materials and also other skill acquisition activities. Vocational teachers should submit the plan of laboratory/workshop work in advance to the head of the institution and get it sanctioned prior to use.

Field visits/ Educational Tour

Field visit is one of the ways and means of learning outside the classroom. It promotes knowledge acquisition by giving opportunity to learners to interact with renowned experts and to make observations of the activities performed by them. An observation check list may help the students to ensure the collection of required information and its analysis for further use. This may be developed with the help of vocational teachers who are in charge of outdoor learning activities. All the field visits are well planned by taking into consideration of the learning requirements, distance to travel, time, health and hygiene. The Principal and teachers should plan to implement at least three field visits within a year by making all necessary arrangements.

Virtual Field Visits, Expert Interactions and Practical Activities

With the rapid potentials offered by information technology in digital classrooms, the extent of virtual field visits, online expert interactions and online demonstrations cum practical activities can be worked out. It may be helpful amid the current Covid 19 pandemic scenario. A State level cluster of teachers and experts in the concerned subject can be pooled together for the purpose. The guidelines for such activities can be issued by the concerned SCERTs.

Suggested Topics for Expert Interaction

1) Opportunities for plastic processing technicians
2) Quality control in plastic processing
3) Plastic processing
4) Manufacture of PET bottles

5) Manufacture of PVC pipes
6) Manufacture of plastic films
7) Manufacture of plastic water tanks
8) Manufacture of blow moulded plastic products
9) Manufacture of moulds and dies
10) Health and safety in plastic processing
11) Preventive maintenance of plastic processing machineries
12) 5S concepts

4. ASSESSMENT AND CERTIFICATION

The National Skill Qualification Framework (NSQF) is based on outcomes rather than inputs referred by the National Occupation Standards (NOSs). Learning outcomes, as per the NSQF level descriptors, include the Process, Professional Knowledge, Professional Skills, Core Skills and Responsibility. Knowledge in the job of a learner shall be the basis of assessment. It would also be considered if the learning program undertaken by the learner has delivered the required output. Certification is based on required standards so that the learner and the employer could come to know about the competency attained in the vocational subject/ course. In order to make the assessment reliable, valid, flexible, convenient, cost effective, fair and transparent standardised assessment tools are to be used. Technology assisted assessment process is in vogue now.

Knowledge Assessment (Theory)

Knowledge Assessment usually includes two components – Internal Assessment and External Assessment. External assessment includes theory examination conducted by the concerned examination Boards. Tools for assessment contain components for testing the application of knowledge. Knowledge testing can be performed by making use of either objective or short answer type paper-based test. Source of the questions should be the content of the curriculum.

Written Test

A group, comprising of academicians, experts from existing vocational subject experts / teachers, subject experts from University/ College or from the industry prepare theory question paper for the vocational subjects. A panel of experts for question paper setting and conducting examination should be formed by the respective central / state boards. Written tests allow the learners to demonstrate that they have acquired the necessary knowledge and skill in the given topics.

The blue print for the question paper may be as follows:

Duration: 3 hrs **Maximum scores: 50**

		No. of Questions			
	Typology of Question	**Very Short Answer (1 score)**	**Short Answer (2 scores)**	**Long Answer (3 scores)**	**Scores**
1.	Remembering – (Knowledge based simple recall questions, to know specific facts, terms, concepts, principles, or theories; identify, define or recite, information)	**3**	**3**	**4**	**18**
2.	Understanding – (Comprehension – to be familiar with meaning and to understand conceptually, interpret, compare, contrast, explain, paraphrase, or interpret information)	**2**	**4**	**3**	**19**
3.	Application – (Use abstract information in concrete situation, to apply knowledge to new situations: Use given content to interpret a situation, private an example, or solve a problem)	**0**	**2**	**1**	**07**
4.	High Order Thinking Skills – (Analysis and Synthesis – Classify, compare, contrast, or differentiate between different pieces of information; Organize and/ or integrate unique pieces of information from a variety of sources)	**0**	**2**	**0**	**04**
5.	Evaluation – (Appraise, judge, and/or justify the value or worth of a decision or outcome, or to predict outcomes based on values)	**0**	**1**	**0**	**02**
	Total	**5x1=5**	**12x2=20**	**7x3=21**	**50 (24 questions)**

Skill Assessment (Practical)

Skill assessment should be done by considering the practical demonstration of skills by the candidate. It is assessed by making use of a competency checklist prepared by experts. The competency checklist should be developed as per the National Occupation Standards (NOSs). This should be in tune with the qualification pack for the Job Role to ensure necessary consistency in the quality of assessment across different sectors and institutions. As per the performance criteria defined in the National Occupation Standards, the students have to demonstrate their competencies in front of the examiners. Assessment will indicate whether they are competent or incompetent. The assessors assessing the skills of the students should possess enough industrial experience and should have undergone a rigorous training in assessment principles and practices. The Sector Skill Councils (SSCs) should ensure that the assessors are given the required training on the assessment of competencies.

The demonstration of knowledge and skill in performing a task of the learners, is the purpose of the practical examination. This include practical examination where hands on experience will be displayed and a viva voce. A team of two evaluators, one a subject teacher and the other an expert from the relevant industry certified by the relevant Board or SSCs concerned can conduct practical examination as well as viva voce.

Project Work

Project is an efficient strategy to assess the practical skills acquired along a certain timeline. Project is chosen and given to candidates only on the basis of their capabilities, because it needs specific skills. It is performed step by step and the first and foremost step is classroom discussion and selection of the topic for the project. After fixing the topic and objectives, the methodology of the project work should be decided during the classroom discussions. Monitoring and evaluation should be done at each stage. Proper feedback shall be provided to the learners for improvement and innovation. Field visits can be organized as part of the project work. The data collected may be used for presentations and report writing. Accuracy of the data is to be ensured. The entire project work is maintained as a practical work file or as student's portfolio.

Student Portfolio

It is a document that supports the candidate claim of competencies acquired as a part of the teaching learning process. The student portfolio is a compilation of project reports, articles, photos of products prepared by the student.

Viva Voce

Viva voce provides chance to each candidate to demonstrate communication skills and content knowledge. It is a way of obtaining feedback on the student's experience, learning, project work

and field visit. Audio visual recording of the whole procedure can be done for future reference and documentation. A Board, including external examiners, is constituted as per the norms which in turn should be suitably adapted to the specific requirement of the vocational subjects.

The central/state examination board for secondary education and the respective Sector Skill Councils can certify the competencies of the learner upon the successful completion of the course.

5. UNIT CONTENTS

CLASS 11

Part A: Employability Skills

Sl.No.	Units	Duration (Hrs)
1.	Communication Skills- III	25
2.	Self-management Skills – III	25
3.	Information and Communication Technology Skills – III	20
4.	Entrepreneurial Skills – III	25
5.	Green Skills – III	15
	Total	**110**

Unit 1: Communication Skill– III			
Expected Learning Outcome	**Theory (10 hrs)**	**Practical (15 hrs)**	**Duration (25 hrs)**
1. Demonstrate knowledge of various methods of communication	➢ Methods of communication • Verbal • Non-verbal • Visual	• Writing pros and cons of written, verbal and non-verbal communication • Listing do's and don'ts for avoiding common body language mistakes	05
2. Identify specific communication styles	• Communication styles- assertive, aggressive, passive-aggressive, submissive, etc.	• Observing and sharing communication styles of friends, teachers and family members and adapting the best practices • Roleplays on communication styles.	10
3. Demonstrate basic writing skills	➢ Writing skills to the following: • Sentence • Phrase • Kinds of Sentences • Parts of Sentence • Parts of Speech • Articles • Construction of a Paragraph	• Demonstration and practice of writing sentences and paragraphs on topics related to the subject	10
Total			**25**

Unit 2: Self-Management – III			
Expected Learning Outcome	**Theory (10 hrs)**	**Practical (15 hrs)**	**Duration (25 hrs)**
1. Demonstrate impressive appearance and grooming	• Describe the importance of dressing appropriately, looking decent and positive body language • Describe the term grooming • Prepare a personal grooming checklist • Describe the techniques of self- exploration	• Demonstration of impressive appearance and groomed personality • Demonstration of the ability to self-explore	10
2. Demonstrate team work skills	• Describe the important factors that influence in team building • Describe factors influencing team work	• Group discussion on qualities of a good team • Group discussion on strategies that are adopted for team building and team work	10
3. Apply time management strategies and techniques	• Meaning and importance of time management – setting and prioritizing goals, creating a schedule, making lists of tasks, balancing work and leisure, using different optimization tools to break large tasks into smaller tasks.	• Game on time management • Checklist preparation • To-do-list preparation	05
Total			**25**

Unit 3: Information and Communication Technology– III			
Expected Learning Outcome	**Theory (08 hrs)**	**Practical (12 hrs)**	**Duration (20 hrs)**
1. Create a document on word processor	• Introduction to word processing. • Software packages for word processing. • Opening and exiting the word processor. • Creating a document	➢ Demonstration and practice of the following: • Listing the features of word processing • Listing the software packages for word processing • Opening and exit the word processor • Creating a document	10
2. Edit, save and print a document in word processor	• Editing text • Wrapping and aligning the text	➢ Demonstration and practising the following:	10

	• Font size, type and face • Header and Footer • Auto correct • Numbering and bullet • Creating table • Find and replace • Page numbering • Printing document • Saving a document in various formats	• Editing the text • Word wrapping and alignment • Changing font type, size and face • Inserting header and footer • Removing header and footer • Using autocorrect option • Insert page numbers and bullet • Save and print a document	
Total			**20**

Unit 4: Entrepreneurial Skills – III			
Expected Learning Outcome	**Theory (10 hrs)**	**Practical (15 hrs)**	**Duration (25 hrs)**
1. Describe the significance of entrepreneurial values and attitude	• Values in general and entrepreneurial values • Entrepreneurial value orientation with respect to innovativeness, independence, outstanding performance and respect for work	• Listing of entrepreneurial values by the students. • Group work on identification of entrepreneurial values and their roles after listing or reading 2-3 stories of successful entrepreneur • Exhibiting entrepreneurial values in Ice breaking, rapport building, group work and home assignments	10
2. Demonstrate the knowledge of attitudinal changes required to become an entrepreneur	• Attitudes in general and entrepreneurial attitudes • Using imagination/ intuition • Tendency to take moderate risk • Enjoying freedom of expression and action • Looking for economic opportunities • Believing that we can	• Preparing a list of factors that influence attitude in general and entrepreneurial attitude • Demonstrating and identifying own entrepreneurial attitudes during the following micro lab activities like	15

	change the environment • Analyzing situation and planning action • Involving in activity	thematic appreciation test • Preparing a short write-up on "who am I" • Take up a product and suggest how its features can be improved • Group activity for suggesting brand names, names of enterprises, etc.	
Total			**25**

Unit 5: Green Skills – III			
Expected Learning Outcome	**Theory (07 hrs)**	**Practical (08 hrs)**	**Duration (15 hrs)**
1. Describe importance of main sector of green economy	• Main sectors of green economy- E-waste management, green transportation, renewal energy, green construction, water management • Policy initiatives for greening economy in India	• Preparing a poster on any one of the sectors of green economy • Writing a two-page essay on important initiatives taken in India for promoting green economy	08
2. Describe the major green Sectors/Areas and the role of various stakeholder in green economy	• Stakeholders in green economy • Role of government and private agencies in greening cities, buildings, tourism, industry, transport, renewable energy, waste management, agriculture, water, forests and fisheries	• Preparing posters on green Sectors/Areas: cities, buildings, tourism, industry, transport, renewable energy, waste management, agriculture, water, forests and fisheries	07
Total			**15**

PART B: VOCATIONAL SKILLS

Sl.No.	**Units**	**Duration (hrs)**
1.	Introduction to Plastic Processing	20
2.	Basic fittings and measurements	40
3.	Plastic materials	35
4.	Injection Moulding	50
5.	Production Process and documentation	20
	Total	**165**

Unit 1: Introduction to Plastic Processing			
Expected Learning Outcome	**Theory (10 hrs)**	**Practical (10 hrs)**	**Duration (20 hrs)**
1. Explain the developmental history of plastic.	• History of plastics Early discoveries World plastic consumption, statistics, Indian plastic industry Scope of plastic product manufacturing in India	• Prepare a chronological list of developments in the history of plastics • List major plastic industries in India. List plastic industries in your locality	5
2. Explain the basic concepts of polymers	• Define polymer, monomer, polymerization. • Addition and condensation polymerization • Classification of polymers • Distinguish plastics, rubbers, fibers and resins	• Prepare a comparison chart of thermoplastics vs thermosets • Compare addition and condensation polymerization	3
3. Explain different plastic processing methods	• Define different plastic processing methods like Injection moulding, Blow Moulding, Extrusion, rotational moulding, thermoforming, compression moulding etc. Identify the type of process used for making different products • Recycling symbols	• Prepare a list of products that are manufactured by different plastic processing methods • Prepare a chart of recycling symbols	8
4. Identify the roles and responsibilities of Machine Operator Assistant – Plastic processing	• Roles and responsibilities of Machine Operator Assistant – Plastic processing, Qualification pack, Performance criteria	• List the Roles and responsibilities of Machine Operator Assistant – Plastic processing	4
Total			**20**

Unit 2: Basic fittings and measurements			
Expected Learning Outcome	**Theory (15 hrs)**	**Practical (25 hrs)**	**Duration (40 hrs)**
1. Identify the dimensions of a product.	• Understanding the dimensions of a product from work order.	• Identify the dimension of a product from work order	3
2. Demonstrate the use of measuring instruments	• Use of measuring instruments such as vernier calliper, screw gauge, Micro meter, Vernier height gauge, Pie tape etc.	• Measurement of dimensions (OD, ID) using vernier caliper. Measurement of dimensions using Screw gauge. Measurement of thickness using micro meter.	16

		Measurement of height using Vernier height gauge. Measurement of circumference using pie tape.	
3. Demonstrate the use of common hand tools	• Study of common hand tools like, screw driver, Allen key, spanner, bench wise, hack saw, plier,etc	• Prepare a record of common hand tools • Demonstrate the use of common hand tools. Perform Hack sawing Perform Filing practice Check Flatness Check right angle	11
4. Demonstrate the use of drilling machine, grinder etc.	• Identify the different parts of a drilling machine, grinding machine	• Perform drilling a blind hole Perform sharpening of chisels/ tools with a grinding machine.	10
Total			**40**

Unit 3: Plastic Materials			
Expected Learning Outcome	**Theory (15 hrs)**	**Practical (20 hrs)**	**Duration (35 hrs)**
1. Explain the basics of polymers	• Introduction to basics of polymers • Classification of polymers • Amorphous, crystalline and semi crystalline polymers	• Prepare a comparison chart of thermoplastics and thermosets	4
2. Explain the properties and applications of various kinds of plastics	• Properties applications and different grades of commodity plastics, engineering plastics, speciality plastics and thermoset plastics	• Identification of different plastics by physical means. • Prepare a chart of properties and applications of plastics Perform Melting point test	20
3. Explain the processing temperatures of different plastic materials	• Melting temperature range, Processing temperature range, and mould temperature range of common plastics	• Prepare a chart of processing temperatures of common plastics. • Observe and record processing temperature on hand injection moulding operation.	6
4. Identify different additives for plastics and explain their role	• Additives used in plastics Role of additives. • Mixing/Blending of additives	• Identify the various additives used in plastic industry. • Blend different additives with plastics using a blender	5
Total			**35**

Unit 4: Injection Moulding			
Expected Learning Outcome	**Theory (20 hrs)**	**Practical (30 hrs)**	**Duration (50 hrs)**
1. Describe the injection moulding process	• Injection moulding process, • Advantages and disadvantages of IM. Different types of IMM , Plunger type, Screw type, Hand IMM, • Semi-automatic IMM • Fully automatic IMM	• Prepare a chart of different types of injection moulding machines	5
2. Set up and operate hand injection moulding machine and semi-automatic injection moulding machine	• Working of Hand IMM and semi-automatic IMM Mould setting and temperature setting. Operation of Hand Injection Moulding Machine	• Operate a hand injection moulding machine and take trial production • Operate a semi-automatic injection moulding machine and take trial production	15
3. Explain the working of a microprocessor based injection moulding machine.	• Microprocessor based injection moulding machine-parts and functions, Injection unit, Barrel, screw, feed hopper, band heaters, non-return valve, clamping unit - hydraulic and toggle, Mould, hot runner cold runner systems, ejection systems, Control unit • Shot weight, barrel residence time. Clamping force, Screw speed, holding pressure etc. • Machine start up procedure Machine shut down procedure Operation of Injection moulding machine	• Setting of parameters like temperature, pressure, speed and time on injection moulding machine. • Study the effect of various processing variables on the injection moulding operation. • Check various temperatures, pressures and time set on injection moulding machine. Take trial production in an IMM under supervision	15
4. Identify the defects causes and remedies in injection moulding operation	• Common defects in injection moulding, causes and remedies	• Inspect a lot of plastic products and identify the defective parts and type of defects.	8
5. Perform finishing operations and inspection of products.	• Perform finishing operations. • Remove flash, sprue, apply protective tapes and labels	• Practice flash removal, trimming, apply protective tapes and labels	7
Total			**50**

Unit 5: Production process and documentation			
Expected Learning Outcome	**Theory (10 hrs)**	**Practical (10hrs)**	**Duration (20 hrs)**
1. Identify different product/ process related documents	• Work Order, Product data sheet Process data sheet, • Understand the dimensions and properties of the product. • Work Instructions, SOPs QC check list, Safety manuals etc.	• Prepare a sample work order. • Prepare sample work instruction for Injection moulding. • Prepare a sample SOP • Prepare a QC check list	5
2. Organise the production process according to the work order in consultation with the operator	• Ensure the required materials • Ensure proper blending of additives. • Ensure proper pre drying of materials Arrange the mould and other required tools • Ensure proper cleaning of moulds and tools	• Prepare raw material indent • Demonstrate pre drying of plastic granules • Demonstrate Blending of additives to plastics • Demonstrate cleaning of moulds and tools	5
3. Perform pre moulding Check on machine settings	• Understand the control panel in injection moulding machine. • Important temperature, pressure and time settings • Machine warning systems	• Check power supply, oil level, gear box, water connections • Check barrel temperature, Mould temperature • Check dehumidifier and chiller working. • Check temperature pressure and speeds at regular intervals	5
4. Perform post moulding Checks	• Visual check on final product • Trimming, printing • Storing the product in the specified area. • Cleaning the machine and equipment	• Visual check on final product • Trimming, printing • Storing the product in the specified area. • Cleaning the machine and equipment	5
Total			**20**

CLASS 12

Part A: Employability Skills

Sl.No.	Units	Duration (hrs)
1.	Communication Skills- IV	25
2.	Self-management Skills – IV	25
3.	Information and Communication Technology Skills – IV	20
4.	Entrepreneurial Skills – IV	25
5.	Green Skills – IV	15
	Total	**110**

Unit 1: Communication Skills - IV

Expected Learning Outcome	Theory (10 hrs)	Practical (15 hrs)	Duration (25 hrs)
1. Describe the steps to active listening skills	• Importance of active listening at workplace • Steps to active listening	• Demonstration of the key aspects of becoming active listener • Preparing posters of steps for active listening	10
2. Demonstrate basic writing skills	Writing skills to the following: • Sentence • Phrase • Kinds of Sentences • Parts of Sentence • Parts of Speech • Articles • Construction of a Paragraph	• Demonstration and practice of writing sentences and paragraphs on topics related to the subject	15
Total			**25**

Unit 2: Self-Management Skills – IV

Expected Learning Outcome	Theory (10 hrs)	Practical (15 hrs)	Duration (25 hrs)
1. Describe the various factors influencing self-motivation	• Finding and listing motives (needs and desires); • Finding sources of motivation and inspiration (music, books, activities);expansive thoughts; living fully in the present moment; dreaming big	• Group discussion on identifying needs and desire • Discussion on sources of motivation and inspiration	10

2. Describe the basic personality traits, types and disorders	• Describe the meaning of personality • Describe how personality influence others • Describe basic personality traits • Describe common personality disorders- paranoid, antisocial, schizoid, borderline, narcissistic, avoidant, dependent and obsessive	• Demonstrate the knowledge of different personality types	15
Total			**25**

Unit 3: Information and Communication Technology Skills– IV			
Expected Learning Outcome	**Theory (06 hrs)**	**Practical (14 hrs)**	**Duration (20 hrs)**
1. Perform tabulation using spreadsheet application	• Introduction to spreadsheet application • Spreadsheet applications • Creating a new worksheet • Opening workbook and entering text • Resizing fonts and styles • Copying and moving • Filter and sorting • Formulas and functions • Password protection. • Printing a spreadsheet. • Saving a spreadsheet in various formats.	➢ Demonstration and practice on the following: • Introduction to the spreadsheet application • Listing the spreadsheet applications • Creating a new worksheet • Opening the workbook and enter text • Resizing fonts and styles • Copying and move the cell data • Sorting and Filter the data • Applying elementary formulas and functions • Protecting the spreadsheet with password • Printing a spreadsheet • Saving the spreadsheet in various formats.	**10**
2. Prepare presentation using presentation application	• Introduction to presentation • Software packages for presentation • Creating a new presentation	➢ Demonstration and practice on the following: • Listing the software packages for presentation	**10**

	• Adding a slide • Deleting a slide • Entering and editing text • Formatting text • Inserting clipart and images • Slide layout • Saving a presentation • Printing a presentation document.	• Explaining the features of presentation • Creating a new presentation • Adding a slide to presentation. • Deleting a slide • Entering and edit text • Formatting text • Inserting clipart and images • Sliding layout • Saving a presentation • Printing a presentation document	
Total			**20**

Unit 4: Entrepreneurial Skills – IV			
Expected Learning Outcome	**Theory (10 hrs)**	**Practical (15 hrs)**	**Duration (25 hrs)**
1. Identify the general and entrepreneurial behavioural competencies	• Barriers to becoming entrepreneur • Behavioural and entrepreneurial competencies – adaptability/ • decisiveness, initiative/perseverance, interpersonal skills, organizational skills, stress management, valuing service and diversity	• Administering self-rating questionnaire and score responses on each of the competencies • Collect small story/ anecdote of prominent successful entrepreneurs • Identify entrepreneurial competencies reflected in each story and connect it to the definition of behavioural competencies • Preparation of competencies profile of students	**10**
2. Demonstrate the knowledge of self-assessment of behavioural competencies	• Entrepreneurial competencies in particular: self - confidence, initiative, seeing and acting on opportunities, concern for quality, goal setting and risk taking, problem solving and creativity, systematic planning and efficiency, information seeking,	• Games and exercises on changing entrepreneurial behaviour and development of competencies for enhancing self-confidence, problem solving, goal setting, information seeking,	**15**

	persistence, influencing and negotiating, team building	team building and creativity	
Total			**25**

Unit 5: Green Skills – IV			
Expected Learning Outcome	**Theory (05 hrs)**	**Practical (10 hrs)**	**Duration (15 hrs)**
1. Identify the role and importance of green jobs in different **sectors**	• Role of green jobs in toxin-free homes, • Green organic gardening, public transport and energy conservation, • Green jobs in water conservation • Green jobs in solar and wind power, waste reduction, reuse and recycling of wastes, • Green jobs in green tourism • Green jobs in building and construction • Green jobs in appropriate technology • Role of green jobs in Improving energy and raw materials use • Role of green jobs in limiting greenhouse gas emissions • Role of green jobs minimizing waste and pollution • Role of green jobs in protecting and restoring ecosystems • Role of green jobs in support adaptation to the effects of climate change	• Listing of green jobs and preparation of posters on green job profiles • Prepare posters on green jobs.	**15**
Total			**15**

Part B–Vocational Skills

Sl.No.	**Units**	**Duration (hrs)**
1.	Extrusion	50
2.	Blow moulding	45
3.	Auxiliary equipment in plastic processing	20
4.	Safety concepts and practice	40
5.	Maintenance of Machine, Moulds and dies	10
	Total	**165**

Unit 1: Extrusion			
Expected Learning Outcome	**Theory (20 hrs)**	**Practical (30 hrs)**	**Duration (50 hrs)**
1. Explain the Extrusion process	• Principle of extrusion • Different types of Extruders – Ram extruder, Single screw extruder, twin screw extruder	• List different types of extruders	6
2. Describe the different parts of a single screw extruder and explain their function	• Single screw extruder – feed hopper, barrel, screw, screen pack, breaker plate, die head, die, drive units, heating and cooling systems. • Screw design, type of screws	• Prepare a chart of single screw extruder	12
3. Explain the manufacture extruded products such as pipes, films, sheets, profiles and cables.	• Manufacture of PVC pipes and hoses- pipe dies, cooling, cutting and take off systems. • Manufacture of plastic films by blown film extrusion • Manufacture of plastic sheets, profiles and cables by extrusion • Pre extrusion and post extrusion operations	• Work practice on plastic extruder. • Work practice on blown film extrusion unit.	20
4. Identify the defects causes and their remedies in plastic extrusion	• Defects in plastic extrusion, their causes and remedies	• Prepare a chart of defects in plastic extrusion.	12
Total			**50**

Unit 2: Blow Moulding			
Expected Learning Outcome	**Theory (20 hrs)**	**Practical (25 hrs)**	**Duration (45 hrs)**
1. Explain the blow moulding process.	• Blow moulding process • Types of blow moulding • Steps in blow moulding	• List different blow moulding methods	5
2. Explain extrusion blow moulding	• Extrusion blow moulding, Types of extrusion blow moulding, Reciprocating screw extruder, Accumulator head method, Ram accumulator extrusion, • Continuous extrusion blow moulding – shuttle type, rotary wheel type.	• Prepare a chart of extrusion blow moulding.	12

	• Parison swell, Convergent and divergent dies • Defects causes and remedies		
3. Explain injection blow moulding and Stretch blow moulding.	• Injection blow moulding – steps • Stretch blow moulding- bi axial orientation. • Comparison between extrusion and injection blow moulding.	• Prepare a chart of injection blow moulding and stretch blow moulding • Prepare a comparison chart of extrusion and injection blow moulding.	14
4. Set up and operate a hand blow moulding machine	• Different parts of hand blow moulding machine • Set temperature of the barrel • Operate hand blow moulding machine	• Produce Hand blow moulded products	14
Total			**45**

Unit 3: Auxiliary equipment in plastic processing			
Expected Learning Outcome	**Theory (10 hrs)**	**Practical (10 hrs)**	**Duration (20 hrs)**
1. Identify the various auxiliary equipment used in plastic processing	• Oven, pre-dryer, chiller, cooling tower, mould temperature controller, dry blender, hopper loader, scrap grinder, and agglomerator	• List out auxiliary equipment used in plastic industry and their uses	2
2. Explain the uses and advantages oven and pre dryer used in plastic processing	• Working of oven, pre dryer • Difference between oven and pre dryer	• Operation of Oven/Pre dryer	6
3. Explain the working of mould temperature controller, Chiller and cooling tower	• Working of mould temperature controller, Chiller and cooling tower	• Operation of mould temperature controller, chiller and cooling tower	6
4. Explain the use of dry blender, hopper loader, scrap grinder, and agglomerator	• Working of dry blender, hopper loader, scrap grinder, and agglomerator	• Operation of dry blender, hopper loader, scrap grinder, and agglomerator.	6
Total			**20**

Unit 4: Safety concepts and practice			
Expected Learning Outcome	**Theory (20 hrs)**	**Practical (20 hrs)**	**Duration (35 hrs)**
1. Identify the basic safety	• General safety practices	• List general safety	8

precautions to be observed in a plastic processing workshop.	• Personal safety practices • Machine safety practices	practices • List personal safety practices • List machine safety practices	
2. Develop basic knowledge of safety procedures like firefighting and first aid	• ABC of first aid, Air way breathing and circulation, CPR, first aid for a burn, a concussion etc. • Report and call medical emergencies • Preventing fires, extinguishing fires, Classification and use of fire extinguishers	• Using various fire extinguishers, • Demonstrate First aid for different accidents like burn, cut etc.	12
3. Identify risk/ hazards associated with plastic processing and follow appropriate safety measures	• What is an accident, causes for accidents, follow safety signs, floor markings, safe lifting methods, • Sorting and segregation of tools and other materials • Use of personal protective	• Prepare a chart of safety signs • Practice keeping tools and equipment in its designated position • Use of personal protective equipment	10
4. Ensure safe and clean working environment and follow personal hygiene	• Cleaning and dressing, Clothing and footwear, Manage long hair • 5S concepts • Segregation of waste and recycling	• Cleaning machine and surroundings • List 5S concepts	10
Total			**40**

Unit 5: Maintenance of machine moulds and dies			
Expected Learning Outcome	**Theory (5 hrs)**	**Practical (5 hrs)**	**Duration (10 hrs)**
1. Ensure proper maintenance of plastic processing machineries	• Types of maintenance • Preventive maintenance • Keep the machines clean • Monitor level, temperature and quality of hydraulic oil • Filter cleaning • Cooler cleaning • Check electrical connections and fuses	• List general safety practices • List personal safety practices • List machine safety practices • List preventive maintenance checks	6

	• Check thermocouples • Apply oil and lubricants to moving parts		
2. Ensure proper maintenance of moulds and dies	• Cleaning and maintenance of moulds and dies.	• Cleaning the moulds and dies • Apply oiling and protective spray • Apply oil and lubricants to moving parts	4
Total			**10**

6. ORGANISATION OF FIELD VISITS/ON-THE-JOB TRAINING

In a year, at least 3 field visits/educational tours should be organised for the students to expose them to the activities in the workplace. Teachers and students should visit plastic industries to observe and practice various aspects of plastic processing like injection moulding, Extrusion, Blow moulding, auxiliary equipment, pre moulding practices, post moulding practicesetc. During the visit the student should obtain the following information

1. Type of plastic products produced
2. Type of plastic processing technology adopted
3. Number and capacity of machines used in the company
4. Make and specifications of different machineries used.
5. Layout of the plant
6. Type of plastic materials used
7. Type of job roles in the company
8. Market for the products
9. Total turnover of the company
10. Profitability

On-the-job training of at least 80 hours is to be organised by the institution to provide hands-on training to the students.

7. LIST OF EQUIPMENT AND MATERIALS

The list given below is suggestive and an exhaustive list should be prepared by thevocational teacher. Only basic tools, equipment and accessories should be procured by theInstitution so that the routine tasks can be performed by the students regularly for practiceand acquiring adequate practical experience.

Sl. No	Item
1	Steel Rule 300 mm in English and Metric combined
2	Engineer's Square 150 mm with knife edge
3	Bench Vice of 150 mm
4	Outside micrometer 0-25 mm, with 0.01 mm least count
5	Vernier caliper-Range 200 mm, with 0.02 mm least count
6	Vernier height gauge - Range 300 mm, with 0.02 mm least Count
7	Pie tape
8	Pillar Drilling Machine 0-20 mm capacity.
9	Bench Pedestal Grinding machine (General purpose) D.E. with 20 cm dia. Capacity
10	MFI apparatus
11	Plastic scrap grinder
12	Pre heater 12 trays of 25 kgs. of 20 minutes capacity
13	Hand operated Injection Moulding machine with 30 grams capacity
14	Automatic Injection Moulding Machine 50 T capacity (with microprocessor /PLC controller)
15	Hand operated Blow Moulding Machine with moulds and accessories of ¼ litre capacity
16	Auto Blow Moulding Machine with set of moulds and accessories 1 litre capacity (with Microprocessor/PLC controller)
17	30 mm extruder with downstream lines such as film pipe with re-processing unit.
18	Injection Moulds
19	Blow Moulds
20	Extrusion dies
21	Hacksaw frame adjustable with pistol grip for 200-300 mm blade
22	Centre punch 10 mm
23	File flat Medium 250 mm
24	File flat 2nd cut Medium 250 mm
25	File flat safe edge 200 mm
26	File triangular smooth 200 mm
27	Caliper inside spring type-150 mm
28	Caliper outside spring type-150 mm
29	Screw driver – 150 mm
30	Screw driver – 200 mm
31	File card
32	Hammer Ball Peen 0.5 kg with handle
33	Surface plate 300 x 300 x 80 mm
34	Fire Extinguisher
35	Fire buckets with stand

8. LIST OF CONTRIBUTORS

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