# Course Curricula

for

## Short Term Courses based on Modular Employable Skills (MES)

in

# Plastic Processing Sector

**DIRECTORATE GENERAL OF EMPLOYMENT AND TRAINING**
**MINISTRY OF LABOUR & EMPLOYMENT**
**GOVERNMENT OF INDIA**

**Course Curricula for Short Term Courses based on Modular Employable Skills (MES) in the Plastic Processing Operator Sector**

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## Skill Development based on Modular Employable Skills (MES)

### Background

The need for giving emphasis on the Skill Development, especially for the less educated, poor and out of school youth has been highlighted in various forums. The skill level and educational attainment of the work force determines the productivity, income levels as well as the adaptability of the working class in changing environment. Large percentage of population in India is living below poverty line. One of the important causes is lower percentage of skilled persons in the workforce

The skill development at present is taking place mostly in the informal way, i.e. persons acquire skill at the work-place when they help their parents, relatives and employers etc. Such persons do not have a formal certificate and thus earn lower wages and are exploited by employers. They have come through informal system due to socio-economic circumstances of the family and the compulsions of earning a livelihood rather than attending a formal course. While their productivity is low, their contribution to the national GDP cannot be ignored. If the country can create a system of certification which not only recognizes their skills but also provides education and training in a mode that suits their economic compulsions, it will not only benefit the workforce to earn a decent living but also contribute to the national economy by better productivity of this workforce.

Another related problem to be tackled is large number of students drop outs (About 63% of the school students drop out at different stages before reaching Class-X).

### Frame work for Skill Development based on 'Modular Employable Skills (MES)'

Very few opportunities for skill development are available for the above referred groups (out of school youth & existing workers especially in the informal sector). Most of the existing Skill Development programmes are long term in nature. Poor and less educated persons can not afford long term training programmes due to higher entry qualifications, opportunity cost etc. Therefore, a new frame work for Skill Development for the Informal Sector has been evolved by the DGET to address to the above mentioned problems. The **key features of the new frame work for skill development** are:

- Demand driven Short term training courses based on modular employable skills decided in consultation with Industry
- Flexible delivery mechanism (part time, weekends, full time)
- Different levels of programmes (Foundation level as well as skill upgradation) to meet demands of various target groups
- Central Government will facilitate and promote training while Vocational Training (VT) Providers under the Govt. and Private Sector will provide training
- Optimum utilisation of existing infrastructure to make training cost effective.
- Testing of skills of trainees by independent assessing bodies who would not be involved in conduct of the training programme, to ensure that it is done impartially.
- Testing & certification of prior learning (skills of persons acquired informally)

The Short Term courses would be based on 'Modular Employable Skills (MES)'.
The **concept for the MES** is :

- Identification of 'minimum skills set' which is sufficient to get an employment in the labour market.
- It allows skills upgradation, multiskilling, multi entry and exit, vertical mobility and life long learning opportunities in a flexible manner.
- It also allows recognition of prior learning (certification of skills acquired informally) effectively.
- The modules in a sector when grouped together could lead to a qualification equivalent to National Trade Certificate or higher.
- Courses could be available from level 1 to level 3 in different vocations depending upon the need of the employer organisations.
- MES would benefit different target groups like :
  - Workers seeking certification of their skills acquired informally
  - workers seeking skill upgradation
  - early school drop-outs and unemployed
  - previously child labour and their familly

## Age of participants

The minimum age limit for persons to take part in the scheme is 14 years but there is no upper age limit.

## Curriculum Development Process

Following procedure is used for developing course curricula

- Identification of Employable Skills set in a sector based on division of work in the labour market.
- Development of training modules corresponding to skills set identified so as to provide training for specific & fit for purpose
- Organization of modules in to a Course Matrix indicating vertical and horizontal mobility. The course matrix depicts pictorially relation among various modules, pre requisites for higher level modules and how one can progress from one level to another.
- Development of detailed curriculum and vetting by a trade committee and by the NCVT

(Close involvement of Employers Organizations, State Governments, experts, vocational training providers and other stake holders is ensured at each stages).

## Development of Core Competencies

Possession of proper attitudes is one of the most important attribute of a competent person. Without proper attitudes, the performance of a person gets adversely affected. Hence, systematic efforts will be made to develop attitudes during the training programme.

The trainees deal with men, materials and machines. They handle sophisticated tools and instruments. Positive attitudes have to be developed in the trainees by properly guiding them

and setting up examples of good attitudes by demonstrated behaviors and by the environment provided during training.

Some important core competencies to be developed are:

1. Safety consciousness and safe working practices
2. Care of equipment and tools
3. Punctuality, discipline and honesty
4. Concern for quality
5. Respect for rules and regulations
6. Concern for health and hygiene
7. Cordial relationship and Cooperation with co-workers and team Work
8. Positive attitude and behavior
9. Responsibility and accountability
10. Learn continously
11. Communication Skills
12. Concern for environment and waste disposal

Following competencies should also be developed during level-II and higher courses:

1. Ability for planning, organizing and coordinating
2. Creative thinking, problem solving and decision making
3. Leadership
4. Ability to bear stress
5. Negotiation

## Duration of the Programmes

Time taken to gain the qualification will vary according to the pathway taken and will be kept very flexible for persons with different backgrounds and experience. Duration has been prescribed in hours in the curriculum of individual module, which are based on the content and requirements of a MES Module. However, some persons may take more time than the prescribed time. They should be provided reasonable time to complete the course.

## Pathways to acquire Qualification:

**Access to** the qualification could be through:

- An approved training programme; **Or**
- A combination of an approved training programme plus recognition of prior learning including credit transfer; **Or**
- The recognition of prior learning that provides evidence of the achievement of the competencies for the qualification.

## Methodology

The training methods to be used should be appropriate to the development of competencies. The focus of the programme is on “performing” and not on “Knowing”. Lecturing will be restricted to the minimum necessary and emphasis to be given for ‘hands on training’.

The training methods will be individual centered to make each person a competent one. Opportunities for individual work will be provided. The learning process will be continuously monitored and feedback will be provided on individual basis.

Demonstrations using different models, audio visual aids and equipment will be used intensively.

## Instructional Media Packages

In order to maintain quality of training uniformly all over the country, instructional media packages (IMPs) will be developed by the National Instructional Media Institute (NIMI), Chennai.

## Assessment

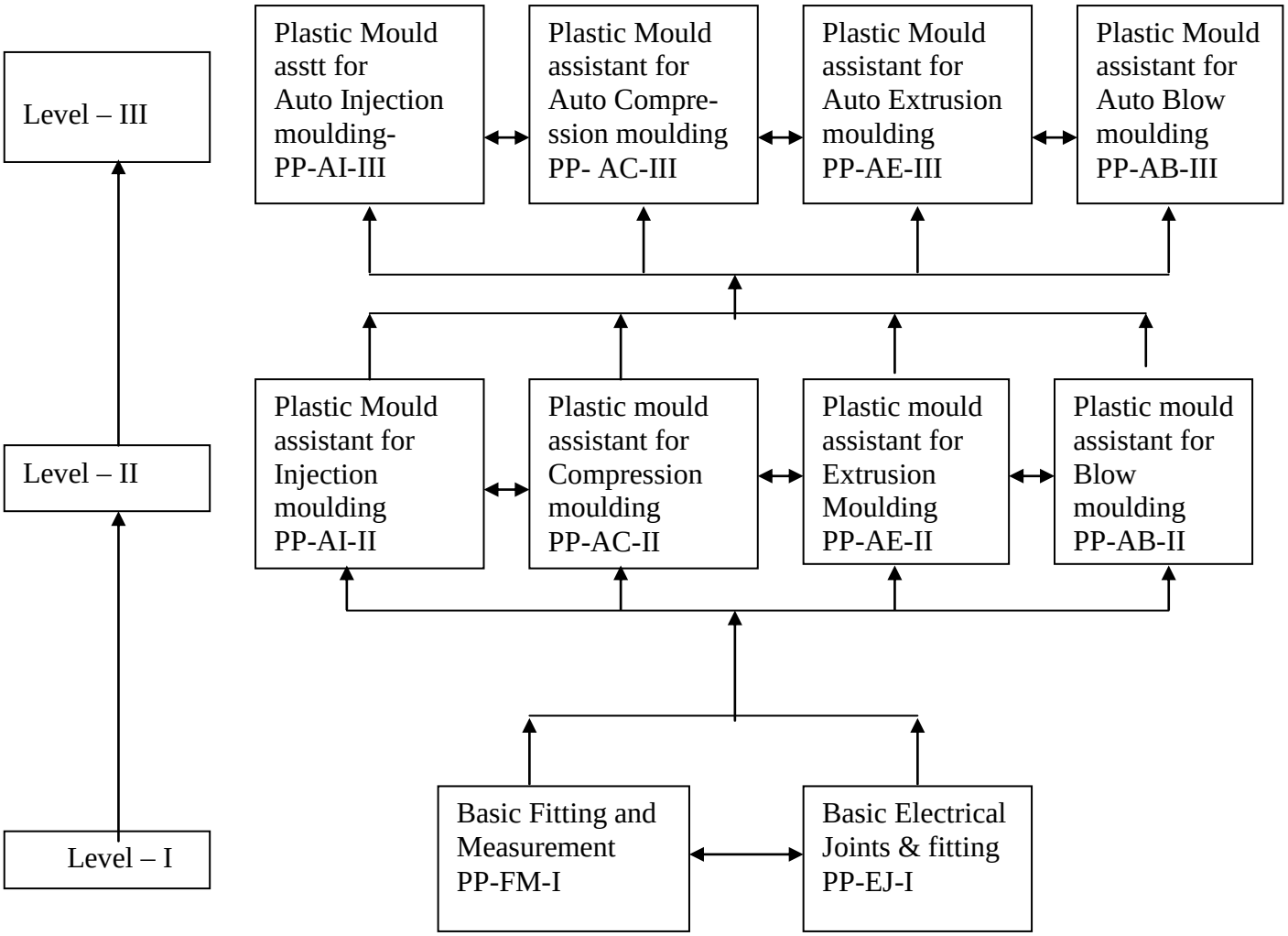
DGE&T will appoint assessing bodies to assess the competencies of the trained persons. The assessing body will be an independent agency, which will not be involved in conducting the training programmes. This, in turn, will ensure quality of training and credibility of the scheme. Keeping in view the target of providing training/testing of one million persons through out the country and to avoid monopoly, more than one assessing bodies will be appointed for a sector or an area.

## Certificate

Successful persons will be awarded certificates issued by National Council for Vocational Training (NCVT).

**Course Matrix**

## Course Module for Plastic Processing



## MODULES

### Basic Fitting and Measurement

*** Name** : Basic Fitting and Measurement

*** Sector** : Plastic Processing Industries

*** Code** : **PLA101**

*** Terminal Competency**: On Completion of training the trainee will be able to:

a) Use of fitter's hand tools, marking of job as per drawing, filing, hack sawing, chipping, drilling, manufacturing of individual components with in an accuracy of ± 0.1 mm.

(b) Assembly of individual components maintaining interchangeability.

*** Duration** : 120 hours

*** Entry requirement**: a) Qualification: V th class.

b) Age: Minimum 14 years.

**Course Contents:**

| Practical Competencies | Underpinning Knowledge (Theory) |
|---|---|
| ● Familiarisation with tools and equipment used in the trade.<br>● Carry out safe working practices and demonstrate the use of safety devices<br>● Marking out of straight and parallel lines with the help of odd leg calipers, steel rule, scribing blocks, dividers and hack sawing to a given dimension of different types of metals of different sections.<br>●Filling flat and square to a given dimension to an accuracy of ±0.1 mm.<br>● Chipping flat surface along a marked line.<br>● Marking and drilling of holes on flat surface, finding centre of round bar with the help of 'V' according to drawing.<br>● Forming external & internal threads with taps & dies.<br>● Exercise on measuring instruments such as for linear measurement - steel rule, caliper, height gauge & for cylindrical diameter – micrometer (inside & outside)<br>● Exercise on angular measuring instruments using combination set & vernier bevel protector.<br>● Finish different components individually and assembling them as per drawing maintaining interchangeability. | ● Importance of general safety, machine & electrical safety, shop floor safety observed while working in work shop.<br>● Description of different kinds of hand tools used in bench work - bench vice & hack - saw frames, hacksaw blade, marking & punching tools, chisels, their types use, care and maintenance.<br>● Hammer, punch and chisel-their types and use.<br>● Description of Files- their grades, cuts and uses.<br>● Drilling machine and its types - Bench type, pillar type, radial type, gang and multi spindle drilling machine.<br>● Measuring instruments – vernier caliper, micrometer, height gauges, dial gauge, bevel protector – with its least count calculation.<br>● Description and use of Taps and Die. |

## Basic Electrical Joints & fitting

*** Name** : Basic Electrical Joints & fitting

*** Sector** : Plastic Processing Industries

*** Code** : **PLA102**

*** Terminal Competency**: On Completion of training the trainee will be able to:

(a) Fix and connect electrical accessories such as switches, holders, fuse, plugs, sockets etc.

(b) Study of simple electrical circuit (series and parallel) and knowledge of electrical measuring instrument its function and use.

*** Duration** : 120 hours

*** Entry requirement**: a) Qualification: V th class.

b) Age: Minimum 14 years.

***Course Contents:**

| Practical Competencies | Underpinning Knowledge (Theory) |
|---|---|
| ● Demonstration about use of safety equipments and artificial respiration.<br>● Use of electrical hand tools.<br>● Safety precaution about electric joints and electric instruments.<br>● Measurements of electric current, voltage, power and energy by using voltmeter, ammeter, wattmeter and energy meter.<br>● Practice in fixing and connecting electrical accessories such as switches, holders, fuse, plug and sockets on extension boards.<br>● Forming a simple electrical circuits (series and parallel ) measuring insulation resistance and earth resistance. | ● Safety precaution and first aid for electric shock. Common terms used in electrical work conductors and insulators.<br>● Electrical Units, insulation and resistance, ohms law and its application.<br>● Basic concept about simple electrical circuit - essential requirements of electrical circuit–series and parallel, different types of resistance, fuses, earthing etc.<br>● Types, grades and size of insulated wires and cables – their proper selection and use. |

## Plastic Mould Assistant (Injection Molding)

*** Name** : Plastic Mould Assistant (Injection Molding)

*** Sector** : Plastic Processing Industries

*** Code** : **PLA203**

*** Terminal Competency**: On Completion of training the person will be able to :

(a) Manually operate plastic processing Injection Moulding machine.

(b) Help to running maintenance of manually operate Injection Moulding machine.

*** Duration** : 120 hours

*** Entry requirement** : a) Qualification: V th class & MES Modules on Basic Fitting and Measurement / Basic Electrical Joints & fitting

b) Age : Minimum 14 years.

***Course Contents:**

| Practical Competencies | Underpinning Knowledge (Theory) |
|---|---|
| ● Demonstration about personal, machine & electrical safety while working on hand operated injection Moulding machine.<br>● Familiarisation with the mechanical & electrical system of hand operated Injection moulding machine and its different parts and their respective functions.<br>● Operating and controlling of hand operated Injection Moulding Machine in ideal run observation (IRO) - Fitting of mould injector, locking and cooling of mould, adjusting feed of screw or ram, Temperature controlling, fitting and adjusting nozzle, injector pressure and speed).<br>● Operating and controlling of hand operated Injection Moulding Machine in Trial Run Observation (TRO) using thermoplastic material as available.<br>● Operating and controlling of hand operated Injection Moulding Machine in Trial Run Observation (TRO) using thermosetting material as available.<br>●Oiling, Lubrication and preventive maintenance of hand operated injection moulding machine.<br>Identification and Testing of plastic. | ● Importance of safety and general precautions observed in plastic processing work shop.<br>● Hand operated Plastic processing Injection Molding Machine's different parts of mould, construction, their function and moulding techniques.<br>● Definition, types, properties and uses of polymer substance such as wood, plastic, rubber, fibers etc.<br>● Group of plastics - Thermoplastic– its properties use and application.<br>● Low and high density polyethylene, polypropylene their properties use and application.<br>● Styrene group of plastic ABS, SAN, PVC, Nylon group, Polycarbonate - properties, uses and application. |

## Plastic Mould Assistant (Compression Moulding)

*** Name** : Plastic Mould Assistant (Compression Moulding)

*** Sector** : Plastic Processing Industries

*** Code** : **PLA204**

*** Terminal Competency** : On Completion of training person will be able to:
(a) Manually operate plastic processing Compression Moulding machine.
(b) Help to running maintenance of manually operate Compression Moulding machine.

*** Duration** : 120 hours

*** Entry requirement**: a) Qualification: V th class & MES Modules on Basic Fitting and Measurement / Basic Electrical Joints & fitting
b) Age : Minimum 14 years.

***Course Contents:**

| Practical Competencies | Underpinning Knowledge (Theory) |
|---|---|
| ● Demonstration about personal, machine & electrical safety while working on compression molding machine.<br>● Familiarisation with mechanical & electrical system of hand operated compression moulding machine - different Parts and their respective functions.<br>● Operating and controlling of hand operated compression moulding machine in IRO (movement of platen top or bottom adjustment and control, adjusting pressure in terms of per – square area, total tonnage, fitting and heating of modules controlling temperature, checking of bulk factor/ density etc.)<br>● Operating and controlling of hand operated compression moulding machine in IRO using thermoplastic and thermosetting material as available.<br>●Oiling, lubricating and preventive maintenance of hand operated compression moulding machine.<br>● Testing method of plastics. | ● Importance of safety and general precautions observed in plastic processing work shop.<br>● Hand operated compression moulding machine – its construction, different parts - their function and moulding technique.<br>● Thermosetting plastic material phenol formaldehyde (PE) urea formaldehyde (UF) melamine formaldehyde (MF) polyester based resin – its various form, properties, use and application.<br>● Basic parts of mould and its construction details.<br>● Moulding defects and their remedies.<br>● Identification of plastic<br>● Different plastic testing machines. |

## Plastic Mould Assistant (Extrusion Moulding)

*** Name of the Module** : Plastic Mould Assistant (Extrusion Moulding)

*** Sector** : Plastic Processing Industries

*** Code** : **PLA205**

*** Terminal Competency** : On Completion of training the trainee will be able to:
(a) Manually operate plastic processing Extrusion Moulding machine.
(b) Help to running maintenance of manually operate Extrusion Moulding machine.

*** Duration** : 120 hours

*** Entry requirement** : a) Qualification: V th class MES Modules on Basic Fitting and Measurement / Basic Electrical Joints & fitting
b) Age : Minimum 14 years.

*** Course Contents:**

| Practical Competencies | Underpinning Knowledge (Theory) |
|---|---|
| ● Demonstration about personal, machine & electrical safety while working on hand operated extrusion molding machine.<br>● Familiarisation with mechanical & electrical system of Extrusion machine and its different parts and their respective functions.<br>● Operating of hand operated Extrusion machine in IRO (Changing and cleaning of screws in extruder, adjusting and controlling temperature, adjusting screen pack arrangement, adjusting variable speed, setting and adjusting die head for profile and film etc.)<br>● Operating and controlling of hand operated Extrusion Machine in (TRO) using thermoplastic and thermosetting material as available.<br>● Oiling, lubricating and preventive maintenance of hand operated extrusion moulding machine.<br>● Identification and testing of plastic. | ● Importance of safety and general precautions observed in plastic processing work shop.<br>● Hand operated Eaxtrusion machine – its construction, different parts - their function and moulding technique.<br>● Knowledge of multilayer extrusion.<br>● Thermoplastic- polybutylene terephthalate (PBT), polyethylene terephthalate (PET)- their description, properties and use in hand operated extrusion moulding process.<br>● Polyester resin- its properties and use.<br>● Expxy resin- its properties and use.<br>● Printing technique involved in pipe.<br>● Preventive maintenance, oiling and lubrication of hand operated extrusion machine. |

## Plastic Mould Assistant (Blow Moulding)

*** Name of the Module** : Plastic Mould Assistant (Blow Moulding)

*** Sector** : Plastic Processing Industries

*** Code** : **PLA206**

*** Terminal Competency**: On Completion of training the trainee will be able to:
(a) Manually operate plastic processing Blow Moulding machine.
(b) Help to running maintenance of manually operate Blow Moulding machine.

*** Duration** : 120 hours

*** Entry requirement** : a) Qualification: V th class & MES Modules on Basic Fitting and Measurement / Basic Electrical Joints & fitting
b) Age : Minimum 14 years.

*** Course Contents :**

| Practical Competencies | Underpinning Knowledge (Theory) |
|---|---|
| ● Demonstration about personal, machine & electrical safety while working on hand operated blow molding machine.<br>● Familiarization with mechanical & Electrical system of Blow- Molding Machine and its different parts and their respective functions.<br>● Operating and controlling of hand operated Blow-Molding Machine in IRO(Setting of die, adjusting mandrel, controlling and adjusting thickness uniformity).<br>● Operating and controlling of hand operated Blow-Molding Machine in TRO using thermoplastic and thermosetting material as available.<br>● Preventive maintenance of hand operated blow-molding machine-oiling and Lubrication.<br>● Testing of mechanical properties-operating testing machine to determine tensile impact, elongation and compressive strength.<br>● Cup flow testing identification of various plastic in relation to properties. | ● Importance of safety and general precautions observed in plastic processing work shop.<br>● Hand operated Blow moulding machine – its construction, different parts - their function and moulding technique.<br>● Polymer - their properties, use and application of LDPE,HDPE,PET, PC.<br>● Foamed plastic - its properties, use and application.<br>● Knowledge of multilayer extrusion blow moulding, extrusion stretch blow moulding, press blow moulding for squeezable container.<br>● Preventive maintenance, oiling and lubrication of hand operated Blow Moulding Machine.<br>● Foamed plastic- its properties, use and application.<br>● Thermoforming – its properties and use.<br>● Concept of different testing machines and their use for testing and quality control with respect to manufacturing parameters. |

## Auto Plastic Mould Assistant (Injection Molding)

*** Name** : Auto Plastic Mould Assistant (Injection Molding)

*** Sector** : Plastic Processing Industries

*** Code** : **PLA307**

*** Terminal Competency**: On Completion of training the trainee will be able to:
(a) Operate plastic processing auto injection Moulding machine.
(b) Help to running maintenance of auto injection Moulding machine.

*** Duration** : 120 hours

*** Entry requirement**: a) Qualification: V th class **+ MES Modules** on Basic Fitting and Measurement / Basic Electrical Joints & fitting /Plastic Mould Assistant (Injection Molding)/Plastic Mould Assistant (Compression Moulding)/Plastic Mould Assistant (Extrusion Moulding)/Plastic Mould Assistant (Blow Moulding)
b) Age : Minimum 14 years.

***Course Contents:**

| Practical Competencies | Underpinning Knowledge (Theory) |
|---|---|
| ● Demonstration about personal, machine, electrical & hydraulic safety while working on semi-auto & auto injection Moulding machine.<br>● Familiarisation with the mechanical, electrical and hydraulic system of semi automatic & automatic Injection moulding machine and its different parts and their respective functions.<br>● Operating and controlling of semi automatic Injection Moulding Machine to produce components in different moulds, cycle time, process parameter & study in IRO.<br>● Operating and controlling of automatic Injection Moulding Machine – its process sequence, ejector stroke, tie-bar distance platen sizes, mould clamping arrangements.<br>● Idle Run Observation (IRO) & study of injection unit, clamping system, start up & shut-down procedure, types of nozzle & hydraulic system.<br>●Oiling, Lubrication and preventive maintenance of semi automatic automatic injection moulding machine. | ● Importance of safety and general precautions observed in plastic processing work shop.<br>● Types of semi-automatic & automatic Injection Molding Machine their different parts, construction and their function and moulding techniques.<br>●Nomenclature of moulds - its types and material.<br>● Importance of pre-drying of plastic materials.<br>● Setting of mould, process parameters.<br>● Operational requirement of annealing, stress relieving, warp age control. |

## Auto Plastic Mould Assistant (Compression Moulding)

*** Name** : Auto Plastic Mould Assistant (Compression Moulding)

*** Sector** : Plastic Processing Industries

*** Code** **: PLA308**

*** Terminal Competency** : On Completion of training the trainee will be able to:
(a) Operate plastic processing Compression Moulding machine.
(b) Help to running maintenance of Compression Moulding machine.

*** Duration** : 120 hours

*** Entry requirement** : a) Qualification: V th class + **MES Modules** on Basic Fitting and Measurement / Basic Electrical Joints & fitting / Plastic Mould Assistant (Injection Molding)/Plastic Mould Assistant (Compression Moulding)/Plastic Mould Assistant (Extrusion Moulding)/Plastic Mould Assistant (Blow Moulding)
b) Age : Minimum 14 years.

***Course Contents:**

| Practical Competencies | Underpinning Knowledge (Theory) |
|---|---|
| ● Demonstration about personal, machine, electrical & hydraulic safety while working on semi automatic & automatic compression molding machine.<br>● Familiarisation with mechanical, electrical and hydraulic system of semi automatic & automatic compression moulding machine – different Parts and their respective functions.<br>● IRO of automatic compression Moulding Machine parts, mould loading / unloading, setting up process and its process variables.<br>● Operating and controlling of compression moulding machine in IRO using thermoplastic and thermoforming material as available.<br>● IRO of Roto Moulding Machine mould loading / unloading, setting up process.<br>● Oiling, lubricating and preventive maintenance of compression moulding & roto moulding machine.<br>● Testing method of plastics. | ● Importance of safety and general precautions observed in plastic processing work shop.<br>● Types of semiautomatic & automatic compression moulding machine – its construction, different parts - their function and moulding technique.<br>● Types of transfer mouldsits function, limitation, advantages.<br>● Principle of compression moulding of thermoplastic and thermoforming.<br>● Roto moulding machine and its process. |

## Auto plastic Mould Assistant (Extrusion Moulding)

*** Name** : Auto plastic Mould Assistant (Extrusion Moulding)

*** Sector** **:** Plastic Processing Industries

*** Code** : **PLA309**

*** Terminal Competency:** On Completion of training the trainee will be able to:
(a) Operate plastic processing Extrusion Moulding machine.
(b) Help to running maintenance of Extrusion Moulding machine.

*** Duration** : 120 hours

*** Entry requirement** : a) Qualification: V th class + **MES Modules** on Basic Fitting and Measurement / Basic Electrical Joints & fitting / Plastic Mould Assistant (Injection Molding)/Plastic Mould Assistant (Compression Moulding)/Plastic Mould Assistant (Extrusion Moulding)/Plastic Mould Assistant (Blow Moulding)
b) Age : Minimum 14 years.

*** Course Contents:**

| Practical Competencies | Underpinning Knowledge (Theory) |
|---|---|
| ● Demonstration about personal, machine, electrical & hydraulic safety while working on semi automatic & automatic extrusion molding machine.<br>● Familiarisation with mechanical, electrical and hydraulic system of semi automatic & automatic extrusion machine and its different parts and their respective functions.<br>● Operating of semi automatic & automatic Extrusion machine in IRO (Setting process parameters, screw speed, nip roller speed, wider speed, blow ratio, control of cooling bubble & air pressure).<br>● Practice of die setting on the machine, sizing techniques, procedure for parameter setting & operation practice to produce pipes.<br>● Practice of operating machines to produce different size of pipes.<br>● Oiling, lubricating and preventive maintenance of semi automatic & automatic extrusion machines.<br>● Identification and testing of plastic. | ● Importance of safety and general precautions observed in plastic processing work shop.<br>● Types of semi automatic & automatic extrusion machine – its construction, different parts & their function.<br>● Fundamental knowledge of semi automatic & autometic extrusion process.<br>● Fundamental knowledge about extrusion moulding materials, its behavior.<br>● Simple method of identification of plastic materials.<br>● Basic knowledge about extrusion coating materials, its pretreatment and surface treatment.<br>● Basic knowledge about processing parameter, defects, cause and remedies of trouble shooting for extrusion moulding process.<br>● Simple techniques of reprocessing of plastic waste. |

## Auto Plastic Mould Assistant (Blow Moulding)

*** Name** : Auto Plastic Mould Assistant (Blow Moulding)

*** Sector** : Plastic Processing Industries

*** Code** : **PLA310**

*** Terminal Competency**: On Completion of training the trainee will be able to:
(a) Operator plastic processing Blow Moulding machine.
(b) Help to running maintenance of Blow Moulding machine.

*** Duration** : 120 hours

*** Entry requirement** : a) Qualification: V th class **MES Modules** on Basic Fitting and Measurement / Basic Electrical Joints & fitting / Plastic Mould Assistant (Injection Molding)/Plastic Mould Assistant (Compression Moulding)/Plastic Mould Assistant (Extrusion Moulding)/Plastic Mould Assistant (Blow Moulding)

b) Age : Minimum 14 years.

*** Course Contents:**

| Practical Competencies | Underpinning Knowledge (Theory) |
|---|---|
| ● Demonstration about personal, machine, electrical & hydraulic safety while working on blow molding machine.<br>● Familiarization with mechanical, Electrical and hydraulic system of semi automatic & automatic blow- molding machine and its different parts and their respective functions.<br>● Operating and controlling of semi automatic & automatic Blow-Molding Machine in IRO (Setting of dies, mould, cycle time and process parameter).<br>● Operating & practice of removing & fix the parison die to produce correct type of blowing system.<br>● Operating and practice of single stage, two stage blow moulding process.<br>● Operation and practice of multilayer blow moulding process.<br>● Operation and practice of dip and press moulding process . | ● Importance of safety and general precautions observed in plastic processing work shop.<br>● Fundamental knowledge of Semi automating and automatic Blow moulding machine – its construction, different parts - their function and moulding technique.<br>● Fundamental knowledge of extruded multilayer, die and press Blow moulding machine – its construction, different parts - their function and moulding technique.<br>● Fundamental knowledge of multilayer extrusion blow moulding, extrusion stretch blow moulding, press blow moulding for squeezable container.<br>● Basic knowledge of blow moulds, materials, temperature control during blow moulding process.<br>● Basic knowledge about processing parameter, defects, cause and remedies of trouble shooting for blow moulding process. |

**● List of Tools (For a batch of 16 trainees)**

| Sr No. | Name of the Tools & Equipment | Quantity for Instructor | Trainees | Total |
|---|---|---|---|---|
| 1. | Rule steel 15 cm with metric graduations. | 1 | 16 | 17 |
| 2. | Try square 10 cm blade. | 1 | 16 | 17 |

| | | | |
|---|---|---|---|
| 3. Outside spring caliper.15 cm | 1 | 16 | 17 |
| 4. Inside spring caliper 15 cm | 1 | 16 | 17 |
| 5. Divider 15 cm spring. | 1 | 16 | 17 |
| 6. Scriber 15 cm. | 1 | 16 | 17 |
| 7. Punch Centre 10 cm. | 1 | 16 | 17 |
| 8. Screw driver 15 cm. | 1 | 16 | 17 |
| 9. Chisel cold 10. | 1 | 16 | 17 |
| 10. Hammer ball pein 0.45 kg with handle. | 1 | 16 | 17 |
| 11. Hammer ball pein 0.22 kg with handle. | 1 | 16 | 17 |
| 12. File flat 25 cm second cut. | 1 | 16 | 17 |
| 13. File flat 25 cm smooth. | 1 | 16 | 17 |
| 14. File half round 2nd cut 15 cm. | 1 | 16 | 17 |
| 15. Hacksaw frame adjustable 20-30 cm. | 1 | 16 | 17 |
| 16. Safety goggles. | 1 | 16 | 17 |
| 17. Dot slot punch. | 1 | 16 | 17 |

**Instruments & General Shop Outfit per Unit**

| | |
|---|---|
| 1. Plate surface 45 cm * 45 cm | 2 |
| 2. Marking table 91 * 91 * 122 cm height | 1 |
| 3. Portable hand drill (electric) 0 to 6 mm | 2 |
| 4. Drill brace hand o to 12 mm | 2 |
| 5. Drill twist S/S 1.5 to 12 mm by 0.4 mm | 1 set. |
| 6. Drill twist S/S 8 mm to 15 mm by ½ mm | 1 set. |
| 7. Taps and dies complete set in box B.S.F. | 1 |
| 8. Taps and dies complete set in box (Metric) | 1 |
| 9. Micrometer 25-50 mm outside | 3 |
| 10. Vernier caliper 20 cm | 1 |
| 11. Vice Bench 12 cm jaw | 16 |
| 12. Bench working L:240 cm * W:120 cm * H:75 cm | 4 |
| 13. Lockers with 8 drawers (standard size) | 2 |
| 14. Almirah 180 CM * 90 cm * 30 cm | 2 |
| 15. Metal rack 182 cm * 182 cm * 45 cm | 1 |
| 16. Black Board | 1 |
| 17. Fire extinguisher (For 4 units) | 2 |
| 18. Fire buckets | 2 |
| 19. Hand hammer 1 kg with handle | 2 |
| 20. Rule wooden 4 fold 600 mm | 2 |
| 21. Saw tennon 250 mm | 2 |
| 22. C-Clamps ( 100 mm,150 mm and 200 mm ) | 2 each |
| 23. Drill Machine hand 6 mm cap | 2 |
| 24. Rawal plug tool and kit | 2 sets |
| 25. Ammeter 1 ma to 500 ma DC | 10 |
| 26. Ammeter 0 to 1 Amp. DC | 10 |
| 27. Volt Meter 0-300 V A.C. | 10 Nos. |
| 28. A.C. Ammeter 0.5 & 0.25 Amp. | 5 each |
| 29. Magger 500 volts | 1 |
| 30. Electric switches, fuses, holders, lamps, teak wood boards, plug sockets, solder, flux, wires and cables, battens, round blicks and other consumables. | As required. |

- **Machinery**

1. Drilling Machine Pilar Sensitive 0-20 mm cap. With swivel 1

| | |
|---|---|
| table motorized with chuck & key. | |
| 2. Grinding machine (General purpose) D.E. pedestal with 20 cm dia. Wheels rough & smooth with twist drill grinding attachment. | 1 |
| 3. 30 mm extruder with downstream lines such as film pipe with re-processing unit to process PVC,IDP & RDP. | 1 |
| 4. Auto Injection Moulding Machine 40 T Cap. | 1 |
| 5. Hand operated injection moulding machines | |
| (a) 13 grams capacity | 1 |
| (b) 30 grams capacity | 1 |
| (c) 60 grams capacity | 1 |
| 6. Hand operated compression moulding machines 40 T Cap. | 1 |
| 7. Automatic compression press 100 T cap. with moulds. | 1 |
| 8. Pipe extrusion machine | 1 |
| 9. Hand operated Blow Moulding Machine --- | |
| (a) 1 litre capacity | 1 |
| (b) 3 litre capacity | 1 |
| 10. Full automatic double stage blow moulding machine with multilayer extrusion with accessories | 1 |
| 11. Test Equipment (Tensile, MFI, Hardness, Izod, Impact identifying unit etc. ) | 1 set |
| 12. Accessories & moulds including scrap grinder | 1 set |
| 13. Hand operated compression moulding machine 60 ton cap. | 1 No. |
| 14. Preheater 12 trays of 25 kgs. capacity. | 1 No. |

**List of Expert/Trade Committee Members**

CURRICULUM DEVELOPMENT FOR SHORT TERM COURSES BASED ON MODULAR EMPLOYABLE SKILLS

SECTOR/AREA: **Plastic Processing**

# MEMBERS OF THE TRADE COMMITTEE

1. **SHRI KETAN V. PAREKH,** DIRECTOR,
   NATIONAL PLASTIC INDUSTRIES LTD., ANDHERI, MUMBAI
2. **SHRI YASHWANT R. JUNNARKAR ,** GENERAL MANAGER ( TECHNICAL),
   PRINCE PLASTICS INTERNATIONAL PVT. LTD., ANDHERI, MUMBAI
3. **SHRI CHETAN SHAH,** MANAGING DIRECTOR,
   ZOOM DEVELOPERS PVT. LTD., ANDHERI , MUMBAI
4. **SHRI GIRISH NITSURE,** MANAGER ,
   ZOOM DEVELOPERS PVT. LTD., ANDHERI , MUMBAI
5. **SHRI SUNIL CHOUDHURY,**
   RAMA PACKAGING INDUSTRIES, MAHIM ( W), MUMBAI
6. **PROF. M. A. SHENOY,**
   UNIVERSITY DEPTT OF CHEMICAL TECHNOLOGY, MATUNGA, MUMBAI
7. **DR. MAHANAWAR,**
   UNIVERSITY DEPTT OF CHEMICAL TECHNOLOGY, MATUNGA, MUMBAI
8. **PROF. G. G. PATWARDHANE,**
   DEPTT OF PLASTIC ENGINEERING, VILLE PARLE ( W), MUMBAI
9. **PROF. D. M. KARAD,**
   DEPTT. OF PLASTIC ENGINEERING, VILLE PARLE ( W), MUMBAI,
10. **DR. A. N. SANGHVI,** PRINCIPAL,
    SHRI BHAGUBHAI MAFATLAL POLYTECHNIC, VILE PARLE ( W),MUMBAI
11. **MR. D. R. PATEL,** BORIVILLI(W), MUMBAI
12. **SHRI. MOULIK MODI**,
    A.J. AUTO PVT. LTD., ANDHERI ( E), MUMBAI
13. **Shri Dinesh Nijhawan**, Joint Director, DGET

File name : MES - ppo Aug 2007

| Sl. No. | Course Code | Name of Courses | Duration of Training in Hrs. | Entry Qualification | Batch Size |
|---|---|---|---|---|---|
| **Sector - Plastics Processing** | | | | | |
| 1 | PLA601 | Injection Moulding Machine Operations (IMMO) | 1200 | 8th | 50 |
| 2 | PLA602 | Film Extrusion Machine Operations (FEMO) | 800 | 8th | 50 |
| 3 | PLA603 | Pipe & Profile Extrusion Machine Operations (PPEMO) | 800 | 8th | 50 |
| 4 | PLA604 | Blow & Roto Moulding Machine Operations (BRMO) | 1000 | 8th | 50 |
| 5 | PLA605 | Plastics Recycling Machine Operations (PRMO) | 1200 | 8th | 50 |
| 6 | PLA606 | FRP Products Manufacturing Operations (FPMO) | 800 | 8th | 50 |
| 7 | PLA607 | Plastics Sacks Machine Operations (PSMO) | 800 | 8th | 50 |
| 8 | PLA608 | Plastics Pipe Fitting & Joining Operations (PPFJO) | 800 | 8th | 50 |
| 9 | PLA609 | PVC Pipe Threading Machine Operations (PPTMO) | 800 | 8th | 50 |
| 10 | PLA610 | Testing & Quality Control for Plastics Materials & Products (TQC) | 800 | 10th | 50 |
| 11 | PLA611 | Maintenance of Plastics Processing Machinery (MPPM) | 1000 | 10th | 25 |
| 12 | PLA701 | Plastics Mould Manufacturing (PMM) | 1200 | 10th | 25 |
| 13 | PLA702 | Advanced Plastics Mould Manufacturing (APMM) | 1200 | 10th + PLA701 / ITI (Tool & Die making) / Diploma (Mechanical) | 25 |
| 14 | PLA703 | CNC Lathe Programming & Operation for Plastics Industries (CNC-L) | 1000 | 10th | 25 |
| 15 | PLA704 | CNC Milling Programming & Operation for Plastics Industries (CNC-M) | 1000 | 10th | 25 |
| 16 | PLA705 | Plastics Product and Mould Design (PPMD) | 1200 | 10th + PLA701 / ITI (Tool & Die making) / Diploma (Mechanical) | 25 |

**Course Name: INJECTION MOULDING MACHINE OPERATIONS (IMMO)**

| | | |
|---|---|---|
| **Sector** | : | Plastic Processing Industries |
| **Code** | : | PLA601 |
| **Terminal Competency** | : | On successful completion of training the person will be able to operate Injection moulding machines, take care of machine maintenance and trouble shooting. |
| **Duration** | : | 1200 Hrs |
| **Eligibility** | : | $8^{th}$ |
| **Age Limit** | : | Minimum 17 years |
| **Course Contents** | : | |

| Theory (240 Hrs.) | Practical (960 Hrs.) |
|---|---|
| Importance of safety and general precautions observed in plastic processing work shop.<br>**Fitter Tools &Fitting Equipments**: Description of Fitter, common hand tools, names, description and the material from which they are made, description of simple fittings,hacksawing,punching,filling,types of files, method of using drills, tapes and dies, study of measuring tools i.e. Vernier calliper, micrometre.<br>**Introduction:** Polymers, Fundamentals, Terminology of polymers, Classification of polymers.<br>**Thermoplastics:** Brief introduction to raw materials, properties, additives and processing and applications of commodity plastics, engineering plastics and speciality Plastics, material grades, raw material manufacturers.<br>**Thermoset materials:** Brief introduction to raw materials, properties and applications, raw material manufacturers.<br>**Oven / Pre Drier:** Different types of pre drying methods, Purpose, structure, function, process and maintenance.<br>**Fundamentals of Plastics Processing Techniques:** Different Types of Processes - Description and Limitation - Processing Flow Chart - Selecting a Process–Process Advantage of Plastics over Conventional Materials.<br>**Injection Moulding Techniques:** Basic process principle, Machine rating and specification - types of Machines – construction - parts and its functions, Start-up and shut down procedure - Operation procedure - Clamping system - type of Screw and its function - heating system - Ejection system – back pressure - suck back - drooling - nozzle type - Process variables - Moulding cycle purging - Material recommendation - Press capacity projected area -Shot weight Basic theoretical concepts and their relationship to processing shrinkage – Annealing - dimensional control - moulding record - Injection moulding of thermosetting materials – Automation - introduction to troubleshooting.<br>**Microprocessor Controlled Injection Moulding Process:** Start-up and shut down procedure - Moulding cycle, Study of Basic concepts of Micro processor control, Comparison of Micro Processor- Controlled M/cs with Conventional M/Cs, Machine Setting Procedure, Programming, Procedure for Process-Parameter-setting on monitor or control Panel, introduction to troubleshooting.<br>**Advanced Injection Moulding Techniques:** Gas assisted injection moulding, Multi colour moulding, thermoset injection moulding, Insert Moulding and over moulding.<br>**Mould Technology:** Types of mould-two plate mould, three plate mould, hot runner mould , mould temperature controller, types of gate, types of ejection, mould material, balanced runner system and unbalanced runner system.<br>**Plastic testing and quality control:** Introduction to plastics testing and quality control.<br>• Behavioral Science and, Entrepreneurship development , Role of DIC and industrial policy, Banking and its assistance<br>• Industrial visit<br>• 5S and TPM concept | Demonstration about personal, machine & electrical safety while working on plastics processing machines<br>Description of Fitter, common hand tools, names, description and the material from which they are made, description of simple fittings, hacksawing, punching, filling, types of files, method of using drills, tap's and dies, study of measuring tools i.e. Vernier calliper, micrometre.<br>**Hand Operated Injection Moulding Machine**: Study of machine in Idle-Run Observation (IRO), parts & functions, operating principles, free sketch of machine parts e.g. Nozzle, Torpedo, Hopper, Rack & Pinion Barrel etc., shot capacity definition. Operation practice to produce moulding on different hand injection moulds. Moulding Conditions, Recording the observation and results in practical record book.<br>**Injection Moulding Semi Automatic:** (i) Study of semi automatic Injection moulding machines of all types in IRO. Comparative study of Pneumatic type & Hydraulic type of machines operating principles of machines with nomenclature of parts, machines specifications. (ii) Operation of Pneumatic & Hydraulic type of Semi automatic Injection moulding machines, to produce components in different moulds. Cycle-time analysis, observations of process parameters & Procedure to be recorded.<br>**Automatic Injection Moulding machines:** Study of M/c Parts & function, Study of clamping systems in M/cs, Technical specification of Machine, study of process sequence in Machine, Study & definitions of terms related to M/c operation e.g. M/c Day light, Locating -Ring Dimensions, ejector-stroke, Tie-Bar distance, M/c Platen sizes & mould clamping arrangements. Definitions of all Processing Parameters & study of controls in M/cs.<br>**Microprocessor Controlled Injection Moulding Machine:** Study of Basic concepts of Micro processor control, Comparison of Micro Processor- Controlled M/cs with Conventional M/Cs, Machine Setting Procedure, Procedure for Process-Parameter-setting on monitor or control Panel. Operation of M/c with Mould fixing & setting on the M/c with different plastics materials, cycle-time analysis, Analysis of Product defects, causes & remedies during M/c operation, listing of important operating procedure points, safety precautions through M/C Instruction/Manual operating.<br>**Scrap Grinding:** (i) M/c Study in IRO, specification of M/c, study of parts & function, Line Diagram of M/c. (ii) Operation-practice with different materials and output study in Kg/hour for different materials.<br>**Oven / Pre Drier:** Specification of machine, study of parts & function, operation practice with different materials & process temperature, annealing process.<br>**Maintenance:** Types of Maintenance, Repair and maintenance of various components used in Injection moulding machines, machine maintenance and Mould maintenance.<br>**Post operation techniques of plastics products:** platting, Joining, welding, sealing, decorative coating and printing on moulded products. |

## List of Tools & Instruments (5 Nos. each for the batch size of 50)

1. Steel rule 15 cm with metric Graduations
2. Measure Tape
3. Outside, inside spring calliper
4. Spring divider
5. Try square
6. Combination plier
7. Cutting plier
8. Screwdriver 15 cm
9. Screwdriver set
10. D/E spanner set inch & mm
11. Allen key set inch & mm
12. Pipe wrench
13. Adjustable spanner
14. Hand Hacksaw frame adjustable
15. Hacksaw Blades
16. Bench vice with working table
17. Portable Hand drill 0-6mm with drill bits
18. Centre punch
19. Chisel
20. Flat file second cut & smooth
21. Half round file second cut & smooth
22. Needle file rough & smooth
23. Ball peen hammers
24. Plastic hammer (Soft)
25. Mould Clamping Block
26. Micrometre 0-25 mm
27. Vernier calliper
28. Thickness gauge
29. Electric line Tester
30. Multi meter
31. Test lamp
32. Electric Extension Board with 15A sockets & switches

33. Electric Switches, fuses, holders, lamps, teakwood boards, plug sockets, solder, flux, wires and cables and other consumables.

34. Copper rods and strips.

## List of Machinery & Equipment (1 No. each for the batch size of 50)

1. Hand operated Injection Moulding Machine
2. Semi Auto Vertical Injection Moulding Machine
3. Semi Auto Horizontal Injection Moulding machine
4. Fully Auto Injection Moulding Machine
5. Microprocessor based Injection Moulding Machine
6. Automatic Hopper Loader
7. Oven / Drier
8. Dehumidifier
9. Colour Blender
10. Mould Temperature Controller
11. Scrap Grinder
12. Hydraulic Trainer
13. Pneumatic Trainer
14. Hot air gun
15. Blow lamp
16. Weighing balance
17. Moulds – two plate, three plate, split mould etc. for automatic injection moulding & hand moulds.
18. Mould polishing kit
19. Cooling tower
20. Hydraulic Trolley
21. Crane
22. Chilling Unit
23. Utility equipment (Cooling Circuit)

## Raw material

As required for the batch size, the quantity of plastics raw materials can be procured.

## Instructor

Three instructors-(Instructor: Student=1:20 ratio)

## Qualification for Instructor

Diploma in Plastics Technology / Polymer Engineering / Equivalent with relevant experience / Post Graduate Diploma in Plastics processing & Testing

## Space Required

Minimum 3000 Sq. ft.

**Course name:** **FILM EXTRUSION MACHINE OPERATIONS (FEMO)**

| | | |
|---|---|---|
| **Sector** | : | Plastic Processing Industries |
| **Code** | : | PLA602 |
| **Terminal Competency** | : | On successful completion of training person will be able to operate Extrusion film plant, take care of machine maintenance and trouble shooting. |
| **Duration** | : | 800 Hrs |
| **Eligibility** | : | $8^{th}$ |
| **Age Limit** | : | Minimum 17 years |
| **Course Contents** | : | |

| Theory (160 Hrs.) | Practical (640 Hrs.) |
|---|---|

| | |
|---|---|
| Importance of safety and general precautions observed in plastic processing work shop.<br>**Fitter Tools &Fitting Equipments**: Description of Fitter, common hand tools, names, description and the material from which they are made, description of simple fittings, hacksawing, punching, filling, types of files, method of using drills, tap's and dies, study of measuring tools i.e. Vernier calliper, micrometre, Thickness gauge.<br>**Introduction**: Polymers, Fundamentals, Terminology of polymers, Classification of polymers.<br>**Thermoplastics:** Brief introduction to raw materials, properties, additives and processing and applications of Commodity Plastics, Engineering Plastics and Speciality Plastics, material grades, raw material manufacturers.<br>**Thermoset materials:** Brief introduction to raw materials, properties and applications, raw material manufacturers.<br>**Oven / Pre Drier:** Different types of pre drying methods, Purpose, structure, function, process and maintenance.<br>**Fundamentals of Plastics Processing Techniques:** Different Types of Processes - Description and Limitation - Processing Flow Chart - Selecting a Process–Process Advantage of Plastics over Conventional Materials.<br>**Extrusion Techniques:** Fundamental of extrusion, Process & Principle, classification of extruders, nomenclature of screws, different types of screws, drive mechanism, die design, process parameters, Difference between SSE and TSE, plastics material extrusion, types of extrusion process- film extrusion, single layer film & Multilayer film – applications & comparison - trouble shooting.<br>**Blown Film Extrusion:** Introduction - Process – Machine Parts, Process optimization - Downstream equipments - Dies and applications – Oscillating platform / Oscillating nip roller/ rotating die – Internal bubble cooling etc.<br>Process Parameters, Blowup Ratio, Film Thickness Control, Leaf flat width, Factors affecting film properties, TQPP Extrusion<br>**Cast Film Extrusion:** Introduction - Process – Machine Parts, Process optimization - Downstream equipments - Dies and applications.(BOPET/BOPP Film Extrusion), PVC film process(Medical Applications)<br>Resin Handling & Blending, Polymer Filtration, Pressure control, Feedblock, Single Manifold Die, Chill roll-MDO Unit-TDO Unit-Pull Roll-Winder-Slitter-Scanner. Factors affecting film properties, MD Ratio, TD Ratio Trouble Shootings Comparisons between Blown film & Cast Film Process<br>Application of blown film & Cast film.<br>Hopper loading devices - Drying equipments - Process<br>Dehumidifier / Hot Air Oven, Chilling Plant, Scrap Grinder, Color Blender, Hopper Loader, Plastic RAW Material storage & Handling<br>**Plastic testing and quality control**: Introduction to plastics testing and quality control.<br>• Behavioral Science and, Entrepreneurship development, Role of DIC and industrial policy, Banking and its assistance | Demonstration about personal, machine & electrical safety while working on extrusion machines.<br>Description of Fitter, common hand tools, names, description and the material from which they are made, description of simple fittings,hacksawing,punching,filling,types of files, method of using drills, tapes and dies, study of measuring tools i.e. Vernier calliper, micrometre, Thickness gauge.<br>**Extrusion machine:** Study of extruders in IRO, Free sketch of machines, their parts and parts-function, List of products manufactured by Extrusion process.<br>Study of different types of extrusion process and their products.<br>**Blown/Cast Film Extruder:** Procedure for setting up of Process-parameters eg. Temperature on different zones, Screw-Speed, Nip-roller speed, Winder Speed, Blow-ratio, control of cooling-Air on bubble, Methodology & practice by trainees to fix the Blown Film die on M/C familiarization of Die-parts & their function.<br>Technical specification of M/cs, defects, causes & remedies.<br>Practice of operating M/c to produce different sizes of Blown Film.<br>Practice of Die setting on the machine.<br>Procedure for setting up of parameters & operation practice in running the Machine to produce film.<br>**Scrap Grinding:** (i) M/c Study in IRO, specification of M/c, study of parts & function, Line Diagram of M/c. (ii) Operation-practice with different materials and output study in Kg/hour for different materials.<br>**Oven / Pre Drier:** Specification of machine, study of parts & function, operation practice with different materials & process temperature.<br>**Maintenance of extrusion Machinery:** Types of Maintenance, Repair and maintenance of various components used in extrusion machines<br><br>**Post operation techniques of plastics films:** Cutting and Sealing, printing, bag making. |

## List of Tools & Instruments (5 Nos. each for the batch size of 50)

1. Steel rule 15 cm with metric Graduations
2. Measure Tape
3. Outside, inside spring calliper

4. Spring divider
5. Try square
6. Combination plier
7. Cutting plier
8. Screwdriver 15 cm
9. Screwdriver set
10. D/E spanner set inch & mm
11. Allen key set inch & mm
12. Pipe wrench
13. Adjustable spanner
14. Hand Hacksaw frame adjustable
15. Hacksaw Blades
16. Bench vice with working table
17. Portable Hand drill 0-6mm with drill bits
18. Centre punch
19. Chisel
20. Flat file second cut & smooth
21. Half round file second cut & smooth
22. Needle file rough & smooth
23. Ball peen hammers
24. Plastic hammer (Soft)
25. Mould Clamping Block
26. Micrometre 0-25 mm
27. Vernier calliper
28. Thickness gauge
29. Electric line Tester
30. Multi meter
31. Test lamp
32. Electric Extension Board with 15A sockets & switches
33. Electric switches, fuses, holders, lamps, teakwood boards, plug sockets, solder, flux, wires and cables and other consumables.
34. Copper rods and strips.

## List of Machinery & Equipment (1 No. each for the batch size of 50)

1. Single Layer Film Extruder
2. Multi-Layer Film Extruder
3. Film Cutting & Sealing Machine (Bag Making)
4. Cast Film Extruder
5. TQPP Extruder
6. Flexo Graphic Printer /Rotogravure printer
7. Carona treater
8. Agglomorater
9. Drier / Oven
10. Compounder
11. Air Compressor
12. Pneumatic Trainer
13. Hopper loader
14. Blow lamp
15. Hot air gun
16. Scrap Grinder
17. Utility equipment (Cooling line)

## Raw material

As required for the batch size, the quantity of plastics raw materials can be procured.

## Instructor

Three instructors - (Instructor: Student=1:20 ratio)

## Qualification for Instructor

Diploma in Plastics Technology / Polymer Engineering / Equivalent with relevant experience.

Post Graduate Diploma in Plastics Processing & Testing

## Space Required

Minimum 2000 Sq. ft. with appropriate height

**Course name: PIPE & PROFILE EXTRUSION MACHINE OPERATIONS (PPEMO)**

| | | |
|---|---|---|
| **Sector** | : | Plastic Processing Industries |
| **Code** | : | PLA603 |
| **Terminal Competency** | : | On successful completion of training person will be able to operate Extrusion pipe plant and profile plant, take care of machine maintenance and trouble shooting. |
| **Duration** | : | 800 Hrs |
| **Eligibility** | : | $8^{th}$ |
| **Age Limit** | : | Minimum 17 years |
| **Course Contents** | : | |

| Theory (160 Hrs.) | Practical (640 Hrs.) |
|---|---|

| | |
|---|---|
| Importance of safety and general precautions observed in plastic processing work shop.<br>**Fitter Tools & Fitting Equipments:** Description of Fitter, Common Hand Tools, Names, Description and the Material from which they are made, Description of simple fittings, Hack sawing, punching, filing, Types of files, Method of using drills, taps and dies, Study of measuring tools i.e. vernier calliper, micrometre, Pie Tape, Internal Micrometre, Measuring tapes etc<br>**Introduction:** Polymers, Fundamentals, Terminology of polymers, Classification of polymers.<br>**Thermoplastics:** Brief introduction to raw materials, properties, additives and processing and applications of Commodity Plastics, Engineering Plastics and Speciality plastics, material grades, raw material manufacturers<br>**Thermoset materials:** Brief introduction to raw materials, properties and applications, material grades, material manufacturers<br>**Oven / Pre Drier:** Different types of pre drying methods, Purpose, structure, function, process and maintenance.<br>**Fundamentals of Plastics Processing Techniques:** Different Types of Processes - Description and Limitation - Processing Flow Chart - Selecting a Process–Process Advantage of Plastics over Conventional Materials.<br>**Extrusion Techniques:** Fundamental of extrusion, Process & Principle, classification of extruders, nomenclature of screws, different types of screws, drive mechanism, die design, process parameters, Difference between SSE and TSE, plastics material extrusion, types of extrusion process-pipe, profile extrusion, trouble shooting.<br>**Extrusion of Pipe:** Single screw extruder for producing polyolefin pipes, Co-rotating twin screw extruder for producing of filled polyolefin pipes, Study of pipe die head, Calibrating of vacuum tank, Designing of pipe die head and sizing dies, Study of cooling bath & haul off unit, cutting unit, Twin screw extruder for producing UPVC pipes, Counter rotating twin screw extruder for rigid PVC pipe & profile, Co-extrusion pipes and sizing techniques.<br>**Extrusion of Profile:** PVC profiles for construction and furniture industry, Profile from other, materials, Twin screw extruder, Profile extrusion dies, Calibrating unit (Vacuum, Sort-vacuum, extended mandrel). Extrusion line for Garden Hose Pipe, Extrusion line for Garden corrugated Pipe. Polyolefin profile (Beading)<br>**PVC Compounding Lines:** Purpose of plastic compounding, Guidelines for formulation of compound, Compounding of rigid PVC, Its ingredients depending upon end use.<br>**Twin screw extruder**: Introduction to screw geometry and configuration, significance in comparison with single screw extruder, Masterbatch preparation.<br>**Plastic testing and quality control**: Introduction to plastics testing and quality control.<br>• Behavioral Science and, Entrepreneurship development, Role of DIC and industrial policy, Banking and its assistance<br>• Industrial visit | Demonstration about personal, machine & electrical safety while working on extrusion machines.<br>Description of Fitter, Common Hand Tools, Names, Description and the Material from which they are made, Description of simple fittings, Hack sawing, punching, filing, Types of files ,Method of using drills, taps and dies, Study of measuring tools i.e. vernier calliper, micrometre, Pie Tape, Internal Micrometre, Measuring tapes etc.<br>**Compounding of PVC:** Purpose of plastic compounding, Guidelines for formulation of compound, Compounding of rigid PVC, Its ingredients depending upon end use.<br>**Pipes and profile Extrusion machine:** Procedure for setting up of Process-parameters eg. Temperature on different zones, Screw-Speed, Methodology & practice by trainees to fix the die on M/C familiarization of Die-parts & their function, Technical specification of M/cs, defects, causes & remedies, Practice of operating M/c to produce different sizes of Blown Film. Study of the Machine-parts & function from Screw drive to the Cater pillar. Practice of Die setting on the machine, sizing, procedure for setting up of parameters & operation practice in running the Machine to produce pipe/ Tube/ film.<br>**Twin screw extruder**: Operation practice, control, types of products processed in twin screw extruder.<br>**Maintenance of extrusion Machinery:** Types of Maintenance, Repair and maintenance of various components used in extrusion machines.<br>**Scrap Grinding:** (i) M/c Study in IRO, specification of M/c, study of parts & function, Line Diagram of M/c. (ii) Operation-practice with different materials and output study in Kg/hour for different materials.<br>**Oven / Pre Drier:** Specification of machine, study of parts & function, operation practice with different materials & process temperature.<br>**Post operation techniques of plastic pipes and profiles:** Winding, Cutting, Printing. |

## List of Tools & Instruments (5 Nos. each for the batch size of 50)

1. Steel rule 15 cm with metric Graduations
2. Measure Tape
3. Outside, inside spring calliper
4. Spring divider

5. Try square
6. Combination plier
7. Cutting plier
8. Screwdriver 15 cm
9. Screwdriver set
10. D/E spanner set inch & mm
11. Allen key set inch & mm
12. Pipe wrench
13. Adjustable spanner
14. Hand Hacksaw frame adjustable
15. Hacksaw Blades
16. Bench vice with working table
17. Portable Hand drill 0-6mm with drill bits
18. Centre punch
19. Chisel
20. Flat file second cut & smooth
21. Half round file second cut & smooth
22. Needle file rough & smooth
23. Ball peen hammers
24. Plastic hammer (Soft)
25. Mould Clamping Block
26. Micrometre 0-25 mm
27. Vernier calliper
28. Thickness gauge
29. Electric line Tester
30. Multi meter
31. Test lamp
32. Electric Extension Board with 15A sockets & switches
33. Electric switches, fuses, holders, lamps, teakwood boards, plug sockets, solder, flux, wires and cables and other consumables.
34. Copper rods and strips.

## List of Machinery & Equipment (1 No. each for the batch size of 50)

1. RPVC Pipe Extruder (Single Screw with Post Extrusion Equipments)

2. RPVC Pipe Extruder (Twin Screw with Post Extrusion Equipments)
3. Pipe Extruder (PVC Hose with Equipments)
4. Pipe Extruder for spiral pipes with attachment
5. RPVC – Profile Extruder (with Post Extrusion Equipments)
6. Polyolefin Profile Extruder (with Post Extrusion Equipments)
7. Hot & Cold High Speed Compounder
8. High Speed Compounder for Plasticized PVC
9. Heavy Duty Scrap Grinder for Pipe
10. Pulveriser (PVC)
11. Hopper loader

## Raw material

As required for the batch size, the quantity of plastics raw materials can be procured.

## Instructor

Three instructors - (Instructor: Student=1:20 ratio)

## Qualification for Instructor

Diploma in Plastics Technology / Polymer Engineering / Equivalent with relevant experience / Post Graduate Diploma in Plastics Processing & Testing

## Space Required

Minimum 4000 Sq. ft.

Course name: **BLOW & ROTO MOULDING MACHINE OPERATIONS (BRMO)**

**Sector** : Plastic Processing Industries

**Code** : PLA604

**Terminal Competency** : On successful completion of training person will be able to operate extrusion blow moulding machine, Roto moulding machine take care of machine maintenance and trouble shooting.

**Duration** : 1000 Hrs

**Eligibility** : $8^{th}$

**Age Limit** : Minimum 17 years

**Course Contents** :

| Theory (200 Hrs.) | Practical (800 Hrs.) |
|---|---|
| Importance of safety and general precautions observed in plastic processing work shop.<br>**Fitter Tools &Fitting Equipments**: Description of Fitter, common hand tools, names, description and the material from which they are made, description of simple fittings, hacksawing, punching, filling, types of files, method of using drills, tap's and dies, study of measuring tools i.e. Vernier calliper, micrometre etc.<br>**Introduction:** Polymers, Fundamentals, Terminology of polymers, Classification of polymers.<br>**Thermoplastics:** Brief introduction to raw materials, properties, additives and processing and applications of Commodity Plastics, Engineering Plastics and Speciality Plastics, raw material grades, material manufacturers.<br>**Thermoset materials:** Brief introduction to raw materials, properties and applications, grades and material manufacturers.<br>**Oven / Pre Drier:** Different types of pre drying methods, Purpose, structure, function, process and maintenance.<br>**Fundamentals of Plastics Processing Techniques:** Different Types of Processes - Description and Limitation - Processing Flow Chart - Selecting a Process–Process Advantage of Plastics over Conventional Materials.<br>**Blow moulding:** Basic principles and definitions-Development of blow moulding industry- Processing Parameters-Temperature-Pressure and cycle time Components – Materials requirements related to process and product performance-Materials used-Limitations in product design presented by process characteristics-Design guide lines for optimum product performance and appearance-Equipment used-Hand and power operated equipment. Screw and Plunger Systems-Cross head and die design-Blow moulding machine features and operation including hydraulic and pneumatic electrical control systems-defects, causes and remedies.<br>Injection Blow Moulding-Stretch Blow Moulding - parison control, blow mould construction, cooling methods, mould venting, blow moulding of difficult articles like fuel tanks, odd shaped containers with handles, limitation in blow moulding, decoration of blow moulding products, hot stamping-multi colour printing-faults, causes and remedies.<br>**Rotational Moulding:** Basic principle – Material selection & Estimation through trial analysis – Type of machine – Process variables – Charge size – Wall thickness control – Heating and cooling system process requirement for the moulding of water tank – Dust bin, etc. Moulds for roto moulding, Application of rotational moulding – ejection & finishing – fault – causes & remedies – merits & demerits of rotational moulding process, Multicolor roto moulding process.<br>Extrusion process for pre colouring, pulveriser.<br>**Plastic testing and quality control**: Introduction to plastics testing and quality control.<br>• Behavioral Science and, Entrepreneurship development, Role of DIC and industrial policy, Banking and its assistance<br>• Industrial visit | Demonstration about personal, machine & electrical safety while working on blow moulding machines.<br>Description of Fitter, common hand tools, names, description and the material from which they are made, description of simple fittings, hacksawing, punching, filling, types of files, method of using drills, tapes and dies, study of measuring tools i.e. Vernier calliper, micrometre, etc.<br>**Hand Operated Blow moulding machine**: Study of Hand Blow Moulding M/cs, Free-sketch of M/c with parts & study of part-function, Specification of M/c, Study of Parison-die with sketch. Die-centering practice by Trainees, operation of Hand Blow Machines, to produce components observations, cycle-time analysis Procedure of operation and observations.<br>**Automatic Blow Moulding Machine:** Machine-setting Procedure, Parameter-setting Procedure, Method of Mould fixing & parison-die setting on the M/c, Practice by trainees to remove & fix the parison die to produce on appropriate Parison for blowing, type of blowing systems, operation-practice on different moulds, cycle-time analysis, process-faults & remedies<br>**Rotational Moulding:** Machine study in IRO, Process principle & sequence of operation, Raw material used & loading, Machine type, Mould clamping practice on the machine, Operation practice to produce roto moulded components, Heating & cooling method adopted, Cycle-time analysis, comparison of process with blow moulding & other processes.<br>Study and auxiliary machines for pre coloring (extrusion) pulverize etc.<br>**Scrap Grinding:** (i) M/c Study in IRO, specification of M/c, study of parts & function, Line Diagram of M/c. (ii) Operation-practice with different materials and output study in Kg/hour for different materials.<br>**Oven / Pre Drier:** Specification of machine, study of parts & function, operation practice with different materials & process temperature.<br>**Maintenance of blow moulding Machinery:** Types of maintenance, Repair and maintenance of various components used in blow moulding machines.<br>**Post operation techniques of plastic bottles and containers:** Finishing, pre coloring & printing.<br>Post operation techniques for roto moulding products. |

## List of Tools & Instruments (5 Nos. each for the batch size of 50)

1. Steel rule 15 cm with metric Graduations
2. Measure Tape
3. Outside, inside spring calliper
4. Spring divider
5. Try square
6. Combination plier
7. Cutting plier
8. Screwdriver 15 cm
9. Screwdriver set
10. D/E spanner set inch & mm
11. Allen key set inch & mm
12. Pipe wrench
13. Adjustable spanner
14. Hand Hacksaw frame adjustable
15. Hacksaw Blades
16. Bench vice with working table
17. Portable Hand drill 0-6mm with drill bits
18. Centre punch
19. Chisel
20. Flat file second cut & smooth
21. Half round file second cut & smooth
22. Needle file rough & smooth
23. Ball peen hammers
24. Plastic hammer (Soft)
25. Mould Clamping Block
26. Micrometre 0-25 mm
27. Vernier calliper
28. Thickness gauge
29. Electric line Tester
30. Multi meter
31. Test lamp
32. Electric Extension Board with 15A sockets & switches

33. Electric switches, fuses, holders, lamps, teakwood boards, plug sockets, solder, flux, wires and cables and other consumables.
34. Copper rods and strips.

## List of Machinery & Equipment (1 No. each for the batch size of 50)

1. Hand Operated Blow Moulding Machine
2. Hand operated Rotomolding machine with mould
3. Semi Auto Blow Moulding Machine
4. Fully Auto Blow Moulding Machine with shuttle type.
5. Microprocessor Based Fully Automatic Blow Moulding Machine (with Parison Programming)
6. Twin Head Blow Moulding Machine with ram type
7. Colour Blender
8. Parison Cutter / Hot knife cutter
9. Drier /Oven
10. Air Compressor
11. Roto Moulding Machine with attachments
12. Pulverizer
13. Rotary Printing Machine (Blow Moulded Product)
14. Scrap Grinder
15. Hydraulic Trainer
16. Pneumatic Trainer
17. Hopper loader
18. Chilling unit
19. Blow lamp
20. Gas cylinder for roto mould heating

## Raw material

As required for the batch size, the quantity of plastics raw materials can be procured.

## Instructor

Three instructors - (Instructor: Student=1:20 ratio)

## Qualification for Instructor

Diploma in Plastics Technology / Polymer Engineering / Equivalent with relevant experience / Post Graduate Dimploma in Plastics Processing & Testing

**Space Required**

Minimum 2000 Sq. ft.

Course Name: **PLASTICS RECYCLING MACHINE OPERATIONS (PRMO)**

**Sector** : Plastic Processing Industries

**Code** : PLA605

**Terminal Competency** : On successful completion of training a person will be having adequate knowledge on

- Plastics and its significance over conventional materials, Source of plastics, plastics products, plastics waste and its recyclability.
- Able to operate manual and automatic processing machines and recycling of plastic waste, take care of machine maintenance and trouble shooting.

**Duration** : 1200 Hrs

**Eligibility** : $8^{th}$

**Age Limit** : Minimum 17 years

**Course Contents** :

| Theory (240 Hrs.) | Practical (960 Hrs.) |
|---|---|
| Importance of safety and general precautions observed in plastic processing work shop.<br>**Fitter Tools &Fitting Equipments**: Description of Fitter, common hand tools, names, description and the material from which they are made, description of simple fittings, hacksawing ,punching, filling, types of files, method of using drills, tap's and dies, study of measuring tools i.e. Vernier calliper, micrometre etc.<br>**Introduction:** Polymers, Fundamentals, Terminology of polymers, Classification of polymers.<br>**Thermoplastics:** Brief introduction to raw materials, properties, additives and processing and applications of Commodity Plastics, Engineering Plastics and Speciality Plastics, Raw material grades.<br>**Thermoset materials:** Raw materials, properties, additives and processing and applications.<br>**Oven / Pre Drier:** Different types of pre drying methods, Purpose, structure, function, process and maintenance.<br>**Fundamentals of Plastics Processing Techniques:** Different Types of Processes - Description and Limitation - Processing Flow Chart - Selecting a Process–Process Advantage of Plastics over Conventional Materials.<br>Basic Process Principle - Machine rating and Specification - Types of Machines – Parts and its functions - Start-up and shut down procedure - Operation procedure - Type of Screw and its function - Heating System - Process variables - Purging - Material recommendation and Trouble Shooting of Injection moulding machine, extrusion machine, blow moulding machine and compression moulding machine | Demonstration about personal, machine & electrical safety while working on hand operated plastics processing machines.<br>Description of Fitter, common hand tools, names, description and the material from which they are made, description of simple fittings,hacksawing,punching,filling,types of files, method of using drills, tapes and dies, study of measuring tools i.e. Vernier calliper, micrometre etc.<br>**Hand Operated plastics processing Machine**: Study of machine in Idle-Run Observation (IRO), parts & functions, operating principles, free sketch of machine parts e.g. Nozzle, Torpedo, Hopper, Rack & Pinion Barrel etc., shot capacity definition. Operation practice to produce moulding on different hand injection moulds. Moulding Conditions, Recording the observation and results in practical record book. Study of hand Blow Moulding machines, free-sketch of M/c with parts & study of part function, specification of machine, Study of parison-die with sketch.<br>**Semi/auto processing machines:**<br>**Injection moulding machines**- (i) Study of semi automatic Injection moulding machines of all types in IRO. Comparative study of Pneumatic type & Hydraulic type of machines operating principles of machines with nomenclature of parts, machines specifications. (ii) Operation of Pneumatic & Hydraulic type of Semi automatic Injection moulding machines, to produce components in different moulds. Cycle-time analysis, observations of process parameters & Procedure to be recorded. Idle-run observation (IRO) & study of injection unit, Clamping unit, Process –control knobs, safety precautions, start-up procedure, shut-down procedure, sketch of machine platens, Clamping system, type of nozzle used in machine etc., study of hydraulic system used in the machine.<br>**Blow-Moulding -** Technical specification of machine, Mould clamping on machines. Machine-setting Procedure, Parameter Setting Procedure, Method of mould fixing & Parison-die setting on the machine, type of blowing systems, operation-practice on different moulds, cycle-time analysis, process-faults & remedies.<br>**Extrusion process:** Free sketch of machines, their parts and function, product type. Study of different types of extrusion process. Procedure for setting up of process-parameters eg. Temperature on different zones, screw speed, Nip-roller speed, Winder speed, Blow ratio, Control of cooling. Operation practice in running the machine to produce Pipe/tube/Film. Thermoforming process. |

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| **Need for recycling:** Source of Plastics waste generating, Sorting and segregation of waste, Plastics identification, Plastics production and composition, Plastics waste: Composition, quantities and disposal, alternative types of recycle methods.<br><br>**Primary Recycling:** Equipments for primary recycling, Specific recycling technique for PE films, PP battery cases, Crushing and separation of PET films and bottles<br>**Recycling of plastics from urban waste**: Waste containing paper- hydrolytic treatment, processing of mixed plastics waste, household waste, industrial sector, TPO based materials.<br>**Waste Management:** Medical Plastic generation, medical waste handling methods, Waste management of plastics packaging, effective management of plastics woven sacks, Solid waste generation, municipal solid waste management, infectious waste management, emerging processing technologies for waste reusage<br>**Plastic testing and quality control**: Introduction to plastics testing and quality control.<br>• Behavioral Science and Entrepreneurship development, Role of DIC and industrial policy, Banking and its assistance<br>• Industrial visit<br>• Input of 5S & TPM concept | **Compression and Transfer moulding:** Comparison of compression moulding machine with Injection Moulding machine. Operating Principle of Compression Press, mould setting procedure & parameter setting, operational practice on different compression and transfer moulds, Machine specification.<br>**Plastics Recycling Techniques:** Types and source of plastics waste; Collection and segregation of plastics waste : a) collection of plastics waste, b) Segregation of plastics waste by simple waste by simple identification technique, c) segregation technique based on density d) Segregation by selective dissolution e) equipments based sorting technique. f) Advantage and Disadvantage of NIR (Near Infra red) based sorting system. g) Separation of other materials (melt filtration)<br>**Maintenance of Plastics Processing Machinery:** Types of maintenance Repair and maintenance of various components used in plastics processing machinery.<br>**Basic Mechanical Recycling Plant:** Shredder & Scrap Grinder (Pre washing, Cleaning, Washing & Drying, Agglomerator, Force feeder, Extruder, Screen Changer, Strand Dry. Recycling symbols on plastics - Complications and limitations of recycling of plastics - Recycling of consumer waste - Recycling of industrial waste.<br>**Different size reduction Techniques:** 1. Cutting process 2. Wet size reduction 3. Densification process 4. Pulverization process<br>**Oven / Pre Drier:** Specification of machine, study of parts & function, operation practice with different materials & process temperature.<br>Introduction to Scrap Grinding, Advanced plastics Processing Techniques and Post operation techniques of plastics products |

## List of Tools & Instruments (5 Nos. each for the batch size of 50)

1. Steel rule 15 cm with metric Graduations
2. Measure Tape
3. Outside, inside spring calliper
4. Spring divider
5. Try square
6. Combination plier
7. Cutting plier
8. Screwdriver 15 cm
9. Screwdriver set
10. D/E spanner set inch & mm
11. Allen key set inch & mm
12. Pipe wrench
13. Adjustable spanner
14. Hand Hacksaw frame adjustable
15. Hacksaw Blades
16. Bench vice with working table
17. Portable Hand drill 0-6mm with drill bits
18. Centre punch
19. Chisel
20. Flat file second cut & smooth
21. Half round file second cut & smooth
22. Needle file rough & smooth
23. Ball peen hammers
24. Plastic hammer (Soft)
25. Mould Clamping Block
26. Micrometre 0-25 mm
27. Vernier calliper

28. Thickness gauge
29. Electric line Tester
30. Multi meter
31. Test lamp
32. Electric Extension Board with 15A sockets & switches
33. Electric switches, fuses, holders, lamps, teakwood boards, plug sockets, solder, flux, wires and cables and other consumables.
34. Copper rods and strips.

## List of Machinery & Equipment (1 No. each for the batch size of 50)

1. Processing Machinery – Injection Moulding, Blow Moulding & Compression Moulding
2. Recycling Extruder with pelletizing machine
3. Scrap Grinder (Heavy Duty)
4. Recycling Extruder for Film with attachments
5. Colour Blender
6. Drier /Oven
7. Fully Automatic Recycling Plant with die face cutter
8. Pulverizar
9. Agglorameteer
10. Agitator
11. Washing unit
12. Kit for simple plastic identification
13. Grinding machine for film

## Raw material

As required for the batch size, the quantity of plastics raw materials can be procured.

## Instructor

Three instructors - (Instructor: Student=1:20 ratio)

## Qualification for Instructor

Diploma in Plastics Technology / Polymer Engineering / Equivalent with relevant experience

## Space Required

Minimum 3000 Sq. ft.

**Course Name: FRP PRODUCTS MANUFACTURING OPERATIONS (FPMO)**

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|---|---|---|
| **Sector** | : | Plastic Processing Industries |
| **Code** | : | PLA606 |
| **Terminal Competency** | : | On successful completion of training person will be having adequate knowledge on<br>• Plastics and its significance over conventional materials & plastics products.<br>• Able to make Fibre reinforced plastics (FRP) products, able to operate compression moulding machine, take care of machine maintenance and trouble shooting. |
| **Duration** | : | 800 Hrs |
| **Eligibility** | : | $8^{th}$ |
| **Age Limit** | : | Minimum 17 years |
| **Course Contents** | : | |

| Theory (160 Hrs.) | Practical (640 Hrs.) |
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| Importance of safety and general precautions observed in plastic processing work shop.<br>**Fitter Tools &Fitting Equipments**: Description of Fitter, common hand tools, names, description and the material from which they are made, description of simple fittings, hacksawing, punching, filling, types of files, method of using drills, tapes and dies, study of measuring tools i.e. Vernier calliper, micrometre etc.<br>**Introduction:** Polymers, Fundamentals, Terminology of polymers, Classification of polymers.<br>**Thermoplastics:** Brief introduction to raw materials, properties, additives and processing and applications of commodity plastics, material manufacturers.<br>**Thermoset materials:** Raw materials, properties, material manufacturers, additives and processing and applications.<br>Introduction of SMC, BMC, DMC.<br>**Oven / Pre Drier:** Different types of pre drying methods, Purpose, structure, function, process and maintenance.<br>**Fundamentals of Plastics Processing Techniques:** Different Types of Processes - Description and Limitation - Processing Flow Chart - Selecting a Process–Process Advantage of Plastics over Conventional Materials.<br>**Fibre reinforced plastics:** Composites-matrix-fibres-FRP additives. Comparison of FRP products over conventional materials like metal, wood and ceramic. Fundamentals of FRP process- Introduction to hand lay-up process**,** spray up process, vacuum and presser bag moulding, autoclave, resin transfer moulding, centrifugal casting, filament winding process and pultrusion process and their applications.<br>**Compression moulding & Transfer moulding:** Fundamental principles-Meaning of terms-Bulk factor and flow properties as applied to moulding materials-The methods adopted for estimating these properties and their limitations Process variables-Inter relation between flow properties-Curing time-Mould temperature and Pressure requirements-Preforms and preheating-Techniques of preheating-Machines used-Common moulding faults and their correction-Finishing of mouldings.<br>**Plastic testing and quality control**: Introduction to plastics testing.<br><br>• Behavioral Science and, Entrepreneurship development, Role of DIC and industrial policy, Banking and its assistance<br><br>• Industrial visit | Demonstration about personal, machine & electrical safety while working with chemicals and compression moulding machines.<br>Description of Fitter, common hand tools, names, description and the material from which they are made, description of simple fittings, hacksawing ,punching, filling, types of files, method of using drills, tapes and dies, study of measuring tools i.e. Vernier calliper, micrometre etc.<br>**FRP product manufacturing:** Mould for FRP product making-resin requirement-gel coat-gel point-accessories used in FRP product making. Advantages of FRP to common plastics.<br>Demonstration on hand and spray up, lay-up process, modified lay-up process, curing and cooling method- product ejection-cycle time analysis. Fault , causes and remedies in FRP products-trimming and finishing-product handling<br>Demo in making of FRP products like tray, helmet, dust pin etc. hand layup process, spray up process, RTM process and vacuum intrusion process.<br>**Compression and Transfer moulding:** Comparison of compression moulding machine with Injection Moulding machine. Operating Principle of Compression Press, mould setting procedure & parameter setting, operational practice on different compression and transfer moulds, Machine specification.<br>**Oven / Pre Drier:** Specification of machine, study of parts & function, operation practice with different materials & process temperature.<br>**Maintenance:** Types of maintenance, repair and maintenance of various mould used in FRP product manufacturing, Maintenance of compression moulding machine. |

## List of Tools & Instruments (5 Nos. each for the batch size of 50)

1. Steel rule 15 cm with metric Graduations
2. Measure Tape
3. Outside, inside spring calliper
4. Spring divider
5. Try square

6. Combination plier
7. Cutting plier
8. Screwdriver 15 cm
9. Screwdriver set
10. D/E spanner set inch & mm
11. Allen key set inch & mm
12. Pipe wrench
13. Adjustable spanner
14. Hand Hacksaw frame adjustable
15. Hacksaw Blades
16. Bench vice with working table
17. Portable Hand drill 0-6mm with drill bits
18. Centre punch
19. Chisel
20. Flat file second cut & smooth
21. Half round file second cut & smooth
22. Needle file rough & smooth
23. Ball peen hammers
24. Plastic hammer (Soft)
25. Mould Clamping Block
26. Micrometre 0-25 mm
27. Vernier calliper
28. Thickness gauge
29. Electric line Tester
30. Multi meter
31. Test lamp
32. Electric Extension Board with 15A sockets & switches
33. Electric switches, fuses, holders, lamps, teakwood boards, plug sockets, solder, flux, wires and cables and other consumables.
34. Copper rods and strips.

## List of Machinery & Equipment (1 No. each for the batch size of 50)

1. Hand layup equipment's
2. Spray layup equipments
3. Vacuum bag moulding machine

4. Compression moulding press with multi jack
5. Resin transfer moulding machine
6. Filament winding machine
7. Oven
8. Air Compressor
9. PU Injector for Insulating the FRP Door & Frames
10. Various Moulds
11. Utility equipment (Refrigerator etc.)

## Raw material

As required for the batch size, the quantity of plastics raw materials can be procured.

## Instructor

Three instructors - (Instructor: Student=1:20 ratio)

## Qualification for Instructor

Diploma in Plastics Technology / Polymer Engineering / Equivalent with relevant experience / Post Graduate Diploma in Plastics Processing & Testing

## Space Required

Minimum 3000 Sq. ft.

**Course name:** **PLASTICS SACKS MACHINE OPERATIONS (PSMO)**

**Sector** : Plastic Processing Industries

**Code** : PLA607

**Terminal Competency** : On successful completion of training person will be having adequate knowledge on

- Plastics and its significance over conventional materials, Source of plastics, types of plastics and their amenability to process in extrusion woven sacks machineries.
- Able to operate extrusion machine for producing plastic woven sacks.

**Duration** : 800 Hrs

**Eligibility** : $8^{th}$

**Age Limit** : Minimum 17 years

**Course Contents** :

| Theory (160 Hrs.) | Practical (640 Hrs.) |
|---|---|
| Importance of safety and general precautions observed in plastic processing work shop.<br>**Fitter Tools &Fitting Equipments**: Description of Fitter, common hand tools, names, description and the material from which they are made, description of simple fittings, hacksawing, punching, filling, types of files, method of using drills, tap's and dies, study of measuring tools i.e. Vernier calliper, micrometre etc.<br>**Introduction:** Polymers, Fundamentals, Terminology of polymers, Classification of polymers, material grades, raw material manufacturers.<br>**Thermoplastics:** Brief introduction to raw materials, properties, additives and processing and applications of Commodity Plastics, Engineering Plastics and Speciality Plastics, raw material grades, material manufacturers.<br>**Thermoset materials:** Brief introduction to raw materials, properties and applications, material manufacturers.<br>**Fundamentals of Plastics Processing Techniques:** Different Types of Processes - Description and Limitation - Processing Flow Chart - Selecting a Process–Process Advantage of Plastics over Conventional Materials.<br>**Extrusion Process:** Basic Process Principle - Machine rating and Specification - Types of Machines – Parts and its functions - Start-up and shut down procedure - Operation procedure - Type of Screw and its function - Heating System - Process variables - Purging - Material recommendation and Trouble Shooting of Extrusion Techniques, Different parts of Extruder, Parameter Setting, Blown film extruder for woven sack tape, Sheet extruder for woven sack tape, Process, post extrusion process, start-up & short-down procedure, Die Setup, Process Setup, Process Documentation, Calculation, Trouble Shooting.<br>**Plastic testing and quality control**: Introduction to plastics testing and quality control.<br>• Behavioral Science and, Entrepreneurship development , Role of DIC and industrial policy, Banking and its assistance | Demonstration about personal, machine & electrical safety while working on extrusion machines.<br>Description of Fitter, Common Hand Tools, Names, Description and the Material from which they are made. Description of simple fittings, Hack sawing, punching, filing, Types of files Method of using drills, taps and dies. Study of measuring tools i.e. vernier caliper, micrometer, thickness gauge, measuring tapes etc<br>**Woven sacks manufacturing by Extrusion process:** Free sketch of machines, Study of extruders in IRO, Free sketch of machines, their parts and parts-function, List of products manufactured by Extrusion process. Study of different types of extrusion process. Procedure for setting up of process-parameters eg. Temperature on different zones, screw speed, Nip-roller speed, Winder speed, Blow ratio, Control of cooling-Air on bubble, Methodology & Practice by trainees to fix the Blown film die on M/c. Familiarization of Die-parts & their function, technical specification of machines, defects, causes & remedies, Practice of operating machine to produce different sizes of blown film. Study of the machine parts & function from screw drive to the caterpillar. Practice of Die setting on the machine, Procedure for setting up of parameters & operation practice in running the machine to produce woven sacks.<br>**Maintenance of extrusion Machinery:** Types of maintenance, repair and maintenance of following components used in plastics processing machinery - Barrel, screw, thrust unit, primary gear boxes, calendar roll, mill roll - Pumps – gear pump, piston pump, radial/axial pump and screw pump - Valves, valve sequences, valve counted balance, break valve, pressure reducing valve throttle valve, different control valves - Solenoid valves, Hydraulic motors, hydraulic actuators, filters, compressors, oil seals, O-rings - lubrication system-central lubrication system - transmission system i.e. gears, V-belts, Chains.<br>Introduction to Scrap Grinding, and Post operation techniques of woven sacks. |

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| • Industrial visit | |

## List of Tools & Instruments (5 Nos. each for the batch size of 50)

1. Steel rule 15 cm with metric Graduations
2. Measure Tape
3. Outside, inside spring calliper
4. Spring divider
5. Try square
6. Combination plier
7. Cutting plier
8. Screwdriver 15 cm
9. Screwdriver set
10. D/E spanner set inch & mm
11. Allen key set inch & mm
12. Pipe wrench
13. Adjustable spanner
14. Hand Hacksaw frame adjustable
15. Hacksaw Blades
16. Bench vice with working table
17. Portable Hand drill 0-6mm with drill bits
18. Centre punch
19. Chisel
20. Flat file second cut & smooth
21. Half round file second cut & smooth
22. Needle file rough & smooth
23. Ball peen hammers
24. Plastic hammer (Soft)
25. Mould Clamping Block
26. Micrometre 0-25 mm
27. Vernier calliper
28. Thickness gauge
29. Electric line Tester
30. Multi meter
31. Test lamp
32. Electric Extension Board with 15A sockets & switches
33. Electric switches, fuses, holders, lamps, teakwood boards, plug sockets, solder, flux, wires and cables and other consumables.
34. Copper rods and strips.

## List of Machinery & Equipment (1 No. each for the batch size of 50)

1. Blown film extruder with attachment for Woven Sack tape
2. Cast film extruder with attachment for Woven Sack tape plant
3. Weaving loom
4. Lamination machine
5. Printing Machine roto gravure
6. Cutting & Bottom Stitching Machine
7. Corona Treater
8. Grinding for films
9. Agglomerator

## Raw material

As required for the batch size, the quantity of plastics raw materials can be procured.

## Instructor

Three instructors - (Instructor: Student=1:20 ratio)

## Qualification for Instructor

Diploma in Plastics Technology / Polymer Engineering / Equivalent with relevant experience / Post Graduate Diploma in Plastics Processing & Testing

## Space Required

Minimum 3000 Sq. ft.

**Course Name: PLASTICS PIPE FITTING & JOINING OPERATIONS (PPFJO)**

**Sector** : Plastic Processing Industries
**Code** : PLA608
**Terminal Competency** : On successful completion of training person will be having adequate knowledge on

- Plastics and its significance over conventional materials, Source of plastics, types of plastics and their amenability to process in extrusion machineries and plastics pipes & fitting and their joining.

- Able to fabricate / join plastic pipes and fitting for installation.

**Duration** : 800 Hrs
**Eligibility** : $8^{th}$
**Age Limit** : Minimum 17 years
**Course Contents** :

| Theory (160 Hrs.) | Practical (640 Hrs.) |
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| Importance of safety and general precautions observed in fitting shop.<br>**Fitter Tools &Fitting Equipments**: Description of Fitter, common hand tools, names, description and the material from which they are made, description of simple fittings, hacksawing, punching, filling, types of files, method of using drills, tap's and dies, study of measuring tools i.e. Vernier calliper, micrometre etc.<br>**Introduction:** Polymers, Fundamentals, Terminology of polymers, Classification of polymers.<br>**Thermoplastics:** Brief introduction to raw materials, properties, additives and processing and applications of Commodity Plastics, Engineering Plastics and Speciality Plastics.<br>**Thermoset materials:** Brief introduction to raw materials, properties and applications.<br>**Fundamentals of Plastics Processing Techniques:** Different Types of Processes - Description and Limitation - Processing Flow Chart - Selecting a Process–Process Advantage of Plastics over Conventional Materials.<br>Basic Process Principle - Machine rating and Specification - Types of Machines – Parts and its functions - Start-up and shut down procedure - Operation procedure in extrusion pipe manufacturing.<br>**Introduction to Injection Moulding:** Basic Process Principle - Machine rating and Specification - Types of Machines – Construction - Parts and its functions - Start-up and shut down procedure - Operation procedure - Clamping system - Type of Screw and its function - Heating System - Ejection system – Back Pressure - Suck back - Drooling - Nozzle Type - Process variables - Moulding cycle - Purging - Material recommendation, PVC injection moulding machine & Mould consideration, polyolefin fittings and moulding process.<br>**Auxiliary Equipment related to Fittings & Joining:** Introduction to PVC Solvent Cement, Different Bodies (Heavy, Medium, Normal), Its applications, Procedure of Joining, Joining of Plastics to Plastics by Solvent, heat joining, Joining of Plastics to metal with different procedure, Blow lamp – parts. Soldering, soldering iron – types of solders, uses, flux – function, classes, types. Brazing – type's spelters – advantages of brazing, Hot plate welding for HDPE.<br>• Behavioral Science and, Entrepreneurship development, Role of DIC and industrial policy, Banking and its assistance.<br>• Industrial visit. | Demonstration about personal, machine & electrical safety while working fitting and joining accessories.<br><br>Description of Fitter, Common Hand Tools, Names, Description and the Material from which they are made. Description of simple fittings, Hack sawing, punching, filing, Types of files Method of using drills, taps and dies. Study of measuring tools i.e. vernier caliper, micrometer, thickness gauge, measuring tapes etc<br>**PVC and HDPE pipes Joining & Fittings:** Introduction to plastics processing techniques used for making pipe fittings, Basic parts of extruder and its function, Start-up and short-down procedure, Cooling arrangement, blower, stretching unit and its function, orientation, take-off unit, Die gap adjustment tools, Different parameter setting, Calculation of production rate, PVC fitting like tee, elbow, coupling,etc. produced by injection moulding process. Hot plate welding of HDPE pipes.<br>Materials used in plumbing ferrous metals – pigiron, cast iron and steels. Pipes and tubes: selection of material for construction. Non ferrous metals like copper, brass, tin, lead, gun metal, zinc, aluminum, etc. Non metallic material like PVC, Teflon etc. Corrosion on metals and prevention – types. Non metallic and metallic coatings.<br><br>Pipes – types – G.I., PVC, C.I., SW and AC pipes. Uses, advantages and disadvantages of each pipe for various applications. Pipe cutter – types – uses. Colour code of pipes – identification of pipes through colour (different uses such as hot water, chemical, gas etc.), usage of solvents.<br><br>**Maintenance**: Types of maintenance, maintenance management of extrusion process & injection moulding industry, maintenance of joining and fitting equipments. |

## List of Tools & Instruments (5 Nos. each for the batch size of 50)

1. Steel rule 15 cm with metric Graduations
2. Measure Tape
3. Outside, inside spring calliper
4. Spring divider
5. Try square

6. Combination plier
7. Cutting plier
8. Screwdriver 15 cm
9. Screwdriver set
10. D/E spanner set inch & mm
11. Allen key set inch & mm
12. Pipe wrench
13. Adjustable spanner
14. Hand Hacksaw frame adjustable
15. Hacksaw Blades
16. Bench vice with working table
17. Portable Hand drill 0-6mm with drill bits
18. Centre punch
19. Chisel
20. Flat file second cut & smooth
21. Half round file second cut & smooth
22. Needle file rough & smooth
23. Ball peen hammers
24. Plastic hammer (Soft)
25. Mould Clamping Block
26. Micrometre 0-25 mm
27. Vernier calliper
28. Thickness gauge
29. Electric line Tester
30. Multi meter
31. Test lamp
32. Electric Extension Board with 15A sockets & switches
33. Electric switches, fuses, holders, lamps, teakwood boards, plug sockets, solder, flux, wires and cables and other consumables.
34. Copper rods and strips.

## List of Machinery & Equipment (1 No. each for the batch size of 50)

1. Injection Moulding Machine for PVC Moulded Fittings

2. Micro Processor Machine with Core Attachment drives for Processing of PVC Material.
3. Butt Joining Machine with Different Attachment
4. Compressor
5. PVC Belling Machine for Friction.
6. Welding & Joining Attachment for HDPE Pipe Joining & Welding.
7. Mechanized Saw
8. Pedestal Grinding Machine
9. Hand Grinding Machine
10. Hot plate welding equipment
11. Blow lamp
12. Welding extruder (liester)
13. Hot air gun
14. Polishing kit
15. Spin welding equipment
16. High frequency welding equipment
17. Ultrasonic welding equipment
18. Pipe enlarging mandrels

## Raw material

As required for the batch size, the quantity of plastics raw materials can be procured.

## Instructor

Three instructors - (Instructor: Student=1:20 ratio)

## Qualification for Instructor

Diploma in Plastics Technology / Polymer Engineering / Equivalent with relevant experience / Post Graduate Diploma in Plastics Processing & Testing

## Space Required

Minimum 1000 Sq. ft.

**Course name: PVC PIPE THREADING MACHINE OPERATIONS (PPTMO)**

**Sector** : Plastic Processing Industries
**Code** : PLA609
**Terminal Competency** : On successful completion of training person will be having adequate knowledge on

- Plastics and its significance over conventional materials, process of PVC & PO pipes and threading machineries.
- Able to operate lathe machine for making thread on PVC & PO pipes for joining.

**Duration** : 800 Hrs
**Eligibility** : $8^{th}$
**Age Limit** : Minimum 17 years
**Course Contents** :

| Theory (160 Hrs.) | Practical (640 Hrs.) |
|---|---|
| Importance of safety and general precautions observed in fitting shop.<br>**Fitter Tools &Fitting Equipments**: Description of Fitter, common hand tools, names, description and the material from which they are made, description of simple fittings, hacksawing, punching, filling, types of files, method of using drills, tapes and dies, study of measuring tools i.e. Vernier calliper, micrometre etc.<br>**Introduction:** Polymers, Fundamentals, Terminology of polymers, Classification of polymers.<br>**Thermoplastics:** Brief introduction to raw materials, properties, additives and processing and applications of Commodity Plastics, Engineering Plastics and Speciality Plastics.<br>**Thermoset materials:** Brief introduction to raw materials, properties and applications.<br>**Marking Tools** - Scriber – surface gauges – dividers – V-blocks – Engineer's Parallels – Angle plates – surface plates.<br>**Measuring Instruments** - construction, application and least count. Steel rule – try square – vernier calipers – Vernier height gauges – Micrometers – outside & inside – depth micrometer – height Master – Bore gauges –slip gauges/Pins,.<br>**Standard Gauges** – Types of gauges, Radius gauge, Feeler gauge, Pitch Screw gauge, Taper wire & Thickness gauge, Plain gauge, Plug gauge, Snap gauge, Ring gauge, Combined limit gauge, Position gauge, Taylor's principle of gauge design, Important points for gauge design.<br>**Angular & Taper measurements** – Bevel Protractors and its types-combination set -Sine bar, Sine table and Sine centre - Angle gauges-Auto Collimator-Measurement of Taper using balls & Rollers.<br>**Geometrical Measurements –** Straightness, Flatness, Parallelism, Squareness, Concentricity.<br>**NC Machines** – Basic components of NC system - NC procedure- NC coordinate systems - Types of motion – NC format -Numerical control vs Conventional machine tools - Advantages & Disadvantages of NC machines.<br>**CNC Machine Tools**-Introduction - Comparision of CNC with NC system-functions of CNC Control in Machine tools-types of CNC system-According to - types of motion control systems, programming modes & control loops–Analog and digital controls, Modes of machine operation in CNC machine, Advantages & Disadvantages of CNC machines. Different types of CNC machine tools, introduction to part programming, Trouble shooting of CNC machines- safety & maintenance of CNC machines.<br>**Lathe and Turning Centre**-Difference between machining centre and turning centre-axis designation of CNC lathe- types & classification of CNC lathe- cutting tools and tool holding devices-work holding devices- | Demonstration about personal, machine & electrical safety while working fitting and joining accessories.<br>Description of Fitter, Common Hand Tools, Names, Description and the Material from which they are made. Description of simple fittings, Hack sawing, punching, filing, Types of files Method of using drills, taps and dies. Study of measuring tools i.e. vernier caliper, micrometer, thickness gauge, measuring tapes etc<br>**Pedestal Grinding:** Sharpening of cutting tools - single point, knife tools, Form tools, parting and grooving tools, thread cutting tools.<br>**Lathe Work:** Familiarization with lathes-principal parts, work holding device, Cutting tools & tool holding device, Plain turning and Step turning, Taper turning (Internal & External), Drilling and Reaming, Boring and counter boring, Forming and grooving, Thread cutting and knurling, Combination of above operations Eccentric turning.<br>Practical orientation in different thread gauges of ferrous and non ferrous (Plastics).<br>**Lathe and Turning** -Difference between machining centre and turning centre-axis designation of CNC lathe- types & classification of CNC lathe- cutting tools and tool holding devices-work holding devices- part programming structure and format-coordinate system for CNC lathe.<br>Study of standards as per IS 1239.<br>Study of threading standards as per DIN 2999 & 4925 Manufacturing of plague gauges for male & ring gauge for female thread.<br>Introduction to plastics processing techniques used for making pipe , Basic parts of extruder and its function, Start-up |

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| part programming structure and format-coordinate system for CNC lathe-Preparatory and miscellaneous functions and formats of CNC turning programs-Canned cycles for CNC turning operations-simple programming for CNC lathe operation for making mould elements.<br><br>**Fundamentals of Plastics Processing Techniques:** Different Types of Processes - Description and Limitation -Process Advantage of Plastics over Conventional Materials.<br>Manufacturing of pipes by extrusion process-Introduction- Pipes types – G.I., PVC, C.I., SW, PO and AC pipes. Uses, advantages and disadvantages of each pipe for various applications. Pipe cutter – types – uses. Colour code of pipes.<br>• Behavioral Science and, Entrepreneurship development, Role of DIC and industrial policy, Banking and its assistance.<br><br>• Industrial visit. | and short-down procedure, Cooling arrangement, blower, stretching unit and its function, orientation, take-off unit, Die gap adjustment tools, Different parameter setting, Calculation of production rate, PVC fitting like tee, lebow, coupling etc..<br>Pipes – types – G.I., PVC, C.I., SW, PO and AC pipes. Uses, advantages and disadvantages of each pipe for various applications. Pipe cutter – types – uses. Colour code of pipes – identification of pipes through colour (different uses such as hot water, chemical, gas etc.)<br>Maintenance of threading machineries. |

## List of Tools & Instruments (5 Nos. each for the batch size of 50)

1. Steel rule 15 cm with metric Graduations
2. Measure Tape
3. Outside, inside spring calliper
4. Hermaphrodite Caliper
5. Spring divider
6. Compass
7. Try square
8. Bevel Try Square
9. Combination Set
10. Combination plier
11. Cutting plier
12. Screwdriver 15 cm
13. Screwdriver set
14. D/E spanner set inch & mm
15. Allen key set inch & mm
16. Pipe wrench
17. Adjustable spanner
18. Hand Hacksaw frame adjustable
19. Hacksaw Blades
20. HSS Tool Bit
21. Boring bar
22. Knurling tool
23. Bench vice with working table
24. Portable Hand drill 0-6mm with drill bits
25. Centre punch

26. Sleeve
27. Centre Drill
28. Drill chuck
29. Chisel
30. Scriber
31. Ordinary Scribing Block
32. Universal Scribing Block
33. V-block
34. Angle Plate
35. Plunger Dial
36. Flat file second cut & smooth
37. Half round file second cut & smooth
38. Needle file rough & smooth
39. Ball peen hammers
40. Plastic hammer (Soft)
41. Mould Clamping Block
42. Micrometre
43. Digital Micrometre 0-25 mm
44. Vernier Calliper
45. Digital Vernier calliper
46. Thickness gauge
47. Bore Gauge
48. Surface Gauge
49. Electric line Tester
50. Multi meter
51. Test lamp
52. Electric Extension Board with 15A sockets & switches
53. Electric switches, fuses, holders, lamps, teakwood boards, plug sockets, solder, flux, wires and cables and other consumables.

## List of Machinery & Equipment (1 No. each for the batch size of 50)

1. Conventional Lathe Machine
2. Tools for Lathe Machine
    - Face Grooving Tool
    - Turning Tool
    - Grooving Tool (Parting Off)
    - Thread cutting tool

- Internal Thread cutting tool
- Boring tool

## Instructor

Three instructors - (Instructor: Student=1:20 ratio)

## Qualification for Instructor

Diploma in Plastics Technology / Polymer Engineering / Equivalent with relevant experience

## Space Required

Minimum 1000 Sq. ft.

**Course name:** **TESTING & QUALITY CONTROL FOR PLASTICS MATERIALS & PRODUCTS (TQC)**

**Sector** : Plastic Processing Industries
**Code** : PLA610
**Terminal Competency** : On successful completion of training person will be having adequate knowledge on

- Plastics and its significance over conventional materials & plastics products.
- Able to identify and test plastics products by a suitable standard method and manage to control the testing lab environment.

**Duration** : 800 Hrs
**Eligibility** : $10^{th}$
**Age Limit** : Minimum 17 years
**Course Contents** :

| Theory (160 Hrs.) | Practical (640 Hrs.) |
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| Importance of safety and general precautions observed in plastic testing laboratory.<br>**Fitter Tools &Fitting Equipments**: Description of Fitter, common hand tools, names, description and the material from which they are made, description of simple fittings, hacksawing, punching, filling, types of files, method of using drills, tapes and dies, study of measuring tools i.e. Vernier calliper, micrometre etc.<br>**Introduction:** Polymers, Fundamentals, Terminology of polymers, Classification of polymers.<br>**Thermoplastics:** Brief introduction to raw materials, properties, additives and processing and applications of Commodity Plastics, Engineering Plastics and Speciality Plastics, raw materials grade, Material manufacturers.<br>**Thermoset materials:** Brief introduction to raw materials, properties and applications, material manufacturers.<br>**Fundamentals of Plastics Processing Techniques:**<br>Different Types of Processes - Description and Limitation - Processing Flow Chart - Selecting a Process–Process Advantage of Plastics over Conventional Materials, specimen preparation machineries and equipments – injection moulding process – compression moulding process.<br>**Plastic Testing Techniques:** Concept of Testing-Need for Testing, Identification of plastics Standard and specifications-National & International standards-IS (BIS), ASTM standards**.**<br>Identification of common plastics materials by simple tests: visual inspection, density, combustion and solvents, analysis with common solvents.<br>Preconditioning and test condition-Testing of Mechanical, Thermal, Optical, Electrical, Permeability and Rheological Properties.<br>**Plastic Product Testing:** Testing of HDPE/ uPVC Pipes & Fittings, fil laminates and sheets, PET container, Water storage Tank , Woven Sacks ,FRP based products as per IS specification. Factors for design tests for newer products. Analysis of failure & its measurements, Facto affecting the quality of materials and products.<br>**Calibration: C**alibration of the testing equipments- necessity & Importance, frequency and maintenance of records.<br>**Laboratory Management Systems:** ISO 9001 Quality management systems and ISO-17025 Laboratory management systems (NABL). Implementation and compliance of ISO 9001, ISO-17025 & ISO | Demonstration about personal, machine & electrical safety while working on plastics testing machines.<br>**Fitter Tools &Fitting Equipments**: Description of Fitter, common hand tools, names, description and the material from which they are made, description of simple fittings, hacksawing, punching, filling, types of files, method of using drills, tapes and dies, study of measuring tools i.e. Vernier calliper, micrometre etc.<br>Conditioning and sample preparation by standard method.<br>**Products Testing as per IS /ASTM Standard:**<br>• Identification of plastics by simple method<br>• Determination of Melt Flow Index<br>• Determination of Tensile properties of plastics<br>• Determination of Ash/Filler Content<br>• Determination of Density/Specific Gravity<br>• Determination of Melting point<br>• Determination of Compressive strength<br>• Determination of Impact strength<br>• Determination of HDT/VSP<br>• Determination of opacity testing<br>• Testing of HDPE / uPVC Pipes & Fittings<br>• Testing of PET Containers for drinking |

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| 14000 Standards in Plastics manufacturing industry<br>• Behavioral Science and, Entrepreneurship development, Role of DIC and industrial policy, Banking and its assistance<br>• Industrial visit | Water/Containers<br>• Testing of Water storage Tank<br>• Testing of Woven Sacks<br>• Testing of PE Films and laminates<br>**Reporting of test results and quality control.**<br>**Maintenance of Plastics testing Machinery:** Repair and maintenance of various components used in plastics testing machinery. |

## List of Tools & Instruments (5 Nos. each for the batch size of 50)

1. Steel rule 15 cm with metric Graduations
2. Measure Tape
3. Outside, inside spring calliper
4. Spring divider
5. Try square
6. Combination plier
7. Cutting plier
8. Screwdriver 15 cm
9. Screwdriver set
10. D/E spanner set inch & mm
11. Allen key set inch & mm
12. Pipe wrench
13. Adjustable spanner
14. Hand Hacksaw frame adjustable
15. Hacksaw Blades
16. Bench vice with working table
17. Portable Hand drill 0-6mm with drill bits
18. Centre punch
19. Chisel
20. Flat file second cut & smooth
21. Half round file second cut & smooth
22. Needle file rough & smooth
23. Ball peen hammers
24. Plastic hammer (Soft)

25. Mould Clamping Block
26. Micrometre 0-25 mm
27. Vernier calliper
28. Thickness gauge
29. Electric line Tester
30. Multi meter
31. Test lamp
32. Electric Extension Board with 15A sockets & switches
33. Electric switches, fuses, holders, lamps, teakwood boards, plug sockets, solder, flux, wires and cables and other consumables.
34. Copper rods and strips.

## List of Machinery & Equipment (1 No. each for the batch size of 50)

1. Injection moulding machine
2. Compression moulding machine
3. Melting Point Apparatus
4. MFI Tester (MFI Indexer)
5. Muffle Furnace
6. Chemical Testing Apparatus
    a) PH Meter
    b) Centrifuse
    c) Chemicals & Glass works like burate, pippet, Pnecometer etc.
7. Density Gradient column
8. Universal Testing Machine
9. HDT/VSP tester
10. Machine for PVC Pipes Testing
    a. Brust / Pressure Testing Machine
    b. Weight Testing machine
    c. Fitter Weight Testing Machine
    d. Reversion Oil Bath
    e. Vacuum Oven
    f. Deep Freezer
    g. Impact Tester
    h. Opacity tester

11. For HDPE
    a. Carbon Black Content
    b. Over Head Projector for Carbon Black Dispersion (CBD)
12. Testing Machines for PET Bottles
13. UV Weatherometer

## Instructor

Three instructors - (Instructor: Student=1:20 ratio)

## Qualification for Instructor

Diploma in Plastics Technology / Polymer Engineering / Equivalent with relevant experience / Post Graduate Diploma in Plastics Processing & Testing

## Space Required

Minimum 1500 Sq. ft.

## Course Name: MAINTENANCE OF PLASTICS PROCESSING MACHINERY (MPPM)

**Sector** : Plastic Processing Industries
**Code** : PLA611
**Terminal Competency** : On successful completion of training a person

- Will be having adequate knowledge on plastics processing machineries.
- Able to undertake preventive maintenance and breakdown maintenance of machinery.

**Duration** : 1000 Hrs
**Eligibility** : $10^{th}$
**Age Limit** : Minimum 17 years
**Course Contents** :

| Theory (200 Hrs.) | Practical (800 Hrs.) |
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| **Industrial Safety Practices:** Introduction – Safe guarding methods – Safety in processing shop- Common methods of protection.<br>**Fitter Tools &Fitting Equipments**: Description of Fitter, common hand tools, names, description and the material from which they are made, description of simple fittings, hacksawing, punching, filling, types of files, method of using drills, tapes and dies, study of measuring tools i.e. Vernier calliper, micrometre etc.<br>• **Maintenance:** Maintenance, objective of maintenance, importance of maintenance, preventive maintenance, breakdown maintenance, predictive maintenance, schedule maintenance, maintenance planning.<br><br>**Hydraulics & Pneumatics:** Introduction to hydraulics, basic difference between hydraulics & pneumatics, hydraulics components, actuators, valves, pumps, motor.<br>**Actuators-**different types of actuators.<br>**Valves-**pressure control valve, direction control valve, flow control valve.<br>**Pumps, motor-** different pumps, vane pump, near pump, piston pump, study of different hydraulic circuit & trouble shooting.<br>• **Pneumatics -** introduction to pneumatics and it's principle, different pneumatic components, actuator, valves, air compressor, study of air compressor, air distribution principle, study of different pneumatic valves and their symbol, study of pneumatic circuit.<br><br>**Electrical Engineering: Electrical** -Introduction to electrical, concept of normal close and normal open, different types of switch, different types of relay, different types of sensor, electrical timer, wiring of control circuit an demo board, hardware of plc and connection of plc with computer, digital electronics and application, programming of spdt switch, latching circuit, memory bits application,<br>• **Basic Electronics –** Semiconductor, PN Junction Diode, Transistor, Resistor & fundamental of digital electronics.<br><br>**Plastics Processing:** Introduction to plastics processing, types of conversion techniques, injection moulding, extrusion, blow moulding.<br>**Injection Moulding Machines:** Basic parts and function, clamping mechanism, ejector mechanism, injection mechanism, process parameters, plastics material for injection moulding, mould and | Demonstration about personal, machine & electrical safety while working in plastics processing machines.<br>Description of Fitter, common hand tools, names, description and the material from which they are made, description of simple fittings, hacksawing, punching, filling, types of files, method of using drills, tapes and dies, study of measuring tools i.e. Vernier calliper, micrometre etc.<br>**Mechanical Maintenance:** Installation, commissioning of plastics processing machines<br>To check the line alignment/leveling of various machinery like PVC pipe plant, injection molding machine and blow molding machine<br>Repair and maintenance of hydraulic system in machines such as injection molding, blow molding machines<br>Positive and hydraulic actuators and motors<br>Lubrication system, central lubrication system, o-rings, oil seals<br>To carry out break down maintenance of electrical equipments like induction motors, variable speed motors, circuit breakers used in plastics processing machinery<br>Temperature control and thermocouples, Heater repair, Transmission systems<br>To carry out the preventive maintenance of machines like injection molding machine, blow molding machine, PVC pipe plant, CNC injection molding machine-preparing maintenance charts for periodical inspection to avoid idling of the machines for want of spares.<br>Repair and maintenance of various pumps.<br>**Electrical Maintenance:** Identify test element of power and control circuit in a contactor and their operation in a motor circuit.<br>Contactor programme to control a 3 ∅ induction motor with inch and remote control.<br>Make and internal connection of automatic star – |

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| product design, product defects and trouble shooting, machine start up and shut down procedure, process documentation, micro processor based injection moulding machines, fully electric injection moulding machines.<br>**Extrusion Machines:** Fundamental of extrusion, classification of extruders, nomenclature of screws, different types of screws, drive mechanism, die design, process parameters, difference between sse and tse, plastics material extrusion, types of extrusion process-pipe, film &sheet extrusion, trouble shooting.<br>**Blow Moulding Machines:** Principle of blow moulding, types of blow moulding, machines parts and construction<br>• Plastics materials used, construction of dies assembly, mould used in blow moulding Process parameters, parison programming and trouble shooting<br><br>• Repair and maintenance of following components used in plastics processing machinery - Barrel, screw, thrust unit, primary gearboxes, calendar roll, mill roll - Pumps – gear pump, piston pump, radial/axial pump and screw pump - Valves, valve sequences, valve counted balance, break valve, pressure reducing valve throttle valve, different control valves - Solenoid valves, Hydraulic motors, hydraulic actuators, filters, compressors, oil seals, O-rings - lubrication system-central lubrication system - transmission system i.e. gears, V-belts, Chains<br><br>• **Repair and maintenance:** The following components used in plastics processing machinery - Barrel, screw, thrust unit, primary gearboxes, calendar roll, mill roll - Pumps – gear pump, piston pump, radial/axial pump and screw pump - Valves, valve sequences, valve counted balance, break valve, pressure reducing valve throttle valve, different control valves - Solenoid valves, Hydraulic motors, hydraulic actuators, filters, compressors, oil seals, O-rings - lubrication system-central lubrication system - transmission system i.e. gears, V-belts, Chains.<br><br>•<br><br>• Behavioral Science and, Entrepreneurship development, Role of DIC and industrial policy, Banking and its assistance.<br><br>• Industrial visit | delta starter with three contractor.<br>Connect Start. Run and reverse slip-ring motor through a rotor resistance starter.<br>Auto transformer starter operated by contractor – Connect and run a three phase Induction motor through auto transformer starter operated by contractor.<br>Measure the insulation resistance using an insulation tester (Megger)<br>Measure the resistance of earth electrode.<br>Measure the resistance of E.C.C.<br>I E rules regarding earthing.<br>To measure the gauge of wire by the help of micrometer.<br>Test for wiring as per I.E. rules before supplying mains.<br>Identify terminals verify the ratio of transmission.<br>Three single phase transformer for 3 ∅ operation – Connect 3 single in for 3 ∅ operation of (a) Delta – Delta (b) Delta – Star (c) Star – Star (d) Star – Star<br>Transformer oil testing – Testing the transformer oil with oil testing kit.<br>Operation of Injection Moulding Machine<br>Operation of Blow Moudling Machine<br>Exposure in repair and maintenance of compression moulding machine, thermoforming machine, roto moulding machine and other secondary processing equipments. |

## List of Tools & Instruments (3 Nos. each for the batch size of 25)

1. Steel rule 15 cm with metric Graduations
2. Measure Tape
3. Outside, inside spring calliper
4. Spring divider
5. Try square
6. Combination plier
7. Cutting plier
8. Screwdriver 15 cm
9. Screwdriver set
10. D/E spanner set inch & mm
11. Allen key set inch & mm
12. Pipe wrench
13. Adjustable spanner
14. Hand Hacksaw frame adjustable
15. Hacksaw Blades
16. Bench vice with working table
17. Portable Hand drill 0-6mm with drill bits
18. Centre punch
19. Chisel
20. Flat file second cut & smooth
21. Half round file second cut & smooth
22. Needle file rough & smooth
23. Ball been hammers
24. Plastic hammer (Soft)
25. Electric line Tester
26. Multi meter
27. Megger
28. Test lamp
29. Electric Extension Board with 15A sockets & switches
30. Electric Switches, fuses, holders, lamps, Teakwood Boards, Plug sockets, Solder, flux, wires and cables and other consumables.
31. Clamping Tester
32. Testing Bed for easy fitting of Hydraulic & Pneumatic Product
33. Test Bed for Circuit Diagram Study
34. Other Small Devices like Soldier, Vacuum Pump etc.

## List of Machinery & Equipment (1 No. each for the batch size of 25)

1. Hydraulic Trainer
2. Pneumatic Trainer
3. PLC Kit
4. Electrical Circuit with AC Motor(3 Types), DC Motor (3 Types)
5. Electrical Circuit Temperature Controller
6. Cut Section of Hydraulic Equipment
7. Cut Section of Different Electric Generator & Motor
8. Air Compressor
9. Cooling Tower
10. Chiller
11. Blow lamp
12. Hot air gun
13. Welding equipment
14. Utility equipments (screw bar, rods etc.)
15. Hydraulic jack

## Instructor

Two instructors - (Instructor: Student=1:20 ratio)

## Qualification for Instructor

Diploma in Plastics Technology / Polymer Engineering / Diploma in Electrical Engineering with relevant experience

## Space Required

Minimum 2000 Sq. ft.

## Course Name: PLASTICS MOULD MANUFACTURING (PMM)

**Sector** : Plastic Processing Industries
**Code** : PLA701
**Terminal Competency** : On successful completion of training person will be having adequate knowledge on

- Able to operate conventional tool room machines.
- Mould & die making & its significance in plastics mould manufacturing

**Duration** : 1200 Hrs
**Eligibility** : $10^{th}$
**Age Limit** : Minimum 17 years
**Course Contents** :

| Theory (240 Hrs.) | Practical (960 Hrs.) |
|---|---|
| **Industrial Safety Practices:** Introduction – Safe guarding methods – Safety in Workshop - Common methods of protection in workshop.<br>**Engineering Drawing:** Introduction – Drawing instruments – Lines – Lettering – First angle & Third angle projection – Planes of projection.<br>**Fitting Tools & Measuring Instruments:** Introduction – Bench Vice – Files – Hammers – Punch – Hack-saw – Chisel – Scriber – Surface Gauge – V-block – Try squares etc., Steel rule – Inside / Outside Callipers – Vernier Callipers – Outside micrometer – Inside micrometer – Vernier height gauge – Bore gauge – Dial indicator – Combination set – Bevel protractor – Slip gauge – Screw pitch gauge.<br>**Theory of Metal Cutting:** Basic metal cutting theory – Cutting tools (single point & Multi point) – Nomenclature of single point cutting tool – Tool signature – Mechanics of cutting – Types of chips – Cutting tool materials.<br>**Theory of Machine Tools:** Lathe: Introduction to Lathe – Working Principle – Types of Lathe & its parts – Specification of Lathe – Lathe Centres.<br>**Milling:** Introduction to Milling – Working principle – Types of milling machines & their parts – Milling cutters – Operations performed on milling.<br>**Drilling:** Introduction – Working principle – Types of Drilling machines & their parts.<br>**Grinding:** Introduction–Principle of operation – Construction – Types of grinding machine & their parts. Shaping & Planing: Introduction – Working principle – Specifications – Difference between Shaper & Planer.<br>**Mould Technology:** General Mould consruction,Mould design concepts,mould elements,parting line,construction of core & cavities,bolsters,mould alignment, Mould material, types of moulds – two plate mould, three plate mould, Single impression, multi impression,split moulds –external under cut, split cavities,, side cores,split and core actuation –Finger cam,Dog leg cam, cam track, hydraulic, internal; under cut – form pin, collapsible corer, loose cores, threaded inserts – internal and external threads. Types of gate & runner, balanced runner system and unbalance runner | Demonstration about personal, machine & electrical safety while working on tool room machines.<br>**Familiarization of Workshop Tools:** Hand tools, Marking tools, Scribers, compass, dividers, outside and inside caliper, hermaphrodite caliper, ordinary scribing block, universal scribing block, angle plate, V-block, centre punch, dot punch, prick punch, try square, bevelled try square, surface plate, straight edge, combination set.<br>**Cutting tools:** Chisels – flat, crosscut, half round, diamond point.<br>**Files:** single cut and double cut files- rough, bastard, medium, smooth, dead smooth files – flat, square, pillar, round, triangular, half round, knife and needle files, rifler files (spoon file).<br>**Hack saw:** Types of frame - Solid frame and adjustable frame – blades of different grade.<br>**Striking tools:** Ball peen, Straight peen, Cross peen, Steel hammers and Double-faced plastics hammers (soft hammer).<br>**Holding devices:** Bench vice, hand vice, swivel base vice.<br>**Miscellaneous tools**: screwdrivers, Open end spanner, double end spanner, adjustable spanner, box spanner and ring spanner<br>**Engineering Measuring Instruments:** Construction, application and least count, steel rule - try square - vernier calipers - Micrometers-outside and inside - depth gauges - height gauges – bore gauges - slip gauges.<br>**Geometrical measurements:** Straightness, Flatness, Parallelism, Squareness, Concentricity.<br>**Standard Gauges:** Type of gauges, Radius gauges, Feeler gauges, Screw pitch gauge, Taper gauge & Thickness gauges.<br>**Filing Exercise:** Balancing of hand file, producing flat surface, making parallel surface, making perpendicular surface, radius filing, and taper filing, maintaining dimension.<br>**Universal fitting:** Filing to maintain overall size- Hacksaw cutting, finishing by filing, filing to maintain fit between male and female pieces. 3D- engraving on pantograph.<br>Machining: Practical exercises on drilling, shaper, milling, lathe, surface grinder and cylindrical grinding machines fro various mould operations.<br>**CNC Lathe**: Difference between machining centre and turning centre-axis designation of CNC lathe- types & classification of CNC lathe. |

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| system, types of ejection, mould cooling.<br>**Introduction To CNC Technology:** Introduction to NC & CNC technology – Construction of CNC Lathe & Milling– G-codes, M-codes – Advantages & Applications of CNC machines.<br>• Behavioral Science and, Entrepreneurship development , Role of DIC and industrial policy, Banking and its assistance<br>• Industrial visit | **CNC Milling**: classification of CNC milling machine -cutting tools and tool holding devices-work holding devices- part programming structure and format-coordinate system for CNC milling.<br>**Mould Assembly:** assembly of various mould parts, fitting of guide pillar, bushes, core & cavity etc., blue matching at the parting surface.<br><br>**Maintenance of Tool room Machinery.** |

## List of Tools & Instruments (3 Nos. each for the batch size of 25)

1. Steel rule 15 cm with metric Graduations
2. Measure Tape
3. Outside, inside spring calliper
4. Hermaphrodite Calliper
5. Spring divider
6. Compass
7. Try square
8. Bevel Try Square
9. Combination Set
10. Combination plier
11. Cutting plier
12. Screwdriver 15 cm
13. Screwdriver set
14. D/E spanner set inch & mm
15. Allen key set inch & mm
16. Pipe wrench
17. Adjustable spanner
18. Hand Hacksaw frame adjustable
19. Hacksaw Blades
20. HSS Tool Bit
21. Boring bar
22. Knurling tool
23. Portable Hand drill 0-6mm with drill bits
24. Centre punch
25. Sleeve
26. Centre Drill
27. Drill chuck

28. Chisel
29. Scriber
30. Ordinary Scribing Block
31. Universal Scribing Block
32. V-block
33. Angle Plate
34. Plunger Dial
35. Flat file second cut & smooth
36. Half round file second cut & smooth
37. Needle file rough & smooth
38. Ball peen hammers
39. Straight peen hammers
40. Cross peen hammers
41. Plastic hammer (Soft)
42. Mould Clamping Block
43. Micrometre
44. Digital Micrometre 0-25 mm
45. Vernier Calliper
46. Digital Vernier calliper
47. Thickness gauge
48. Bore Gauge
49. Depth gauges
50. Height gauges
51. Slip gauges
52. Radius gauges
53. Feeler gauges
54. Screw pitch gauge
55. Taper gauge
56. Surface Gauge
57. Bench vice with working table
58. Mould Assembly Table

## List of Machinery & Equipment (1 No. each for the batch size of 25)

1. Conventional Lathe Machine
2. Universal Milling Machine
3. Pantograph Engraving Machine
4. Die Sinking EDM
5. CNC Lathe Machine
6. CNC Milling Machine
7. Radial Drilling Machine
8. Surface Grinding Machine
9. Cylindrical Grinding
10. Pedestal Grinding Machine
11. Tool and Cutter Grinder
12. Mould Polishing Kit
13. Hydraulic Trolley
14. Various types of moulds -two plate, three plate, split, side core etc. for demonstration

## Instructor

Two instructors - (Instructor: Student=1:20 ratio)

## Qualification for Instructor

Diploma in Mould Technology/Diploma in Tool & Die Making / Equivalent with relevant experience

## Space Required

Minimum 2000 Sq. ft.

**Course name: ADVANCED PLASTICS MOULD MANUFACTURING (APMM)**

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| **Sector** | : | Plastic Processing Industries |
| **Code** | : | PLA702 |
| **Terminal Competency** | : | On successful completion of training person will be able to operate advanced moulds making machineries and develop moulds. |
| **Duration** | : | 1200 Hrs |
| **Eligibility** | : | $10^{th}$+PLA701/ ITI (Tool & Die Making) / Diploma (Mechanical) |
| **Age Limit** | : | Minimum 17 years |
| **Course Contents** | : | |

| Theory (240 Hrs.) | Practical (960 Hrs.) |
|---|---|
| **Industrial Safety Practices:** Introduction – Safe guarding methods – Safety in Workshop - Common methods of protection in workshop.<br>**NC Machines** – Basic components of NC system - NC procedure- NC coordinate systems - Types of motion – NC format -Numerical control vs Conventional machine tools - Advantages & Disadvantages of NC machines.<br>CNC Machine Tools-Introduction - Comparision of CNC with NC system-functions of CNC Control in Machine tools-types of CNC system-According to - types of motion control systems, programming modes & control loops–Analog and digital controls, Modes of machine operation in CNC machine, Advantages & Disadvantages of CNC machines.<br>DNC system- components of DNC system - Advantages of DNC, Combined DNC and CNC system.<br>Different types of CNC machine tools, introduction to part programming, Trouble shooting of CNC machines-safety & maintanenace of CNC machines.<br>**Milling and Machining Centre** –classification of CNC milling machine -cutting tools and tool holding devices-work holding devices- part programming structure and format-coordinate system for CNC milling- Preparatory and miscellaneous functions and formats of CNC milling programs-Canned cycles for CNC milling operations-simple programming for CNC milling operation for making mould elements.<br>**Lathe and Turning Centre**-Difference between machining centre and turning centre-axis designation of CNC lathe- types & classification of CNC lathe- cutting tools and tool holding devices-work holding devices- part programming structure and format-coordinate system for CNC lathe- Preparatory and miscellaneous functions and formats of CNC turning programs-Canned cycles for CNC turning operations-simple programming for CNC lathe operation for making mould elements.<br>**CNC EDM** – introduction, principles of operation, theory of metal removal, spark generator frequency, spark gap, accuracy, surface finish metal removal rate, electrode wear, die-electric fluid, flushing and its function, selection of electrode material, electrode size, advantages and disadvantages of EDM -simple programming for CNC EDM operation for making mould elements.<br>**CNC Wire EDM**-Introduction and applications-Selection of wire- simple programming for CNC wire EDM operation for making mould elements, U, V axes. | Demonstration about personal, machine & electrical safety while working on advance mould and dies manufacturing machineries.<br>**Manufacturing of automatic injection, compression, transfer and blow moulds:** Familiarisation of conventional machine tools-lathe-milling-surface grinding-cylindrical grinding-tool and cutter grinding, cutting tools and cutting fluids. Familiarisation of CNC machine tools-Lathe-Milling-EDM-Wire EDM, cutting tools and cutting fluids. Rough machining of Sprue bush, guide pillar, guide bush, ejector pins etc. Familiarisation of cylindrical grinding operation to maintain functional dimensions of hardened guide pillar, guide bush, core and cavity and other elements of mould. Rough machining using shaping machine (Bolster/Mould plates). Surface grinding of mould plates and mould elements. Drilling, reaming and tapping of mould plates and mould element. Precision machining of guide pillar & guide bush holes in mould plates using Jig boring machine / CNC milling machine. Rough machining of Core and Cavity of moulds using Lathe/milling machine. Precision machining of Core and Cavity of moulds using CNC machine tools. Machining of intricate shapes of Core and Cavity (soft/hardened) using CNC EDM & CNC Wire EDM. Polishing of core, cavity, sprue bush, runner, gate etc to mirror finish. Engraving and embossing of script & monograms.<br>**CNC LAB:** Familiarisation of NC & CNC machine tools. Familiarisation of cutting tools and cutting fluids. Programming and operating of CNC lathe machine. Programming and operating of CNC milling machine. Programming and operating of CNC EDM. Programming and operating of CNC Wire-EDM.<br>**Working with CAD:** Setting limits of Drawing, grid, snap, co-ordinates, ortho mode, zooming, drawing lines, arcs, circles, erase, undo, oops – commands, save and end commands- Editing, Adding dimensions and text, Editing drawings using various modified commands. Add dimensions and text on drawings, copy, mirror, array, fillet, chamfer, hatching the sectional views. Developing simple orthographic views and dimension it with text. Developing detailed orthographic views with all features |

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| **Polishing Technology in Mould Making:** Definition of surface roughness, basis of polishing technology - Effect of mould materials on polishability, Types of polishing tools, Methods of polishing - Basic information on ultra sonic polishing – Principles of Electro deposition in damaged moulding surfaces/Protective Coating.<br>**Surface Texturing of Moulds** – Process description, types of moulds, types of patterns and mould shapes, metals that can be etched, mould preparation, limitations of chemical texturing.<br>• Behavioral Science and, Entrepreneurship development , Role of DIC and industrial policy, Banking and its assistance<br>• Industrial visit | **Maintenance of** mould and dies and plastics product manufacturing machines**.** |

## List of Tools & Instruments (3 Nos. each for the batch size of 25)

1. Steel rule 15 cm with metric Graduations
2. Measure Tape
3. Outside, inside spring calliper
4. Hermaphrodite Caliper
5. Spring divider
6. Compass
7. Try square
8. Bevel Try Square
9. Combination Set
10. Combination plier
11. Cutting plier
12. Screwdriver 15 cm
13. Screwdriver set
14. D/E spanner set inch & mm
15. Allen key set inch & mm
16. Pipe wrench
17. Adjustable spanner
18. Hand Hacksaw frame adjustable
19. Hacksaw Blades
20. HSS Tool Bit
21. Boring bar
22. Knurling tool
23. Portable Hand drill 0-6mm with drill bits
24. Centre punch
25. Sleeve
26. Centre Drill
27. Drill chuck
28. Chisel
29. Scriber
30. Ordinary Scribing Block
31. Universal Scribing Block
32. V-block
33. Angle Plate
34. Plunger Dial
35. Flat file second cut & smooth
36. Half round file second cut & smooth
37. Needle file rough & smooth

38. Ball peen hammers
39. Strait peen hammers
40. Cross peen hammers
41. Plastic hammer (Soft)
42. Mould Clamping Block
43. Micrometre
44. Digital Micrometre 0-25 mm
45. Vernier Calliper
46. Digital Vernier calliper
47. Thickness gauge
48. Bore Gauge
49. Depth gauges
50. Height gauges
51. Slip gauges
52. Radius gauges
53. Feeler gauges
54. Screw pitch gauge
55. Taper gauge
56. Surface Gauge
57. Bench vice with working table
58. Mould Assembly Table

## List of Machinery & Equipment (1 No. each for the batch size of 25)

1. Conventional Lathe Machine
2. Universal Milling Machine
3. Jig Boring Machine / CNC Milling Machine
4. Pantograph Engraving Machine
5. CNC Lathe Machine
6. CNC EDM Machine
7. Pedestal Grinding Machine
8. Tool and Cutter Grinder
9. Radial Drilling Machine
10. Surface Grinding Machine
11. Cylindrical Grinding
12. Mould Polishing Kit
13. Mould Assembly Table
14. Hydraulic Trolley
15. Various types of moulds -two plate, three plate, split, side core etc. for demonstration.

## Instructor

Two instructors - (Instructor: Student=1:20 ratio)

## Qualification for Instructor

Diploma in Mould Technology/Diploma in Tool & Die Making / Equivalent with relevant experience

## Space Required

Minimum 2000 Sq. ft.

**Course name:** **CNC LATHE PROGRAMMING & OPERATION FOR PLASTICS INDUSTRIES (CNC-L)**

**Sector** : Plastic Processing Industries
**Code** : PLA703
**Terminal Competency** : On successful completion of training person will be having adequate knowledge & Able to operate CNC lathe machines for manufacturing moulds & dies, manufacturing of precision components.
**Duration** : 1000 Hrs
**Eligibility** : $10^{th}$
**Age Limit** : Minimum 17 years
**Course Contents** :

| Theory (200 Hrs.) | Practical (800 Hrs.) |
|---|---|
| **Industrial Safety Practices:** Introduction – Safe guarding methods – Safety in Workshop - Common methods of protection in workshop.<br>**Engineering Drawing:** Engineering drawing – Limits, fits and Tolerance (Dimensional and Geometrical tolerance), Surface finish representation. Symbolic representation of Wheels, Gears etc<br>Basics on Orthographic views from isometric views of machine parts / components. Dimensionings, Sectioning.<br>**Shop Theory:** Work holding devices, setting & dialling of work piece, tool holding devices, application of coolant.<br>**Metrology & Inspection**<br>**Marking tools:** Introduction to marking tools, Divider, Scriber, Surface Gauge, V-Block, Parallel Block, Surface Plate, Angle Plate & Punches<br>**Measuring Tools: Introduction** to measuring instruments, construction, application of steel rule, try square, vernier calliper, vernier height gauge, micrometre, bore gauge, radius gauge, bevel protractor, callipers & gauges.<br>**Conventional Lathe Machine:** Lathe: Specification - Types - Mechanisms - Operations - Calculations - Capstan and turret lathe – Tooling with examples - Copy turning lathe.<br>**Basics Of N.C Machine Tools:** Conventional Numerical Control: Basic components of NC system, the NC procedure, NC coordinate systems, NC motion control system, applications of numerical control, advantages and disadvantages of NC, computer controls in NC, problems with conventional NC, NC controller technology, computer numerical control, functions of CNC, advantages of CNC.<br>**Tooling:**<br>**Cutting Tool materials and its applications, carbide index able inserts, tooling systems for CNC Lathe, selection of tools for various work piece materials, selection of cutting parameters.**<br>**Programming & Operations On CNC Lathe:** Operating Principles of CNC Lathe Machine, speed and feed selections, Details on G codes, Details on M codes, Part programming, tool offset, nose radius compensation, work locating methods and devices, Applications of CNC Lathe.<br>**Maintenance:** Types of maintenance, preventive maintenance, breakdown maintenance, schedule of | Demonstration about personal, machine & electrical safety while working on conventional lathe & CNC lathe machines.<br>**Familiarization with lathes**- principal parts, work holding device, cutting tools & tool holding device. Plain turning, taper turning, eccentric turning, chamfering, facing, internal thread cutting, tapping, undercutting, parting–off, drilling and reaming, boring and counter boring, thread cutting and knurling combination of above operations.<br>**Operations On CNC Lathe:** Operating Principles of CNC Lathe Machine, speed and feed selections, Part programming, CNC machining centres, Tooling for CNC machines, Advanced CNC applications, tool radius Compensation. Practical on Various Jobs on CNC Lathe Machines. Study of machine speciation & features. Study of machine axis system & concept of coordinate system. Generation of coordinates using Cartesian & polar coordinate system. Study of origin concept & types of origin. Description of various parts of CNC lathe machine & control panel. Description of various G codes & M codes used for programming. Machine start-up & operation in different Modes, Exposure on work & tool setting. Introduction to creation of part programs. Creation of part programs for simple profiles using linear & circular interpolation.<br>Programming using tool nose radius compensation. Programming using canned cycles. (Turning, facing, drilling, boring, tapping etc.).Programming of thread cutting, taper thread cutting, grooving & face grooving cycle. Setting the work piece origin point & tool offset measurement. Practical machining of work pieces<br>Difference between machining centre and turning centre-axis designation of CNC lathe- types & classification of CNC lathe. Exposure on MASTERCAM. CAM software MASTERCAM/Unigraphics/Pro-E/ Cimatron etc.<br>**Maintenance:** Maintenance of Conventional & CNC lathes Machineries. |

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| maintenance, safety precautions.<br>• Behavioral Science and, Entrepreneurship development, Role of DIC and industrial policy, Banking and its assistance.<br>• Industrial visit | |

## List of Tools & Instruments (3 Nos. each for the batch size of 25)

1. Steel rule 15 cm with metric Graduations
2. Measure Tape
3. Outside, inside spring calliper
4. Hermaphrodite Caliper
5. Spring divider
6. Compass
7. Try square
8. Bevel Try Square
9. Combination Set
10. Combination plier
11. Cutting plier
12. Screwdriver 15 cm
13. Screwdriver set
14. D/E spanner set inch & mm
15. Allen key set inch & mm
16. Pipe wrench
17. Adjustable spanner
18. Hand Hacksaw frame adjustable
19. Hacksaw Blades
20. HSS Tool Bit
21. Boring bar
22. Knurling tool
23. Portable Hand drill 0-6mm with drill bits
24. Centre punch
25. Sleeve
26. Centre Drill
27. Drill chuck
28. Chisel
29. Scriber
30. Ordinary Scribing Block
31. Universal Scribing Block
32. V-block
33. Angle Plate
34. Plunger Dial

35. Flat file second cut & smooth
36. Half round file second cut & smooth
37. Needle file rough & smooth
38. Ball peen hammers
39. Strait peen hammers
40. Cross peen hammers
41. Plastic hammer (Soft)
42. Mould Clamping Block
43. Micrometre
44. Digital Micrometre 0-25 mm
45. Vernier Calliper
46. Digital Vernier calliper
47. Thickness gauge
48. Bore Gauge
49. Depth gauges
50. Height gauges
51. Slip gauges
52. Radius gauges
53. Feeler gauges
54. Screw pitch gauge
55. Taper gauge
56. Surface Gauge
57. Bench vice with working table
58. Mould Assembly Table

**List of Machinery & Equipment (1 No. each for the batch size of 25)**

1. Conventional Lathe Machine
2. CNC Lathe Machine
3. Tools for CNC Lathe Machine
    - Face Grooving Tool
    - Turning Tool
    - Grooving Tool (Parting Off)
    - Thread cutting tool
    - Internal Thread cutting tool
    - Boring tool

**Instructor**

Two instructors - (Instructor: Student=1:20 ratio)

**Qualification for Instructor**

Diploma in Mould Technology/Diploma in Tool & Die Making / Equivalent with relevant experience

**Space Required**

Minimum 1500 Sq. ft.

**Course Name: CNC MILLING PROGRAMMING & OPERATION FOR PLASTICS INDUSTRIES (CNC-M)**

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| **Sector** | : | Plastic Processing Industries |
| **Code** | : | PLA704 |
| **Terminal Competency** | : | On successful completion of training person will be having adequate knowledge & able to operate CNC milling machines for manufacturing moulds & dies, manufacturing of precision components. |
| **Duration** | : | 1000 Hrs |
| **Eligibility** | : | $10^{th}$ |
| **Age Limit** | : | Minimum 17 years |
| **Course Contents** | : | |

| Theory (200 Hrs.) | Practical (800 Hrs.) |
|---|---|
| **Industrial Safety Practices:** Introduction – Safe guarding methods – Safety in Workshop - Common methods of protection in workshop.<br>**Engineering Drawing:** Engineering drawing – Limits, fits and Tolerance (Dimensional and Geometrical tolerance), Surface finish representation. Symbolic representation of Wheels, Gears etc. Basics on Orthographic views from isometric views of machine parts / components. Dimensioning & Sectioning.<br>**Shop Theory:** Work holding devices, setting & dialling of work piece, tool holding devices, application of coolant.<br>**Metrology & Inspection**<br>**Marking tools:** Introduction to marking tools, Divider, Scriber, Surface Gauge, V-Block, Parallel Block, Surface Plate, Angle Plate & Punches<br>**Measuring Tools: Introduction** to measuring instruments, construction, application of steel rule, try square, vernier calliper, vernier height gauge, micrometre, bore gauge, radius gauge, bevel protractor, callipers & gauges.<br>**Conventional Milling Machine**<br>**Milling**: Specification - Types - Mechanisms - Operations - Calculations.<br>**Basics Of N.C Machine Tools:** Conventional Numerical Control: Basic components of NC system, the NC procedure, NC coordinate systems, NC motion control system, applications of numerical control, advantages and disadvantages of NC, computer controls in NC, problems with conventional NC, NC controller technology, computer numerical control, functions of CNC, advantages of CNC.<br>Tooling:<br>Cutting Tool materials and its applications, carbide indexable inserts, tooling systems for CNC Milling , selection of tools for various workpiece materials, selection of cutting parameters.<br>**Programming & Operations On CNC Milling:** Operating Principles of CNC Milling Machine, speed and feed selections, Details on G codes, Details on M codes, Part programming, tool offset, cutter radius compensation, work locating methods and devices, Applications of CNC Milling. | Demonstration about personal, machine & electrical safety while working on CNC milling machines.<br>• Practical on usage of measuring instruments<br>• Practical on operation of conventional lathe, milling, drilling, grinding, shaping machines<br>• Practical on programming of different profiles<br>**Familiarization with Milling machine**-principal parts, work holding device, cutting tools & tool holding device. up milling, down milling, Plain surface milling, slot milling, plain and angular milling, pocket milling, index milling and rotary milling<br>**Operations On CNC milling:**<br>• Study of Machines on HASS/Siemens/Fanuc Controller<br>• Study of different features of controller<br>• Study of different key & switches<br>• Familiarization to G codes (Preparatory codes) & M codes (Functional codes)<br>• Tool offset measurement by cut and measure method<br>• Co-ordinate practice & DATUM setting<br>• Tool length offset measurement<br>• Machine startup & operation in different modes<br>• Exposure on work and tool setting<br>• Preparation of part programmes & simulation for absolute, incremental & polar coordinates, Linear & Circular interpolation with suitable practical |

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| **Maintenance:** Types of maintenance, preventive maintenance, breakdown maintenance, schedule of maintenance, safety precautions.<br>• Behavioral Science and, Entrepreneurship development , Role of DIC and industrial policy, Banking and its assistance<br>• Industrial visit | examples<br>• Canned cycles for pocket milling, drilling, boring etc.<br>• DATA transfer through TNC & DNC<br>• Exposure on CAM softwares MASTERCAM/Unigraphics/Pro-E/Cimatron etc.<br>• **Maintenance:** Maintenance of Conventional &CNC milling Machineries. |

## List of Tools & Instruments (3 Nos. each for the batch size of 25)

1. Steel rule 15 cm with metric Graduations
2. Measure Tape
3. Outside, inside spring calliper
4. Hermaphrodite Caliper
5. Spring divider
6. Compass
7. Try square
8. Bevel Try Square
9. Combination Set
10. Combination plier
11. Cutting plier
12. Screwdriver 15 cm
13. Screwdriver set
14. D/E spanner set inch & mm
15. Allen key set inch & mm
16. Pipe wrench
17. Adjustable spanner
18. Hand Hacksaw frame adjustable
19. Hacksaw Blades
20. HSS Tool Bit
21. Boring bar
22. Knurling tool
23. Portable Hand drill 0-6mm with drill bits
24. Centre punch
25. Sleeve
26. Centre Drill
27. Drill chuck
28. Chisel

29. Scriber
30. Ordinary Scribing Block
31. Universal Scribing Block
32. V-block
33. Angle Plate
34. Plunger Dial
35. Flat file second cut & smooth
36. Half round file second cut & smooth
37. Needle file rough & smooth
38. Ball peen hammers
39. Strait peen hammers
40. Cross peen hammers
41. Plastic hammer (Soft)
42. Mould Clamping Block
43. Micrometre
44. Digital Micrometre 0-25 mm
45. Vernier Calliper
46. Digital Vernier calliper
47. Thickness gauge
48. Bore Gauge
49. Depth gauges
50. Height gauges
51. Slip gauges
52. Radius gauges
53. Feeler gauges
54. Screw pitch gauge
55. Taper gauge
56. Surface Gauge
57. Bench vice with working table
58. Mould Assembly Table

## List of Machinery & Equipment (1 No. each for the batch size of 25)

1. Conventional Milling Machine (Vertical)
2. Conventional Milling Machine (Horizontal)
3. Three axis CNC Milling Machine with HASS/Siemens/Fanuc control

   Tool Required for CNC Milling

   - Face mill Cutter

- End mill cutter solid carbide
- Ball Nose Cutter Solid Carbide
- Boring head
- 3D Tester
- Edge Finder
- Tool Pre-setter

## Instructor

Two instructors - (Instructor: Student=1:20 ratio)

## Qualification for Instructor

Diploma in Mould Technology/Diploma in Tool & Die Making / Equivalent with relevant experience

## Space Required

Minimum 1500 Sq. ft.

**Course Name: PLASTICS PRODUCT AND MOULD DESIGN (PPMD)**

**Sector** : Plastic Processing Industries

**Code** : PLA705

**Terminal Competency** : On successful completion of training person will be able to design and develop moulds and products using CAD/CAM/CAE.

**Duration** : 1200 Hrs

**Eligibility** : 10th+PLA701/ ITI (Tool & Die Making) / Diploma (Mechanical)

**Age Limit** : Minimum 17 years

**Course Contents** :

| Theory (240 Hrs.) | Practical (960 Hrs.) |
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| **Industrial Safety Practices:** Introduction – Safe guarding methods – Safety in Workshop - Common methods of protection in workshop.<br>**Basic Engineering Drawing Concept**<br>**The Importance of Engineering Graphics:** Explanation of the scope and objective of Engineering Drawing – its importance as a graphic communication- need for preparing drawing as per standards – BIS, SP 46.<br>**Drawing Instruments:** Basic drawing instruments – T square – Setsquare – compass - dividers – drawing boards – Pencils – Drawing papers – Mini drafter – French curves – Stencils – Selection and method of using them.<br>**Drawing Standards:** Size of drawing sheets – Layout of drawing sheet – Title Blocks – Types of lines – Folding of drawing sheets.<br>**Free hand Lettering and Numbering:** Need for legible lettering and numbering on drawings – selection of suitable size of lettering for different drawing, writing of Engineering drawing titles and notes using both vertical and sloping styles.<br>**Dimensioning:** Function of dimensioning - need for dimensioning - engineering drawing according to BIS – Notation used in dimensioning – Dimension line – Extension line – Arrow heads and leader – System of dimensions - Method I and Method II.<br>**Geometric Construction:** Construction of regular polygon - given the length of its side, Conics-construction of ellipse, parabola and hyperbola by eccentricity method, construction of cycloid, construction of involutes of square and circle, drawing of tangents and normal to the above curves<br>**Principles of Orthographic Projection:** Explanation of the meaning of orthographic projection using a viewing box and a model- number of views obtained need of only three views for displaying the object - explanation of the meaning of first angle and third angle projection – symbol of projection-Front view, top view and side view-sketching these views for a number of engineering objects.<br>**Basic CAD Modelling Concept:** introduction to CAD (CAD using AUTO-CAD & Pro-E), generating & editing wire frames, surface modelling & editing, primitive, power advance, Surfaces, model fixing, solid modelling & editing.<br>**Plastic Materials:** Types of plastic materials-thermoplastics and thermosetting. Properties & applications of LDPE, HDPE, PP, ABS, SAN, Acrylic, Polycarbonate, Nylon etc. Shrinkage and processing conditions.<br>**Product Design:** Plastics product design- concepts, essential factors, principles, tooling aspects on product design, process variables vs product design, product design appraisal.<br>Design guidelines for thermoplastics- wall thickness, draft angle, rib design, internal sharp corners and notches, bosses, holes, threads, undercuts, hinges etc.<br>• Behavioral Science and, Entrepreneurship development, Role of | Demonstration about personal, machine & electrical safety while working on mould and dies manufacturing equipments.<br>**Introduction to Computer Aided Drafting:** History – application – Advantages over manual drafting – Hardware requirements – Software requirements – Different software - Auto CAD – Pro E – Unigraphics-CATIA-IDEAS and Open Source drafting software etc:-, CAD basics – main menu, starting a new drawing, drawing editor, entering commands using mouse, pull down menu, getting help, data entry, entity selection, error correction.<br>**Working with CAD:** Setting limits of Drawing, grid, snap, co-ordinates, orthomode, zooming, drawing lines, arcs, circles, erase, undo, oops – commands, save and end commands-Editing, Adding dimensions and text, Editing drawings using various modified commands. Add dimensions and text on drawings, copy, mirror, array, fillet, chamfer, hatching the sectional views. Developing simple orthographic views and dimensions it with text. Developing detailed orthographic views with all features.<br>**Auto CAD Practical Session:** Importances of CAD, menu selection, begin new drawing, editing existing drawing and practice simple drawing. Co-ordinate system in CAD - absolute, relative and polar. Introduction to utility commands - Help, End, Quit, Save, Limits, Units. Introduction to entity draw commands - Line, Point circles, Oops,Undo, Copy, Move practice. Introduction to display commands - Zoom, Pan, Redraw Layers and its uses. Various file formats – export and import of files.<br>. Inquiry tool bar-distance, area, mass properties. Dimensioning tool bar-Linear, Angular, Align etc. Three dimensional Modelling- UCS, Solid tool bar & solid editing tools, views, shading, rending.<br><br>**CAD Softwares**: Hand on practice on Pro-E/ CATIA/Unigraphics softwares- Modelling, Assembly, Drafting, Surface, Manufacturing, Simulation of toolpath, NC post processing, |

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| DIC and industrial policy, Banking and its assistance.<br>• Industrial visit | Mould wizard, core and cavity extraction and introduction to mould base.<br><br>**Analysis Softwares:** Introduction to Mouldflow, fill, pack, fill & pack, warpage, cooling analysis etc. Analysis of plastic product for various mechanical structural analysis – stress, strain etc using Hypermesh/ ANSYS software |

## Hardware Requirements

1. Workstation with suitable UPS -25 nos.
2. Online UPS for server room - 01 no
3. Server-01no.
4. A.C suffient for the CAD Lab
5. Printer/Scanner/Xerox-01 no.
6. Plotter-01 no.
7. Over Head Projector-01 no.
8. LAP TOP-01 no.
11. LAN Connection Setup

## Software Requirements for Product Development

1. AutoCAD- 25 seats
2. CATIA/ Pro-E/ Unigraphics -25 seats

## Software Requirements for Product Analysis

1. Hyper Mesh / Ansys -10 seats
2. Mold Flow -10 seats

## Instructor

Two instructors - (Instructor: Student=1:20 ratio)

## Qualification for Instructor

Diploma in Mould Technology/Diploma in Tool & Die Making / Equivalent with relevant experience

## Space Required

Minimum 1000 Sq. ft.