

INJECTION MOULDING MACHINE OPERATOR

COMPETENCY BASED CURRICULUM

(Duration: 2 Yrs.)

APPRENTICESHIP TRAINING SCHEME (ATS)

NSQF LEVEL- 5



SECTOR – PRODUCTION & MANUFACTURING



GOVERNMENT OF INDIA
MINISTRY OF SKILL DEVELOPMENT & ENTREPRENEURSHIP
DIRECTORATE GENERAL OF TRAINING

INJECTION MOULDING MACHINE OPERATOR

(Revised in 2018)

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NSQF LEVEL - 5

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Developed By

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Special acknowledgement is extended by DGT to the following expert members who had contributed immensely in this curriculum.

1. Renata Precision, Pune

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1.1 Apprenticeship Training Scheme under Apprentice Act 1961

The Apprentices Act, 1961 was enacted with the objective of regulating the programme of training of apprentices in the industry by utilizing the facilities available therein for imparting on-the-job training. The Act makes it obligatory for employers in specified industries to engage apprentices in designated trades to impart Apprenticeship Training on the job in industry to school leavers and person having National Trade Certificate (ITI pass-outs) issued by National Council for Vocational Training (NCVT) to develop skilled manpower for the industry. There are four categories of apprentices namely; **trade apprentice, graduate, technician and technician (vocational) apprentices.**

Qualifications and period of apprenticeship training of **trade apprentices** vary from trade to trade. The apprenticeship training for trade apprentices consists of basic training followed by practical training. At the end of the training, the apprentices are required to appear in a trade test conducted by NCVT and those successful in the trade tests are awarded the National Apprenticeship Certificate.

The period of apprenticeship training for graduate (engineers), technician (diploma holders and technician (vocational) apprentices is one year. Certificates are awarded on completion of training by the Department of Education, Ministry of Human Resource Development.

1.2 Changes in Industrial Scenario

Recently we have seen huge changes in the Indian industry. The Indian Industry registered an impressive growth during the last decade and half. The number of industries in India have increased manifold in the last fifteen years especially in services and manufacturing sectors. It has been realized that India would become a prosperous and a modern state by raising skill levels, including by engaging a larger proportion of apprentices, will be critical to success; as will stronger collaboration between industry and the trainees to ensure the supply of skilled workforce and drive development through employment. Various initiatives to build up an adequate infrastructure for rapid industrialization and improve the industrial scenario in India have been taken.

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1.3 Reformation

The Apprentices Act, 1961 has been amended and brought into effect from 22nd December, 2014 to make it more responsive to industry and youth. Key amendments are as given below:

- Prescription of number of apprentices to be engaged at establishment level instead of trade-wise.
- Establishment can also engage apprentices in optional trades which are not designated, with the discretion of entry level qualification and syllabus.
- Scope has been extended also to non-engineering occupations.
- Establishments have been permitted to outsource basic training in an institute of their choice.
- The burden of compliance on industry has been reduced significantly.



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2.1 GENERAL

Directorate General of Training (DGT) under Ministry of Skill Development & Entrepreneurship offers range of vocational training courses catering to the need of different sectors of economy/ Labour market. The vocational training programmes are delivered under aegis of National Council of Vocational Training (NCVT). Craftsman Training Scheme (CTS) and Apprenticeship Training Scheme (ATS) are two pioneer programmes of NCVT for propagating vocational training.

Injection Moulding Machine Operator trade under ATS is one of the courses delivered nationwide through different industries. The course is of two years (02 Blocks) duration. It mainly consists of Domain area and Core area. In the Domain area Trade Theory & Practical impart professional - skills and knowledge, while Core area - Workshop Calculation and science, Engineering Drawing and Employability Skills imparts requisite core skills & knowledge and life skills. After passing out the training programme, the trainee is being awarded National Apprenticeship Certificate (NAC) by NCVT having worldwide recognition.

Broadly candidates need to demonstrate that they are able to:

- Read & interpret technical parameters/document, plan and organize work processes, identify necessary materials and tools;
- Perform task with due consideration to safety rules, accident prevention regulations and environmental protection stipulations;
- Apply professional skill, knowledge, core skills & employability skills while performing jobs and solve problem during execution.
- Check the job/assembly as per drawing for functioning, identify and rectify errors in job/assembly.
- Document the technical parameters related to the task undertaken.

2.2 CAREER PROGRESSION PATHWAYS:

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graph BT; NAC[NAC] --> ATech3[Asst. Technician (Tech- III)]; ATech3 --> ATech2[Technician (Tech- II)]; ATech2 --> ATech1[Technician (Tech- I)]; ATech1 --> STech[Senior Technician]; STech --> JSup[Junior Supervisor]; JSup --> SSup[Senior Supervisor]; SSup --> ASWM[Asst. Workshop Manager]; ASWM --> SM[Shop Manager]; SM --> Ent[Entrepreneur]; SSup --> QI[Quality Inspector]; SSup --> Ent; NAC --> AT[Assistant Trainer]; AT --> T[Trainer]; T --> ST[Sr. Trainer]; ST --> TInC[Trg.-In Charge];
```

Table below depicts the distribution of training hours across various course elements during a period of two years (*Basic Training and On-Job Training*): -

| <b>Time<br/>(in months)</b>                       | <b>1-3</b>      | <b>4-12</b>      | <b>13-15</b>      | <b>16-24</b>      |
|---------------------------------------------------|-----------------|------------------|-------------------|-------------------|
| <b>Basic Training</b>                             | <b>Block– I</b> | <b>-----</b>     | <b>Block – II</b> | <b>-----</b>      |
| <b>Practical Training<br/>(On - job training)</b> | <b>----</b>     | <b>Block – I</b> | <b>-----</b>      | <b>Block – II</b> |



## Injection Moulding Machine Operator

### A. Basic Training

For 02 yrs. course (Engg.) :-(**Total 06 months:** 03 months in 1<sup>st</sup>yr. + 03 months in 2<sup>nd</sup> yr.)

For 01 yr. course (Engg.) :-(**Total 03 months:** 03 months in 1<sup>st</sup>yr.)

| S No. | Course Element                               | Total Notional Training Hours |                   |
|-------|----------------------------------------------|-------------------------------|-------------------|
|       |                                              | For 02 Yrs. course            | For 01 Yr. course |
| 1.    | Professional Skill (Trade Practical)         | 550                           | 275               |
| 2.    | Professional Knowledge (Trade Theory)        | 240                           | 120               |
| 3.    | Workshop Calculation & Science               | 40                            | 20                |
| 4.    | Engineering Drawing                          | 60                            | 30                |
| 5.    | Employability Skills                         | 110                           | 55                |
|       | <b>Total (Including internal assessment)</b> | <b>1000</b>                   | <b>500</b>        |

### B. On-Job Training:-

For 02 yrs. Course (Engg.) :-( **Total 18 months:** 09 months in 1<sup>st</sup> yr. + 09 months in 2<sup>nd</sup> yr.)

Notional Training Hours for On-Job Training: 3120 Hrs.

For 01 yr. course (Engg.) :-( **Total 12 months**)

Notional Training Hours for On-Job Training: 2080 Hrs.

### C. Total training hours:-

| Duration                             | Basic Training | On-Job Training | Total     |
|--------------------------------------|----------------|-----------------|-----------|
| <b>For 02 yrs. course</b><br>(Engg.) | 1000 hrs.      | 3120 hrs.       | 4120 hrs. |
| <b>For 01 yr. course</b><br>(Engg.)  | 500 hrs.       | 2080 hrs.       | 2580 hrs. |

## 2.4 ASSESSMENT & CERTIFICATION:

The trainee will be tested for his skill, knowledge and attitude during the period of course and at the end of the training programme as notified by Govt of India from time to time. The Employability skills will be tested in first two semesters only.

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a) The **Internal assessment** during the period of training will be done by **Formative assessment method** by testing for assessment criteria listed against learning outcomes. The training institute have to maintain individual trainee portfolio as detailed in assessment guideline (section-2.4.2). The marks of internal assessment will be as per the template (Annexure – II).

b) The final assessment will be in the form of summative assessment method. The All India Trade Test for awarding NAC will be conducted by NCVT on completion of course as per guideline of Govt of India. The pattern and marking structure is being notified by govt of India from time to time. **The learning outcome and assessment criteria will be basis for setting question papers for final assessment. The examiner during final examination will also check individual trainee's profile as detailed in assessment guideline (section-2.4.2) before giving marks for practical examination.**

### **2.4.1 PASS REGULATION**

The minimum pass percent for Practical is 60% & minimum pass percent for Theory subjects 40%. The candidate pass in each subject conducted under all India trade test.

### **2.4.2 ASSESSMENT GUIDELINE**

Appropriate arrangements should be made to ensure that there will be no artificial barriers to assessment. The nature of special needs should be taken into account while undertaking assessment. Due consideration should be given while assessing for team work, avoidance/reduction of scrap/wastage and disposal of scarp/wastage as per procedure, behavioral attitude, sensitivity to environment and regularity in training. The sensitivity towards OSHS and self-learning attitude are to be considered while assessing competency.

Assessment will be evidence based comprising the following:

- Job carried out in labs/workshop
- Record book/ daily diary
- Answer sheet of assessment
- Viva-voce
- Progress chart
- Attendance and punctuality
- Assignment
- Project work

Evidences of internal assessments are to be preserved until forthcoming semester examination for audit and verification by examination body. The following marking pattern to be adopted while assessing:

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| Performance Level                                                                                                                                                                                                                                    | Evidence                                                                                                                                                                                                                                                                                                                                                                                                                                 |
|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>(a) Weightage in the range of 60 -75% to be allotted during assessment</b>                                                                                                                                                                        |                                                                                                                                                                                                                                                                                                                                                                                                                                          |
| For performance in this grade, the candidate with occasional guidance and showing due regard for safety procedures and practices, has produced work which demonstrates attainment of an acceptable standard of craftsmanship.                        | <ul style="list-style-type: none"> <li>• Demonstration of good skill in the use of hand tools, machine tools and workshop equipment</li> <li>• Below 70% tolerance dimension/accuracy achieved while undertaking different work with those demanded by the component/job/set standards.</li> <li>• A fairly good level of neatness and consistency in the finish</li> <li>• Occasional support in completing the project/job.</li> </ul> |
| <b>(b) Weightage in the range of above 75% - 90% to be allotted during assessment</b>                                                                                                                                                                |                                                                                                                                                                                                                                                                                                                                                                                                                                          |
| For this grade, the candidate, with little guidance and showing due regard for safety procedures and practices, has produced work which demonstrates attainment of a reasonable standard of craftsmanship.                                           | <ul style="list-style-type: none"> <li>• Good skill levels in the use of hand tools, machine tools and workshop equipment</li> <li>• 70-80% tolerance dimension/accuracy achieved while undertaking different work with those demanded by the component/job/set standards.</li> <li>• A good level of neatness and consistency in the finish</li> <li>• Little support in completing the project/job</li> </ul>                          |
| <b>(c) Weightage in the range of above 90% to be allotted during assessment</b>                                                                                                                                                                      |                                                                                                                                                                                                                                                                                                                                                                                                                                          |
| For performance in this grade, the candidate, with minimal or no support in organization and execution and with due regard for safety procedures and practices, has produced work which demonstrates attainment of a high standard of craftsmanship. | <ul style="list-style-type: none"> <li>• High skill levels in the use of hand tools, machine tools and workshop equipment</li> <li>• Above 80% tolerance dimension/accuracy achieved while undertaking different work with those demanded by the component/job/set standards.</li> <li>• A high level of neatness and consistency in the finish.</li> <li>• Minimal or no support in completing the project.</li> </ul>                  |

#### **Brief description of Job roles:**

**Injection Moulding Machine Operator (Plastics)** sets up and operates injection-moulding machines to cast products from thermoplastic materials. Installs dies on machine, according to work order specifications, using clamps, bolts, and hand-tools; sets thermostatic controls to obtain specified moulding temperature; dumps pre-mixed plastic powders or pellets into hopper and starts machine; pulls lever to close dies and inject into dies to cast part; removes finished product from dies, using hand tools and trims excess material from part using knife. May mix thermoplastic materials and colouring pigments in mixing machine, according to formulae. May grind scrap plastic into powders for reuse.

Plan and organize assigned work and detect & resolve issues during execution. Demonstrate possible solutions and agree tasks within the team. Communicate with required clarity and understand technical English. Sensitive to environment, self-learning and productivity.

Perform TPM (Total Production Management), TQM (Total Quality Management) and record keeping system.

**Reference NCO 2015:** 8142.0501 - Injection Moulding Machine Operator (Plastic)

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### 4. NSQF LEVEL COMPLIANCE

NSQF level for Injection Moulding Machine Operator trade under ATS: **Level 5**

As per notification issued by Govt. of India dated- 27.12.2013 on National Skill Qualification Framework total 10 (Ten) Levels are defined.

Each level of the NSQF is associated with a set of descriptors made up of five outcome statements, which describe in general terms, the minimum knowledge, skills and attributes that a learner needs to acquire in order to be certified for that level.

Each level of the NSQF is described by a statement of learning outcomes in five domains, known as level descriptors. These five domains are:

- a) Process
- b) professional knowledge,
- c) professional skill,
- d) core skill and
- e) Responsibility.

The Broad Learning outcome of Injection Moulding Machine Operator trade under ATS mostly matches with the Level descriptor at Level- 5.

The NSQF level-5 descriptor is given below:

| Level   | Process Required                                                                             | Professional Knowledge                                                                      | Professional Skill                                                                                                                                                  | Core Skill                                                                                                                             | Responsibility                                                                                   |
|---------|----------------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------|
| Level 5 | Job that requires well developed skill, with clear choice of procedures in familiar context. | Knowledge of facts, principles, processes and general concepts, in a field of work or study | A range of cognitive and practical skills required to accomplish tasks and solve problem by selecting and applying basic methods, tools, materials and information. | Desired mathematical skill, understanding of social, political and some skill of collecting and organizing information, communication. | Responsibility for own work and Learning and some responsibility for other's works and learning. |

|                                                                                   |                                                                                                                                                                                            |
|-----------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>Name of the Trade</b>                                                          | INJECTION MOULDING MACHINE OPERATOR                                                                                                                                                        |
| <b>NCO-2015</b>                                                                   | 8142.0501                                                                                                                                                                                  |
| <b>NSQF Level</b>                                                                 | Level – 5                                                                                                                                                                                  |
| <b>Duration of Apprenticeship Training</b><br>(Basic Training + On-Job Training)  | Two years (02 Blocks each of one year duration).                                                                                                                                           |
| <b>Duration of Basic Training</b>                                                 | a) Block –I : 3 months<br>b) Block – II : 3 months<br><b>Total duration of Basic Training: 6 months</b>                                                                                    |
| <b>Duration of On-Job Training</b>                                                | a) Block–I: 9 months<br>b) Block–II : 9 months<br><b>Total duration of Practical Training: 18 months</b>                                                                                   |
| <b>Entry Qualification</b>                                                        | Passed 10th class examination under 10+2 system of education or its equivalent.                                                                                                            |
| <b>Selection of Apprentices</b>                                                   | The apprentices will be selected as per Apprenticeship Act amended time to time.                                                                                                           |
| <b>Instructors Qualification for Basic Training</b>                               | As per ITI instructors qualifications as amended time to time for the specific trade.                                                                                                      |
| <b>Infrastructure for Basic Training</b>                                          | As per related trade of ITI                                                                                                                                                                |
| <b>Examination</b>                                                                | The internal examination/ assessment will be held on completion of each block.<br>Final examination for all subjects will be held at the end of course and same will be conducted by NCVT. |
| <b>Rebate to Ex-ITI Trainees</b>                                                  | i) One year in the trade of BBBT and Advance module in Injection Moulding in the plastic processing Sector under CoE.<br>ii) One year in the trade of Plastic Processing Operator          |
| <b>CTS trades eligible for Injection Moulding Machine Operator Apprenticeship</b> | Plastic Processing Operator                                                                                                                                                                |

**Note:**

- Industry may impart training as per above time schedule for different block, however this is not fixed. The industry may adjust the duration of training considering the fact that all the components under the syllabus must be covered. However the flexibility should be given keeping in view that no safety aspects is compromised.
- For imparting Basic Training the industry to tie-up with ITIs having such specific trade and affiliated to NCVT.

**6.1 GENERIC LEARNING OUTCOME**

The following are minimum broad Common Occupational Skills/ Generic Learning Outcome after completion of the Injection Moulding Machine Operator course of 02 years duration under ATS.

**Block I & II:-**

1. Recognize & comply safe working practices, environment regulation and housekeeping.
2. Understand and explain different mathematical calculation & science in the field of study including basic electrical. *[Different mathematical calculation & science -Work, Power & Energy, Algebra, Geometry & Mensuration, Trigonometry, Heat & Temperature, Levers & Simple machine, graph, Statistics, Centre of gravity, Power transmission, Pressure]*
3. Interpret specifications, different engineering drawing and apply for different application in the field of work. *[Different engineering drawing-Geometrical construction, Dimensioning, Layout, Method of representation, Symbol, scales, Different Projections, Machined components & different thread forms, Assembly drawing, Sectional views, Estimation of material, Electrical & electronic symbol]*
4. Select and ascertain measuring instrument and measure dimension of components and record data.
5. Explain the concept in productivity, quality tools, and labour welfare legislation and apply such in day to day work to improve productivity & quality.
6. Explain energy conservation, global warming and pollution and contribute in day to day work by optimally using available resources.
7. Explain personnel finance, entrepreneurship and manage/organize related task in day to day work for personal & societal growth.
8. Plan and organize the work related to the occupation.

**6.2 SPECIFIC LEARNING OUTCOME**

**Block – I**

1. Practice bets safety and basic Industrial Culture (5S, KAIZEN and TS/ISO/EOHS).
2. Prepare documentation as per industrial need by different methods of recording information.

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3. Assist to operate Hydraulic type of Semi-automatic Injection Moulding Machines, produce components in different moulds carry out cycle-time analysis, observe process-parameters & record parameters.
4. Carry out scrap grinding, make machine study in IRO, list the specifications of machine, explain parts and function, trace line diagram of Machine
5. Troubleshoot injection moulding machine.
6. Carry out Idle-Run Observation of automatic injection moulding machine & identify parts of Injection Unit, Clamping knobs and follow the safety Precautions
7. Practice the start-up Procedure, Shut-down Procedure, Sketch the Machine Platens, Clamping, system, type of nozzle used in Machine etc.
8. Identify and explain the parts and their functions of Hydraulic System used in used in the Machines. Practice machine Operation, process parameter setting for a particular mould on the machine, operation of machine in hand, Semi Automatic and Automatic-mode to produce components and observe all parameters.
9. Troubleshoot for moulding faults and analyse for causes and provide remedies.
10. Explain the basic concepts of Micro-processor control, comparison of Micro-processor controlled Machines with conventional Machines.
11. Practice machine setting procedure, procedure for process parameter setting on monitor/ control panel. Operate machine with mould fixing and setting on the machine with different plastic materials.
12. Carry out cycle time analysis, list the important operating procedure and safety precautions.
13. List out and classify different Types of moulds, injection moulds, mould maintenance and storage.
14. Explain the basic operation of hydraulic and pneumatic systems, electrical system, and define the terms – hydraulic fluid, viscosity, different types of valves.
15. Explain the types and functions of hydraulic pumps, electrical heaters, thermocouples temperature control parameters and timers and electrical motors in the trade.
16. Carry out maintenance work on processing machines including preventive maintenance and prepare the routine check points for all processing machines, carry out housekeeping, check hydraulics and electrical circuit for safety, carry out troubleshooting and provide remedies.

### **Block – II**

1. Identify and follow-up the actions taken of safety rules and regulation as applicable to related shop floor exercise. Practice operation of safety equipment and first aid methods. List out the environment pollution and mechanics role in minimizing the same.
2. Explain the parts and their functions, constructional features and specification of automatic injection moulding machine (IMM). Describe the operation & control



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systems of machine. Identify and explain parts of mould clamping system , explain the methods of starting & shut down procedure.

3. Classify different mould fitting adjustment of m/c daylight, locating ring, ejector stroke and tie bar distance, m/c platen size & clamping arrangement. List out systems used in IMM such as cooling systems, electrical system, Hydraulic systems & electronics system.
4. Identify parts and explain functions of injection unit, clamping unit in IRO. Practice Mould loading / unloading on IMM and observe precautions. Work in TRO using various grade of plastic to set various parameters. Set the process parameter for specific mould on the IMM (fully auto). Operate of IMM by manual, semi auto & fully auto mode to produce articles. Practice record keeping for analysis of fault, causes & remedies using different plastic materials.
5. Explain construction, operation & control of PLC operated IMM. List the procedure for machine & process parameter setting on monitor with control panel. Carry out analysis of product defect causes, their remedies. Carry out starting as per sequence of operation & following the precautions.
6. Identify parts and functions of recycling machine used in injection moulding plastic waste & draw line diagram of recycling. Carry out mixing virgin in to recycled plastic waste material. Identify seven industrial wastages.
7. Test various properties & identify plastic using 7 QC tools.
8. Operate electric heaters, explain their parts, functions, applications & specifications. Operate thermocouples, parts, functions, application & specifications. Operate temperature controllers, parts function, application & specifications.
9. Identify and explain parts and functions of thermo regulator, Colour mixer, chillers, scrap grinder & draw its line diagram, parts, function, application & specification. Operate, control and set utilities used in automatic IM process.
10. Carry out the testing & maintenance work of entire plant including power control equipment, devices & circuits. Test & maintain moulds, clamping system including preventive maintenance. Prepare check points for all processing machines for maintenance. Practice by Daily start up & shut down procedure, trouble shoot and rectify the faults.

**Note:** Learning outcomes are reflection of total competencies of a trainee and assessment will be carried out as per assessment criteria.

**7. LEARNING OUTCOME WITH ASSESSMENT CRITERIA**

| <b>GENERIC LEARNING OUTCOME</b>                                                                           |                                                                                                                                                                                                                       |
|-----------------------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>LEARNING OUTCOMES</b>                                                                                  | <b>ASSESSMENT CRITERIA</b>                                                                                                                                                                                            |
| 1. Recognize & comply safe working practices, environment regulation and housekeeping.                    | 1. 1. Follow and maintain procedures to achieve a safe working environment in line with occupational health and safety regulations and requirements.                                                                  |
|                                                                                                           | 1. 2. Recognize and report all unsafe situations according to site policy.                                                                                                                                            |
|                                                                                                           | 1. 3. Identify and take necessary precautions on fire and safety hazards and report according to site policy and procedures.                                                                                          |
|                                                                                                           | 1. 4. Identify, handle and store / dispose off dangerous/unsalvageable goods and substances according to site policy and procedures following safety regulations and requirements.                                    |
|                                                                                                           | 1. 5. Identify and observe site policies and procedures in regard to illness or accident.                                                                                                                             |
|                                                                                                           | 1. 6. Identify safety alarms accurately.                                                                                                                                                                              |
|                                                                                                           | 1. 7. Report supervisor/ Competent of authority in the event of accident or sickness of any staff and record accident details correctly according to site accident/injury procedures.                                 |
|                                                                                                           | 1. 8. Identify and observe site evacuation procedures according to site policy.                                                                                                                                       |
|                                                                                                           | 1. 9. Identify Personal Productive Equipment (PPE) and use the same as per related working environment.                                                                                                               |
|                                                                                                           | 1. 10. Identify basic first aid and use them under different circumstances.                                                                                                                                           |
|                                                                                                           | 1. 11. Identify different fire extinguisher and use the same as per requirement.                                                                                                                                      |
|                                                                                                           | 1. 12. Identify environmental pollution & contribute to avoidance of same.                                                                                                                                            |
|                                                                                                           | 1. 13. Take opportunities to use energy and materials in an environmentally friendly manner                                                                                                                           |
|                                                                                                           | 1. 14. Avoid waste and dispose waste as per procedure                                                                                                                                                                 |
|                                                                                                           | 1. 15. Recognize different components of 5S and apply the same in the working environment.                                                                                                                            |
| 2. Understand, explain different mathematical calculation & science in the field of study including basic | 2.1 Explain concept of basic science related to the field such as Material science, Mass, weight, density, speed, velocity, heat & temperature, force, motion, pressure, heat treatment, centre of gravity, friction. |

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|                                                                                                                                                                                                                                                                                                                                                                                                               |                                                                                                                                                            |
|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------|
| electrical and apply in day to day work.[Different mathematical calculation & science -Work, Power & Energy, Algebra, Geometry & Mensuration, Trigonometry, Heat & Temperature, Levers & Simple machine, graph, Statistics, Centre of gravity, Power transmission, Pressure]                                                                                                                                  | 2.2 Measure dimensions as per drawing                                                                                                                      |
|                                                                                                                                                                                                                                                                                                                                                                                                               | 2.3 Use scale/ tapes to measure for fitting to specification.                                                                                              |
|                                                                                                                                                                                                                                                                                                                                                                                                               | 2.4 Comply given tolerance.                                                                                                                                |
|                                                                                                                                                                                                                                                                                                                                                                                                               | 2.5 Prepare list of appropriate materials by interpreting detail drawings and determine quantities of such materials.                                      |
|                                                                                                                                                                                                                                                                                                                                                                                                               | 2.6 Ensure dimensional accuracy of assembly by using different instruments/gauges.                                                                         |
|                                                                                                                                                                                                                                                                                                                                                                                                               | 2.7 Explain basic electricity, insulation & earthing.                                                                                                      |
|                                                                                                                                                                                                                                                                                                                                                                                                               |                                                                                                                                                            |
| 3. Interpret specifications, different engineering drawing and apply for different application in the field of work. [Different engineering drawing-Geometrical construction, Dimensioning, Layout, Method of representation, Symbol, scales, Different Projections, Machined components & different thread forms, Assembly drawing, Sectional views, Estimation of material, Electrical & electronic symbol] | 3. 1. Read & interpret the information on drawings and apply in executing practical work.                                                                  |
|                                                                                                                                                                                                                                                                                                                                                                                                               | 3. 2. Read & analyse the specification to ascertain the material requirement, tools, and machining /assembly /maintenance parameters.                      |
|                                                                                                                                                                                                                                                                                                                                                                                                               | 3. 3. Encounter drawings with missing/unspecified key information and make own calculations to fill in missing dimension/parameters to carry out the work. |
|                                                                                                                                                                                                                                                                                                                                                                                                               |                                                                                                                                                            |
| 4. Select and ascertain measuring instrument and measure dimension of components and record data.                                                                                                                                                                                                                                                                                                             | 4.1 Select appropriate measuring instruments such as micrometers, vernier calipers, dial gauge, bevel protector and height gauge (as per tool list).       |
|                                                                                                                                                                                                                                                                                                                                                                                                               | 4.2 Ascertain the functionality & correctness of the instrument.                                                                                           |
|                                                                                                                                                                                                                                                                                                                                                                                                               | 4.3 Measure dimension of the components & record data to analyse the with given drawing/measurement.                                                       |
|                                                                                                                                                                                                                                                                                                                                                                                                               |                                                                                                                                                            |
| 5. Explain the concept in productivity, quality tools, and labour welfare legislation and apply such in day to day work to improve productivity & quality.                                                                                                                                                                                                                                                    | 5.1 Explain the concept of productivity and quality tools and apply during execution of job.                                                               |
|                                                                                                                                                                                                                                                                                                                                                                                                               | 5.2 Understand the basic concept of labour welfare legislation and adhere to responsibilities and remain sensitive towards such laws.                      |
|                                                                                                                                                                                                                                                                                                                                                                                                               | 5.3 Knows benefits guaranteed under various acts                                                                                                           |
|                                                                                                                                                                                                                                                                                                                                                                                                               |                                                                                                                                                            |

## Injection Moulding Machine Operator

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|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 6. Explain energy conservation, global warming and pollution and contribute in day to day work by optimally using available resources.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        | 6.1 Explain the concept of energy conservation, global warming, pollution and utilize the available resources optimally & remain sensitive to avoid environment pollution.                                                                      |
|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               | 6.2 Dispose waste following standard procedure.                                                                                                                                                                                                 |
|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |                                                                                                                                                                                                                                                 |
| 7. Explain personnel finance, entrepreneurship and manage/organize related task in day to day work for personal & societal growth.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            | 7. 1. Explain personnel finance and entrepreneurship.                                                                                                                                                                                           |
|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               | 7. 2. Explain role of Various Schemes and Institutes for self-employment i.e. DIC, SIDA, SISI, NSIC, SIDO, Idea for financing/ non financing support agencies to familiarizes with the Policies /Programmes & procedure & the available scheme. |
|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               | 7. 3. Prepare Project report to become an entrepreneur for submission to financial institutions.                                                                                                                                                |
|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |                                                                                                                                                                                                                                                 |
| 8. Plan and organize the work related to the occupation.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      | 8. 1. Use documents, drawings and recognize hazards in the work site.                                                                                                                                                                           |
|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               | 8. 2. Plan workplace/ assembly location with due consideration to operational stipulation                                                                                                                                                       |
|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               | 8. 3. Communicate effectively with others and plan project tasks                                                                                                                                                                                |
|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               | 8. 4. Assign roles and responsibilities of the co-trainees for execution of the task effectively and monitor the same.                                                                                                                          |
| <b>SPECIFIC OUTCOME</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |                                                                                                                                                                                                                                                 |
| <b><u>Block- I &amp; II (Section:10)</u></b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |                                                                                                                                                                                                                                                 |
| <p><i>Assessment Criteria i.e. the standard of performance, for each specific learning outcome mentioned under <b>block – I &amp; II</b> (section: 10) must ensure that the trainee achieves well developed skill with clear choice of procedure in familiar context. Assessment criteria should broadly cover the aspect of <b>Planning</b> (Identify, ascertain, estimate etc.); <b>Execution</b> (perform, illustration, demonstration etc. by applying 1) a range of cognitive and practical skills required to accomplish tasks and solve problems by selecting and applying basic methods, tools, materials and information 2) Knowledge of facts, principles, processes, and general concepts, in a field of work or study 3)Desired Mathematical Skills and some skill of collecting and organizing information, communication) and <b>Checking/ Testing</b> to ensure functionality during the assessment of each outcome. The assessments parameters must also ascertain that the candidate is responsible for own work and learning and some responsibility for other's work and learning.</i></p> |                                                                                                                                                                                                                                                 |

**BASIC TRAINING (Block – I)****Duration: (03) Three Months**

| Week No. | Professional Skills                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               | Professional Knowledge                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |
|----------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 1.       | <p>Safety: - its importance, classification, personal, general, workshop and job safety.</p> <p>Occupational health and safety.</p> <p>Basic injury prevention, Basic first aid, Hazard identification and avoidance, safety signs for Danger, Warning, caution &amp; personal safety message.</p> <p>Preventive measures for electrical accidents &amp; steps to be taken in such accidents.</p> <p>Importance of housekeeping &amp; good shop floor practices.</p> <p>Disposal procedure of waste materials like cotton waste, metal chips/burrs etc.</p> <p>Fire &amp; safety: Use of Fire extinguishers.</p> <p>Safety regarding working with different types of steam and its First-Aid.</p> | <p>Importance of safety and general precautions observed in the industry/shop floor. All necessary guidance to be provided to the new comers to become familiar with the working of Institute system including stores procedures.</p> <p>Introduction of First aid. Safety attitude development of the trainee by educating him to use Personal Protective Equipment (PPE).</p> <p>Response to emergencies e.g.; power failure, fire, and system failure.</p> <p>Accidents- Definition types and causes.</p> <p>First-Aid, nature and causes of injury and utilization of first-aid.</p> <p>Introduction to 5S concept &amp; its application.</p> <p>Fire: - Types, causes and prevention methods. Fire Extinguisher, its types.</p> <p>Define environment, environment Pollution, Pollutants, type of Pollution (Air pollution, water pollution, soil pollution noise pollution, thermal pollution, radiation.</p> <p>Global warming its causes and remedies.</p> <p>Industrial Waste its types, sources and waste Management.</p> |
| 2.       | <p>Familiarize with Basic fitting and measurement hand tools. Filing a flat surface of Mild steel and cast iron. Check for flatness, straightness and squareness.</p> <p>Physical introduction to measuring instruments – handling of instruments – exercise in the use of Linear measuring instruments such as Steel rule of different ranges.</p> <p>Outside calipers, inside calipers for</p>                                                                                                                                                                                                                                                                                                  | <p>Introduction to hand tools and their safety.</p> <p>Classification of files, shapes, sizes &amp; grades.</p> <p>Selection criteria of files</p> <p>Selection of measuring instruments, care, use and maintenance of measuring instruments–Heading of precision instruments–Vernier Caliper, Micrometer, Height Gauge, Dial Gauge (Plunger and bevel type) with stand (0.01mm Resolution), checking squareness using</p>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |

## Injection Moulding Machine Operator

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|    | measuring outside & inside parameters. Vernier calipers – Least count, exercise in outside measurement, inside measurements, depth gauge.                                                                                                                                | combination set.                                                                                                                                                                                                                                                                                                                                                                                                                    |
| 3. | Hack sawing to dimension. Measurement of flat rectangular objects, cylinder objects, hollow components, threaded components. Exercises on external & internal measurements using Micrometers and Height gauges                                                           | Introduction to Metrology, Objectives of Metrology – measurements – principles – methods of measurement.<br>Terminology used in Metrology – Accuracy– Repeatability – Resolution etc.<br>SI units of measurements – physical quantities under SI system.<br>Marking and punching tools and their uses.<br>Hacksaw – types, specification and their uses.                                                                            |
| 4. | Filling flat and square to size to an accuracy of $\pm 0.1\text{mm}$ . Exercise on angular measurement using combination set & Vernier Bevel protector. Center drilling, drilling, reaming, counter sinking, counter boring and tapping for various sizes of mild steel. | Vernier Bevel Protector – reading and use.<br>Use of thread gauge & screw thread micrometer.<br>Drilling machine – Types – Drilling operation – Drill bits.<br>Reamers – types, care and maintenance.<br>Definition of terms- Hydraulic Fluid, Viscosity, Different Types of Valves and Hydraulic pumps.                                                                                                                            |
| 5. | Safety precautions while working on live wires/high voltage. Use of hand tools. Joining Practice with single and multi-stand conductors of different wires. Joining practice of bare conductors – soldering Practice on Printed circuit boards                           | General care & maintenance of common hand tools. Wires & cables – conductors, Insulators & semiconductors – their shapes, sizes with respect to low, medium & high voltage<br>Soldering Printed circuit boards & and its uses – Different fluxes for different purposes on metals – crimping equipment – Joining of conductors by soldering. Importance of Preventive Maintenance and routine tests<br>Earthing and its importance. |
| 6. | Making of simple circuit with a lamp and battery Study and use of Multimeters – measurement of current, voltage, resistance in DC/AC circuits. Demonstration of Series circuits – Parallel circuits.                                                                     | Resistance, Voltage, Current, open circuit and short circuits – Ohm's law – Voltage drop – series & parallel circuits – Power & energy relations – electrical measuring Instruments – Multi-meters Common electrical accessories used in Industries – Bus – bars, Relays, contactors, Circuit                                                                                                                                       |

## Injection Moulding Machine Operator

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|     |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 | Breakers, etc.<br>Fuses and its ratings – materials used.                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |
| 7.  | Demonstration & practice on connecting & replacement of common electrical accessories in circuits – use of tong tester and megger. Repairing & testing of electrical heaters & Temp. Indicator controller use in plastic moulding machines<br>Calibration & setting of Temp. controller indicator.                                                                                                                                                                                                                              | Types of heaters, thermocouples Temp. Indicator controller.<br>Types and function: Electrical heaters, thermocouples and temperature control parameters and timers, electrical motors – types and function.                                                                                                                                                                                                                                                                                                                     |
| 8.  | Starting & shut down a computer. Use start menu for opening an application. Familiarize with Key board and Keys. Open MSWord, create a new file, save a file, open an existing file, type a paragraph, set for left and right margins, draw a simple table, insert rows, insert columns, erase rows, erase columns, print the letter in a printer attached, in portrait and landscape. Search using search engine like Google for certain topics, download a file from the internet, save the downloaded file. Mail a document. | Use of desktop, control panel settings, Explorer, creating shortcuts, Use of simple applications like Paint Creating directories. Creating sample documents using MSWord, Text wrapping, Text formatting, changing letters to different case, drawing table, mail merging, page formatting, using different font types printing a document.                                                                                                                                                                                     |
| 9.  | <b><u>INJECTION MOULDING MACHINE – SEMI AUTOMATIC</u></b><br>Familiarization with Semi-Automatic Injection Moulding machine of all types in Ideal Run Operation (IRO). Operating Principles of machines, Line diagrams of machines with nomenclature of parts, machines specifications.                                                                                                                                                                                                                                         | Different plastic moulding machines and processes involved in moulding operation. Industrial safety while operating Machine. Hazards related to injection process.<br><b><u>INTRODUCTION TO INJECTION MOULDING</u></b><br>1.Features of Injection Moulding Process<br>2.Glossary – Technical terms used in Injection Moulding Process<br><b><u>TYPES OF INJECTION MOULDING MACHINES</u></b><br>Plunger type, Screw type, plunger-plunger type, Screw- Plunger type and Reciprocating Screw Type with their parts and functions. |
| 10. | Operations of Hydraulic type of Semi-automatic Injection Moulding Machines, to produce components in different moulds. Cycle-time analysis,                                                                                                                                                                                                                                                                                                                                                                                     | <b><u>PLASTICS MATERIALS</u></b><br>Plastics Materials Characteristics, types and grades.<br>Plastics Materials Identification by Simple                                                                                                                                                                                                                                                                                                                                                                                        |

## Injection Moulding Machine Operator

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|     | observations of process-parameters & procedure to be recorded.                                                                                                                       | Methods.<br>Criteria for selection of materials.<br>Importance of Pre-drying of Plastics Materials<br>Ancillary Machineries requirements                                                                                                                                                                                                                                                                                                                                                                               |
| 11. | <b><u>SCRAP GRINDING:</u></b><br>Machine study in IRO, specification of Machine, Study of parts and function, line diagram of Machine                                                | <b><u>BASIC PRINCIPLES &amp; FEATURES OF ADVANCE INJECTION MOULDING MACHINES:</u></b><br>Thermoset Injection Moulding Process<br>All electrical Injection Moulding Machines<br>Multi injection Moulding Machines Robotic operations etc.<br>Study and definitions of terms related to Machine operation e.g. Machine Day light, Locating – Ring dimensions, Ejector stroke, Tie-Bar distance, M/c platen sizes and mould clamping arrangements.                                                                        |
| 12. | <b><u>CLAMPING SYSTEMS:</u></b> study of clamping systems in Machines<br><b><u>MACHINE SELECTION:</u></b> Technical specifications of Machine, study of process sequence in machine. | <b><u>CLAMPING SYSTEMS</u></b><br>Manual, Toggle, Hydraulic, Hydro-Mechanical & Tie-Bar less clamping etc.<br><b><u>MACHINE SELECTION:</u></b><br>Based on clamping unit and Injection unit<br>Machine Specifications and its selection<br>Nomenclature, Types of screw, Ring-Plunger assembly, Screw drive etc.<br><b><u>MACHINE OPERATION:</u></b> Definitions of all processing parameters and study of controls in Machines. Manual, Semi and Automatic Process. Basic concepts of SMED, requirement and benefits. |
| 13. | <b>Revision &amp; Internal Assessment</b>                                                                                                                                            |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        |

**Note:** - More emphasis to be given on video/real-life pictures during theoretical classes. Some real-life pictures/videos of related industry operations may be shown to the trainees to give a feel of Industry and their future assignment.



## ***Injection Moulding Machine Operator***

### **BASIC TRAINING (Block – II)**

**Duration: (03) Three Months**

| <b>Week No.</b> | <b>Professional Skills</b>                                                                                                                                                                                                                                                                                   | <b>Professional Knowledge</b>                                                                                                                                                                                                                                                                                                   |
|-----------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 1.              | Familiarization with basic idea of mechanical electrical and hydraulic system of compression Moulding Machine and its different parts and their respective functions                                                                                                                                         | Occupational Hazards and safety measures related to the trade. Introduction about environment and environment management system.<br>Hazards related to compression moulding process. Plastic process machinery, compression moulding machine- Hand operated different parts and their respective function.                      |
| 2.              | Operating and controlling of compression Moulding Machine in Ideal run operation (movement of platten top or bottom- adjustment and control, adjusting pressure in terms of per-square area, and total tonnage, Fitting and heating of moulds controlling temperature, checking of bulk factor/density etc.) | Compression moulding machine automatic different parts and their respective function                                                                                                                                                                                                                                            |
| 3.              | Operating and controlling of compression moulding Machine in Ideal run operation using thermosetting material as available                                                                                                                                                                                   | Polymer- their properties and use, Basic thermosetting material properties, use and application. Thermosetting plastic material Phenol formaldehyde (PF) Urea Formaldehyde (UF) melamine formaldehyde (MF) polyester Based resin in various form and epoxy resin – properties, use and application. Introduction of FRP process |
| 4.              | Familiarization with automatic Blow Moulding Machine and its different parts and their respective functions - sequence to be followed in operating the machine.<br>Familiarization with basic idea of mechanical, Electrical and hydraulic & pneumatic system of Blow Moulding Machine.                      | Hazards related to Blow moulding process. Polymer theory, groups of plastics, blow moulding materials.<br>Familiarization of Blow moulding process.                                                                                                                                                                             |
| 5.              | Operating and controlling of Blow-Moulding Machine in Ideal Run                                                                                                                                                                                                                                              | Polymer, their properties, use and application of LDPE, HDPE, PET, PC.                                                                                                                                                                                                                                                          |

## Injection Moulding Machine Operator

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|     | Operation (Setting of die, adjusting mandrel, controlling, parison, adjusting thickness uniformity).                                                                                                                                                                               | Processability of plastic material, Processing techniques of plastic material.                                                                                                                                                                                                                                                                                                                                                                      |
| 6.  | Operating and controlling of Blow- Moulding Machine in Trial Run Operation using thermoplastic material as available.                                                                                                                                                              | Basic parts of mould and construction details, Brief description of multi-layer extrusion Blow moulding, Extrusion stretch Blow moulding, Injection stretch Blow moulding, and press blow moulding for squeezable container.                                                                                                                                                                                                                        |
| 7.  | Familiarization with basic idea of mechanical, electrical and hydraulic system of Extrusion machine and its different parts and their respective functions.                                                                                                                        | Hazards related to Extrusions process. Extrusion machine, its description and use different parts and their respective function, operating, controlling, all equipment relating to Extrusion.                                                                                                                                                                                                                                                       |
| 8.  | Operating and controlling of Extrusion machine in Ideal run operation. (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.) | Extrusion machine, its description and use different parts and their respective function, operating, controlling, all equipments relating to Extrusion.                                                                                                                                                                                                                                                                                             |
| 9.  | Operating and controlling of Extrusion machine in Ideal Run Operation. (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.) | Extrusion machine, its description and use different parts and their respective function, operating, controlling, all equipments relating to Extrusion                                                                                                                                                                                                                                                                                              |
| 10. | Operations of 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.                                                                         | <p><u>PROCESS PRINCIPLES &amp; FEATURES OF ADVANCE INJECTION MOULDING PROCESSES:</u></p> <p>Gas &amp; Water Assist Injection Moulding<br/>Thin Wall Injection Moulding<br/>Mucell Injection Moulding Foam moulding etc.<br/>Process Principle and Features.</p> <p><u>MELT BEHAVIOR</u></p> <p>Processing behavior of different Plastics<br/>Plastic melt behavior inside the Barrel and the Mould<br/>Processing defects, causes, remedies and</p> |

## Injection Moulding Machine Operator

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|     |                                           | trouble shooting<br>Product Dimensions, process validation.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |
| 11. | -do-                                      | <b><u>MICRO-PROCESSOR CONTROLLED INJECTION MOULDING M/C:</u></b><br>Principal of Microprocessor Control Systems, Open/close Loop Control Systems.<br>Study of terminology of automatic injection mould; features parts, function & specification.<br><b><u>PROCESS &amp; QUALITY CONTROLS:</u></b><br>Brief introduction to Statistical Process control and Statistical Quality Control.                                                                                                                                                                                                                                                                                                                                                                                                                     |
| 12. | IRO & TRO thermoforming process.          | <b><u>POST MOULDING OPERATIONS:</u></b><br>Annealing/Stress Relieving etc.<br>Thermoforming/vacuum forming cycle and its types.<br><b><u>MOULDS</u></b><br>Mould materials, faults and its remedies.<br>Nomenclature of moulds, Types of moulds used, Hot Runner Moulds, Mould material etc.<br><b><u>HYDRAULIC MACHINE OPERATIONS:</u></b><br>Study of basic knowledge of hydraulic, pneumatic & all electric control system. Study of different valves, parts, functions, application & specification. Study of different hydraulic pumps, parts, functions, applications & specification. Oil requirements Functioning of Valves and Other Accessories<br>Control Systems – Thermocouple/Pyro. Meter, Valves, Pumps, Limit Switches, Timers etc.<br>Machine Maintenance –<br>Preventive/Routine/Breakdown |
| 13. | <b>Revision &amp; Internal Assessment</b> |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |

**Note:** - More emphasis to be given on video/real-life pictures during theoretical classes. Some real-life pictures/videos of related industry operations may be shown to the trainees to give a feel of Industry and their future assignment.

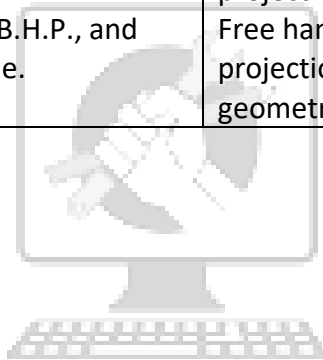
## 9.1 WORKSHOP CALCULATION SCIENCE &amp; ENGINEERING DRAWING

## Block - I

| Topic no. | a) Workshop Science & Calculation                                                                                                                                                                                                                                                                              | b) Engineering Drawing                                                                                                                                                                                                                                                                                                                                        |
|-----------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 1         | <b>Units &amp; Measurements-</b> FPS, CGS, MKS/SI unit, unit of length, Mass and time. Fundamentals and derived units Conversion of units and applied problems.                                                                                                                                                | Engineering Drawing: Introduction and its importance<br>Different types of standards used in engineering drawing.<br>Drawing Instruments: their uses<br>Drawing board, T-Square, Drafter (Drafting M/c), Set Squares, Protractor, Drawing Instrument Box (Compass, Dividers, Scale, Diagonal Scales etc.), Pencils of different Grades, Drawing pins / Clips. |
| 2         | <b>Material Science :</b> properties -Physical & Mechanical, Types -Ferrous & Non-Ferrous, difference between Ferrous and Non-Ferrous metals                                                                                                                                                                   | Lines :<br>types and applications in Drawing as per BIS SP:46-2003<br>Drawing geometrical object using all types of lines.<br><b>Drawing of Geometrical Figures:</b> Angle, Triangle, Square, Rectangle and Circle.<br><b>Letters:</b> - Lettering styles, Single stroke letters and numbers as per IS standard. Lettering practice                           |
| 3         | <b>Mass .Weight and Density :</b> Mass, Unit of Mass, Weight, difference between mass and weight, Density, unit of density,                                                                                                                                                                                    | <b>Dimensioning-</b> Types of dimension, elements of dimensions, Methods of indicating Values, Arrangement, Alignment and indication of dimensions.<br><b>Scales:-</b> Types use and construction. Representative factor of scale.                                                                                                                            |
| 4         | <b>Speed and Velocity:</b> Rest and motion, speed, velocity, difference between speed and velocity, acceleration, retardation.<br>Average Velocity, Acceleration & Retardation. Related problems.<br>Circular Motion: Relation between circular motion and Linear motion, Centrifugal force, Centripetal force | Method of presentation of Engineering Drawing<br>- Pictorial View<br>- Orthogonal View<br>- Isometric view                                                                                                                                                                                                                                                    |

## Injection Moulding Machine Operator

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| 5 | <b>Ratio &amp; Proportion :</b><br>Simple calculation on related problems.<br><b>Percentage:</b> Introduction, Simple calculation.                                                                                                                                                              | <b>Constructions:</b> - Draw proportionate free hand sketches of plane figures. Sketch horizontal, vertical and inclined line by free hand, Draw circles by free hand using square and radial line method, Draw arcs and ellipse by free hand                                                                                                                  |
| 6 | <b>Work, Power and Energy:</b> work, unit of work, power, unit of power, Horse power of engines, mechanical efficiency, energy, use of energy, potential and kinetic energy, examples of potential energy and kinetic energy.<br>Meaning of H.P., I.H.P., B.H.P., and F.H.P. and CC and Torque. | Projections:<br>Concept of axes plane and quadrant.<br>Orthographic projections<br>Method of first angle and third angle projections (definition and difference)<br>Symbol of 1 <sup>st</sup> angle and 3 <sup>rd</sup> angle projection as per IS specification.<br>Free hand Drawing of Orthographic projection from isometric/3D view of geometrical blocks |



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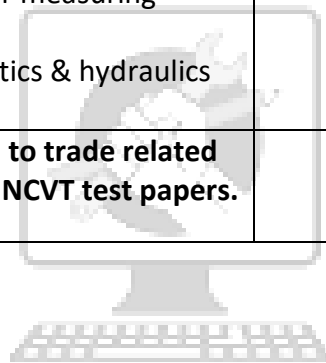
## Injection Moulding Machine Operator

### B. Block- II

| Topic No. | a) Workshop Science & Calculation                                                                                                                                                                                                                                                                                                               | b) Engineering Drawing                                                                                               |
|-----------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------|
| 1         | <b>Algebra:</b><br>Addition, Subtraction, Multiplication, Division, Algebraic formula, Linear equations (with two variables).                                                                                                                                                                                                                   | <b>Screw :-</b><br>Its Types and Sizes, Screw thread, their standard forms as per BIS, external and internal thread. |
| 2         | <b>Heat &amp; Temperature:</b><br>Heat and temperature, their units, difference between heat and temperature, boiling point, melting point, scale of temperature, relation between different scale of temperature, Thermometer, pyrometer, transmission of heat, conduction, convection, radiation.                                             | <b>Rivets and Joints:-</b><br>Prepare a drawing sheet on rivets nomenclature and Joints.                             |
| 3         | <b>Mensuration:</b> Area and perimeter of square, rectangle, parallelogram, triangle, circle, semi circle, Volume of solids - cube, cuboid, cylinder and Sphere.<br>Surface area of solids -cube, cuboid, cylinder and Sphere.<br>Volume of cut-out solids: hollow cylinders, frustum of cone, block section.<br>Volume of simple solid blocks. | <b>Free hand Sketches for simple pipe line with general fittings.</b>                                                |
| 4         | <b>Basic Electricity:</b> Introduction, use of electricity, how electricity is produced, Types of current_ AC, DC, their comparison, voltage, resistance, their units. Conductor, insulator, Types of connections - series, parallel, electric power, Horse power, energy, unit of electrical energy. Concept of earthing.                      | <b>Reading of drawing. Simple exercises related to missing lines, dimensions. How to make queries.</b>               |
| 5         | <b>Simple machines Transmission of power: -</b><br>Transmission of power by belt, pulleys & gear drive.<br><b>Heat treatment process: -</b> Heat treatment and advantages. Annealing, Normalizing, Hardening, Tempering.                                                                                                                        | <b>Simple exercises related to trade related symbols.</b><br><b>Basic electrical and electronic symbols</b>          |
| 6         | <b>Trigonometry:</b><br>Trigonometrical ratios, measurement of angles. Trigonometric tables.                                                                                                                                                                                                                                                    | <b>Free hand sketch of trade related components / parts /cutting tool indicating angles.</b>                         |

## ***Injection Moulding Machine Operator***

|   |                                                                                                                                                                                                                                                                                                                                           |  |
|---|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--|
|   | <p>Finding the value of unknown sides and angles of a triangle by Trigonometrical method.</p> <p>Finding height and distance by trigonometry.</p> <p>Application of trigonometry in shop problems. (viz. taper angle calculation).</p> <p>Calculate the area of triangle by using trigonometry and application of Pythagoras theorem.</p> |  |
| 7 | <p><b>Concept of pressure - Definition:-</b>Force, Pressure, and their units, atmospheric pressure, gauges used for measuring pressure, problems.</p> <p>Introduction to pneumatics &amp; hydraulics systems.</p>                                                                                                                         |  |
| 8 | <p><b>Simple exercises related to trade related Test Papers. Solution of NCVT test papers.</b></p>                                                                                                                                                                                                                                        |  |



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## ***Injection Moulding Machine Operator***

### **9.2 EMPLOYABILITY SKILLS**

**(DURATION: - 110 HRS.)**

| <b>Block – I</b><br><b>(Duration – 55 hrs.)</b>             |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 |
|-------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>1. English Literacy</b><br>Duration : 20 Hrs. Marks : 09 |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 |
| <b>Pronunciation</b>                                        | Accentuation (mode of pronunciation) on simple words, Diction (use of word and speech)                                                                                                                                                                                                                                                                                                                                                                                                                          |
| <b>Functional Grammar</b>                                   | Transformation of sentences, Voice change, Change of tense, Spellings.                                                                                                                                                                                                                                                                                                                                                                                                                                          |
| <b>Reading</b>                                              | Reading and understanding simple sentences about self, work and environment                                                                                                                                                                                                                                                                                                                                                                                                                                     |
| <b>Writing</b>                                              | Construction of simple sentences Writing simple English                                                                                                                                                                                                                                                                                                                                                                                                                                                         |
| <b>Speaking / Spoken English</b>                            | Speaking with preparation on self, on family, on friends/ classmates, on know, picture reading gain confidence through role-playing and discussions on current happening job description, asking about someone's job habitual actions. Cardinal (fundamental) numbers ordinal numbers. Taking messages, passing messages on and filling in message forms Greeting and introductions office hospitality, Resumes or curriculum vita essential parts, letters of application reference to previous communication. |
| <b>2. I.T. Literacy</b><br>Duration : 20 Hrs. Marks : 09    |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 |
| <b>Basics of Computer</b>                                   | Introduction, Computer and its applications, Hardware and peripherals, Switching on-Starting and shutting down of computer.                                                                                                                                                                                                                                                                                                                                                                                     |
| <b>Computer Operating System</b>                            | Basics of Operating System, WINDOWS, The user interface of Windows OS, Create, Copy, Move and delete Files and Folders, Use of External memory like pen drive, CD, DVD etc, Use of Common applications.                                                                                                                                                                                                                                                                                                         |
| <b>Word processing and Worksheet</b>                        | Basic operating of Word Processing, Creating, opening and closing Documents, use of shortcuts, Creating and Editing of Text, Formatting the Text, Insertion & creation of Tables. Printing document. Basics of Excel worksheet, understanding basic commands, creating simple worksheets, understanding sample worksheets, use of simple formulas and functions, Printing of simple excel sheets.                                                                                                               |
| <b>Computer Networking and Internet</b>                     | Basic of computer Networks (using real life examples), Definitions of Local Area Network (LAN), Wide Area Network (WAN), Internet, Concept of Internet (Network of Networks),                                                                                                                                                                                                                                                                                                                                   |



## Injection Moulding Machine Operator

|                                                                                                       |                                                                                                                                                                                                                                                                                                                                                                                                      |
|-------------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
|                                                                                                       | <p>Meaning of World Wide Web (WWW), Web Browser, Web Site, Web page and Search Engines. Accessing the Internet using Web Browser, Downloading and Printing Web Pages, Opening an email account and use of email. Social media sites and its implication.</p> <p>Information Security and antivirus tools, Do's and Don'ts in Information Security, Awareness of IT - ACT, types of cyber crimes.</p> |
| <b>3. Communication Skills</b><br>Duration : 15 Hrs. <span style="float: right;">Marks : 07</span>    |                                                                                                                                                                                                                                                                                                                                                                                                      |
| <b>Introduction to Communication Skills</b>                                                           | <p>Communication and its importance</p> <p>Principles of Effective communication</p> <p>Types of communication - verbal, non verbal, written, email, talking on phone.</p> <p>Non verbal communication - characteristics, components-Para-language</p> <p>Body language</p> <p>Barriers to communication and dealing with barriers.</p> <p>Handling nervousness/ discomfort.</p>                     |
| <b>Listening Skills</b>                                                                               | <p>Listening-hearing and listening, effective listening, barriers to effective listening guidelines for effective listening.</p> <p>Triple- A Listening - Attitude, Attention &amp; Adjustment.</p> <p>Active Listening Skills.</p>                                                                                                                                                                  |
| <b>Motivational Training</b>                                                                          | <p>Characteristics Essential to Achieving Success.</p> <p>The Power of Positive Attitude.</p> <p>Self awareness</p> <p>Importance of Commitment</p> <p>Ethics and Values</p> <p>Ways to Motivate Oneself</p> <p>Personal Goal setting and Employability Planning.</p>                                                                                                                                |
| <b>Facing Interviews</b>                                                                              | <p>Manners, Etiquettes, Dress code for an interview</p> <p>Do's &amp; Don'ts for an interview.</p>                                                                                                                                                                                                                                                                                                   |
| <b>Behavioral Skills</b>                                                                              | <p>Problem Solving</p> <p>Confidence Building</p> <p>Attitude</p>                                                                                                                                                                                                                                                                                                                                    |
| <b>Block – II</b><br><b>Duration – 55 hrs.</b>                                                        |                                                                                                                                                                                                                                                                                                                                                                                                      |
| <b>4. Entrepreneurship Skills</b><br>Duration : 15 Hrs. <span style="float: right;">Marks : 06</span> |                                                                                                                                                                                                                                                                                                                                                                                                      |
| <b>Concept of Entrepreneurship</b>                                                                    | <p>Entrepreneur - Entrepreneurship - Enterprises:-Conceptual issue</p> <p>Entrepreneurship vs. Management, Entrepreneurial motivation.</p> <p>Performance &amp; Record, Role &amp; Function of entrepreneurs in relation to</p>                                                                                                                                                                      |

## ***Injection Moulding Machine Operator***

|                                                                                                  |                                                                                                                                                                                                                                                                |
|--------------------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
|                                                                                                  | the enterprise & relation to the economy, Source of business ideas, Entrepreneurial opportunities, The process of setting up a business.                                                                                                                       |
| <b>Project Preparation &amp; Marketing analysis</b>                                              | Qualities of a good Entrepreneur, SWOT and Risk Analysis. Concept & application of PLC, Sales & distribution Management. Different Between Small Scale & Large Scale Business, Market Survey, Method of marketing, Publicity and advertisement, Marketing Mix. |
| <b>Institutions Support</b>                                                                      | Preparation of Project. Role of Various Schemes and Institutes for self-employment i.e. DIC, SIDA, SISI, NSIC, SIDO, Idea for financing/ non financing support agencies to familiarizes with the Policies /Programmes & procedure & the available scheme.      |
| <b>Investment Procurement</b>                                                                    | Project formation, Feasibility, Legal formalities i.e., Shop Act, Estimation & Costing, Investment procedure - Loan procurement - Banking Processes.                                                                                                           |
| <b>5. Productivity</b><br>Duration : 10 Hrs. Marks : 05                                          |                                                                                                                                                                                                                                                                |
| <b>Benefits</b>                                                                                  | Personal / Workman - Incentive, Production linked Bonus, Improvement in living standard.                                                                                                                                                                       |
| <b>Affecting Factors</b>                                                                         | Skills, Working Aids, Automation, Environment, Motivation - How improves or slows down.                                                                                                                                                                        |
| <b>Comparison with developed countries</b>                                                       | Comparative productivity in developed countries (viz. Germany, Japan and Australia) in selected industries e.g. Manufacturing, Steel, Mining, Construction etc. Living standards of those countries, wages.                                                    |
| <b>Personal Finance Management</b>                                                               | Banking processes, Handling ATM, KYC registration, safe cash handling, Personal risk and Insurance.                                                                                                                                                            |
| <b>6. Occupational Safety, Health and Environment Education</b><br>Duration : 15 Hrs. Marks : 06 |                                                                                                                                                                                                                                                                |
| <b>Safety &amp; Health</b>                                                                       | Introduction to Occupational Safety and Health importance of safety and health at workplace.                                                                                                                                                                   |
| <b>Occupational Hazards</b>                                                                      | Basic Hazards, Chemical Hazards, Vibroacoustic Hazards, Mechanical Hazards, Electrical Hazards, Thermal Hazards. Occupational health, Occupational hygienic, Occupational Diseases/ Disorders & its prevention.                                                |
| <b>Accident &amp; safety</b>                                                                     | Basic principles for protective equipment.<br>Accident Prevention techniques - control of accidents and safety measures.                                                                                                                                       |
| <b>First Aid</b>                                                                                 | Care of injured & Sick at the workplaces, First-Aid & Transportation of                                                                                                                                                                                        |

## Injection Moulding Machine Operator

|                                      |                                                                                                                                                                                                                                                  |
|--------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
|                                      | sick person.                                                                                                                                                                                                                                     |
| <b>Basic Provisions</b>              | Idea of basic provision legislation of India.<br>safety, health, welfare under legislative of India.                                                                                                                                             |
| <b>Ecosystem</b>                     | Introduction to Environment. Relationship between Society and Environment, Ecosystem and Factors causing imbalance.                                                                                                                              |
| <b>Pollution</b>                     | Pollution and pollutants including liquid, gaseous, solid and hazardous waste.                                                                                                                                                                   |
| <b>Energy Conservation</b>           | Conservation of Energy, re-use and recycle.                                                                                                                                                                                                      |
| <b>Global warming</b>                | Global warming, climate change and Ozone layer depletion.                                                                                                                                                                                        |
| <b>Ground Water</b>                  | Hydrological cycle, ground and surface water, Conservation and Harvesting of water.                                                                                                                                                              |
| <b>Environment</b>                   | Right attitude towards environment, Maintenance of in -house environment.                                                                                                                                                                        |
| <b>7. Labour Welfare Legislation</b> |                                                                                                                                                                                                                                                  |
| Duration : 05 Hrs. Marks : 03        |                                                                                                                                                                                                                                                  |
| <b>Welfare Acts</b>                  | Benefits guaranteed under various acts- Factories Act, Apprenticeship Act, Employees State Insurance Act (ESI), Payment Wages Act, Employees Provident Fund Act, The Workmen's compensation Act.                                                 |
| <b>8. Quality Tools</b>              |                                                                                                                                                                                                                                                  |
| Duration : 10 Hrs. Marks : 05        |                                                                                                                                                                                                                                                  |
| <b>Quality Consciousness</b>         | Meaning of quality, Quality characteristic.                                                                                                                                                                                                      |
| <b>Quality Circles</b>               | Definition, Advantage of small group activity, objectives of quality Circle, Roles and function of Quality Circles in Organization, Operation of Quality circle. Approaches to starting Quality Circles, Steps for continuation Quality Circles. |
| <b>Quality Management System</b>     | Idea of ISO 9000 and BIS systems and its importance in maintaining qualities.                                                                                                                                                                    |
| <b>House Keeping</b>                 | Purpose of House-keeping, Practice of good Housekeeping.                                                                                                                                                                                         |
| <b>Quality Tools</b>                 | Basic quality tools with a few examples.                                                                                                                                                                                                         |

BROAD LEARNING TO BE COVERED IN INDUSTRY FOR INJECTION MOULDING MACHINE OPERATOR TRADE:

1. Safety and best practices /Basic Industrial Culture (5S, KAIZEN, etc.)
2. Record keeping and documentation
3. Sets up and operates injection-moulding machines to cast products from thermoplastic materials: Installs dies on machine, according to work order specifications, using clamps, bolts, and hand tools.
4. Sets machine controls, regulating moulding temperature, volume of plastic, moulding pressure and time, according to knowledge of plastics and moulding procedures.
5. Dumps premixed plastic powders or pellets into hopper, and starts machine.
6. Pulls lever to close dies and inject plastic into dies to cast part.
7. Removes finished product from dies, using hand tools.
8. Trims excess material from part, using knife.
9. May mix thermoplastic materials and colouring pigments in mixing machine, according to formula.
10. May grind scrap plastic into powder for re-use.

*Note: Actual training will depend on the existing facilities available in the establishments.*

The **competencies/ specific outcomes** on completion of On-Job Training are detailed below: -

**Block – I**

1. Practice safety and basic Industrial Culture (5S, KAIZEN and TS/ISO/EOHS).
2. Prepare documentation as per industrial need by different methods of recording information.
3. Assist to operate Hydraulic type of Semi-automatic Injection Moulding Machines, produce components in different moulds carry out cycle-time analysis, observe process-parameters & record parameters.
4. Carry out scrap grinding, make machine study in IRO, list the specifications of machine, explain parts and function, trace line diagram of Machine
5. Troubleshoot injection moulding machine.
6. Carry out Idle-Run Observation of automatic injection moulding machine & identify parts of Injection Unit, Clamping knobs and follow the safety Precautions
7. Practice the start-up Procedure, Shut-down Procedure, Sketch the Machine Platens, Clamping, system, type of nozzle used in Machine etc.
8. Identify and explain the parts and their functions of Hydraulic System used in the Machines. Practice machine Operation, process parameter setting for a particular mould on the machine, operation of machine in hand, Semi Automatic and Automatic-mode to produce components and observe all parameters.

## ***Injection Moulding Machine Operator***

9. Troubleshoot for moulding faults and analyse for causes and provide remedies.
10. Explain the basic concepts of Micro-processor control, comparison of Micro-processor controlled Machines with conventional Machines.
11. Practice machine setting procedure, procedure for process parameter setting on monitor/ control panel. Operate machine with mould fixing and setting on the machine with different plastic materials.
12. Carry out cycle time analysis, list the important operating procedure and safety precautions.
13. List out and classify different Types of moulds, injection moulds, mould maintenance and storage.
14. Explain the basic operation of hydraulic and pneumatic systems, electrical system, and define the terms – hydraulic fluid, viscosity, different types of valves.
15. Explain the types and functions of hydraulic pumps, electrical heaters, thermocouples temperature control parameters and timers and electrical motors in the trade.
16. Carry out maintenance work on processing machines including preventive maintenance and prepare the routine check points for all processing machines, carry out housekeeping, check hydraulics and electrical circuit for safety, carry out troubleshooting and provide remedies.

### **Block – II**

1. Identify and follow-up the actions taken of safety rules and regulation as applicable to related shop floor exercise. Practice operation of safety equipment and first aid methods. List out the environment pollution and mechanics role in minimizing the same.
2. Explain the parts and their functions, constructional features and specification of automatic injection moulding machine (IMM). Describe the operation & control systems of machine. Identify and explain parts of mould clamping system, explain the methods of starting & shut down procedure.
3. Classify different mould fitting adjustment of m/c daylight, locating ring, ejector stroke and tie bar distance, m/c platen size & clamping arrangement. List out systems used in IMM such as cooling systems, electrical system, Hydraulic systems & electronics system.
4. Identify parts and explain functions of injection unit, clamping unit in IRO. Practice Mould loading / unloading on IMM and observe precautions. Work in TRO using various grade of plastic to set various parameters. Set the process parameter for specific mould on the IMM (fully auto). Operate of IMM by manual, semi auto & fully auto mode to produce articles. Practice record keeping for analysis of fault, causes & remedies using different plastic materials.
5. Explain construction, operation & control of PLC operated IMM. List the procedure for machine & process parameter setting on monitor with control panel. Carry out analysis

## ***Injection Moulding Machine Operator***

- of product defect causes, their remedies. Carry out starting as per sequence of operation & following the precautions.
6. Identify parts and functions of recycling machine used in injection moulding plastic waste & draw line diagram of recycling. Carry out mixing virgin in to recycled plastic waste material. Identify seven industrial wastages.
  7. Test various properties & identify plastic using 7 QC tools.
  8. Operate electric heaters, explain their parts, functions, applications & specifications. Operate thermocouples, parts, functions, application & specifications. Operate temperature controllers, parts function, application & specifications.
  9. Identify and explain parts and functions of thermo regulator, Colour mixer, chillers, scrap grinder & draw its line diagram, parts, function, application & specification. Operate, control and set utilities used in automatic IM process.
  10. Carry out the testing & maintenance work of entire plant including power control equipment, devices & circuits. Test & maintain moulds, clamping system including preventive maintenance. Prepare check points for all processing machines for maintenance. Practice by Daily start up & shut down procedure, trouble shoot and rectify the faults.

### **Note:**

1. Industry must ensure that above mentioned competencies are achieved by the trainees during their on job training.
2. In addition to above competencies/ outcomes industry may impart additional training relevant to the specific industry.

**Skill India**  
कौशल भारत - कुशल भारत

INFRASTRUCTURE FOR PROFESSIONAL SKILL & PROFESSIONAL KNOWLEDGE

| INJECTION MOULDING MACHINE OPERATOR                                 |                                                           |                            |         |
|---------------------------------------------------------------------|-----------------------------------------------------------|----------------------------|---------|
| LIST OF TOOLS AND EQUIPMENT for Basic Training (For 20 Apprentices) |                                                           |                            |         |
| Sl. No.                                                             | Item                                                      | Specifications             | Qty.    |
| <b>A : TRAINEES TOOL KIT:-</b>                                      |                                                           |                            |         |
| 1.                                                                  | Steel rule 30 cm graduated both in English & Metric units |                            | 20 Nos. |
| 2.                                                                  | Outside spring caliper                                    | 200 mm                     | 20 Nos. |
| 3.                                                                  | Inside spring caliper                                     | 200 mm                     | 20 Nos. |
| 4.                                                                  | Hermaphrodite caliper                                     | 150 mm                     | 20 Nos. |
| 5.                                                                  | Divider spring                                            | 200 mm                     | 20 Nos. |
| 6.                                                                  | Center punch                                              | 100 mm                     | 20 Nos. |
| 7.                                                                  | Hammer B.P.                                               | 0.5 kg                     | 20 Nos. |
| 8.                                                                  | Combination pliers                                        | 150 mm                     | 20 Nos. |
| 9.                                                                  | Safety glasses                                            |                            | 20 Nos. |
| 10.                                                                 | File flat bastard                                         | 300 mm                     | 20 Nos. |
| 11.                                                                 | File flat 2 <sup>nd</sup> cut                             | 250 mm                     | 20 Nos. |
| 12.                                                                 | Engineers screw driver                                    |                            | 20 Nos. |
| 13.                                                                 | File flat smooth                                          | 200 mm                     | 20 Nos. |
| 14.                                                                 | Cold chisel flat                                          | 25 X 200 mm                | 20 Nos. |
| <b>B. Tools, Instruments and General shop Out fit</b>               |                                                           |                            |         |
| 15.                                                                 | Screw driver set (multi heads)                            |                            | 1 Set   |
| 16.                                                                 | Try square                                                | 150 mm                     | 2 Nos.  |
| 17.                                                                 | Straight edge steel                                       | 1 metre                    | 1 No.   |
| 18.                                                                 | Straight edge steel                                       | 500 mm                     | 1 No.   |
| 19.                                                                 | Steel tape in case                                        | 2 metre                    | 1 No.   |
| 20.                                                                 | Spirit level 2V 250,                                      | 05 metre                   | 1 No.   |
| 21.                                                                 | Hammer B.P. with handle                                   | 800 gms                    | 6 Nos.  |
| 22.                                                                 | Spindle blade screw driver                                | 100 mm                     | 2 Nos.  |
| 23.                                                                 | Allen hexagonal key                                       | 2.5 to 12                  | 2 sets  |
| 24.                                                                 | Reduction sleeve MT as required                           |                            | 1 set   |
| 25.                                                                 | Oil can pressure feed                                     | 500 mg                     | 6 Nos.  |
| 26.                                                                 | Twist drills (Parallel shank)                             | 3mm to 13 mm               | 1 set   |
| 27.                                                                 | Drill chuck with taper shank                              | 0-20                       | 1 No.   |
| 28.                                                                 | Center drill                                              | A1 to 5                    | 2set    |
| 29.                                                                 | Clamps C                                                  | 100 & 200 mm               | 2 each. |
| 30.                                                                 | Tap and die set in box metric pitch                       |                            | 1 set   |
| 31.                                                                 | Drill HSS taper shank                                     |                            | 1set    |
| 32.                                                                 | File H/R                                                  | 2 <sup>nd</sup> cut 250 mm | 4 Nos.  |

## Injection Moulding Machine Operator

|     |                                                                                              |                            |         |
|-----|----------------------------------------------------------------------------------------------|----------------------------|---------|
| 33. | File triangular smooth                                                                       | 200 mm                     | 4 Nos.  |
| 34. | Needle file set                                                                              |                            | 1 Nos.  |
| 35. | File square                                                                                  | 2 <sup>nd</sup> cut 250 mm | 4 Nos.  |
| 36. | Reamer                                                                                       | 6 mm to 13 mm<br>by 1 mm   | 1 set   |
| 37. | Hacksaw adjustable with blades                                                               | 250 – 300mm                | 8 Nos.  |
| 38. | Hand vice                                                                                    | 50 mm jaw                  | 2 Nos.  |
| 39. | Magnifying glass                                                                             | 75 mm                      | 2 Nos.  |
| 40. | Micrometer outside                                                                           | 50-75 mm                   | 2 Nos.  |
| 41. | Vernier height gauge                                                                         | 250 mm                     | 1 No    |
| 42. | Vernier bevel protractor with least count of 5 minutes                                       |                            | 1 No    |
| 43. | Radius gauge metric set                                                                      | (1 – 6 mm)                 | 1 set   |
| 44. | Feeler gauge                                                                                 |                            | 1 No    |
| 45. | Drilling machine pillar capacity with accessories                                            | 20 mm                      | 1 No    |
| 46. | Pedestal grinder                                                                             |                            | 1 No    |
| 47. | Hand Drilling Machine Power                                                                  | (10 mm)                    | 1 No    |
| 48. | Combination pliers insulated                                                                 | 200 mm                     | 16 Nos. |
| 49. | Screw driver 100mm,                                                                          | 200 mm                     | 16 Nos. |
| 50. | Neon tester pencil bit type                                                                  | 500 V                      | 16 Nos. |
| 51. | Electrician knife                                                                            |                            | 16 Nos. |
| 52. | Hammer ball pein                                                                             | 1.0 kg                     | 1 No.   |
| 53. | Plier side cutting                                                                           | 200 mm                     | 4 Nos.  |
| 54. | Pliers round nose                                                                            | 200 mm                     | 4 Nos.  |
| 55. | Pliers flat nose                                                                             | 150 mm                     | 4 Nos.  |
| 56. | Pliers long nose                                                                             | 200 mm                     | 4 Nos.  |
| 57. | Wall jumper octagonal                                                                        | 37mm x 450 mm              | 1 No.   |
| 58. | Center punch                                                                                 | 100 mm                     | 1 No.   |
| 59. | Steel measuring tape                                                                         | 20 mts                     | 1 No.   |
| 60. | Spanner double ended set of 6                                                                |                            | 2 Sets  |
| 61. | Adjustable spanner                                                                           |                            | 1 No.   |
| 62. | Steel rule                                                                                   | 300 mm                     | 4 Nos.  |
| 63. | Electric soldering iron                                                                      | 35 w                       | 4 Nos.  |
| 64. | Rubber gloves                                                                                | 5000 V                     | 2 pairs |
| 65. | Multimeter 0-5, 100, 200, 500, milli amperes 0-100-1000, 10000 ohms 0-150, 300, 600 V AC/ DC |                            | 2 Nos.  |
| 66. | Bar magnet                                                                                   |                            | 1 No.   |
| 67. | Horse shoe magnet                                                                            |                            | 1 No.   |
| 68. | Electric drill machine 6mm capacity universal type                                           | 250V                       | 1 No.   |
| 69. | D.C. shunt motor ( Laboratory type)                                                          | 1 H.P. 250 V               | 2 Nos.  |
| 70. | Universal motor                                                                              | 750 W AC/DC 250 V          | 2 Nos.  |
| 71. | Squirrel cage induction motor with DOL Starter                                               | 1 H.P. 230 V               | 1 No.   |



## Injection Moulding Machine Operator

|                                       |                                                                                                                                                                                                                                   |                   |             |
|---------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------|-------------|
| 72.                                   | Tong tester                                                                                                                                                                                                                       |                   | 1 No.       |
| 73.                                   | Megger                                                                                                                                                                                                                            |                   | 1 No.       |
| 74.                                   | DC Power Supply                                                                                                                                                                                                                   | 0 V – 110 V / 5 A | 1 No.       |
| 75.                                   | Auto – transformer – variac                                                                                                                                                                                                       | 230 V             | 1 No.       |
| 76.                                   | Crimping tools                                                                                                                                                                                                                    |                   | 1 Set       |
| 77.                                   | Pentium IV Computer or latest computer with 512 MB RAM with following accessories DVD combo drive with the latest X version Hard Disk with 80 GB or above, 17 Monitor, AGP Graphics Card with 64 MB, 10/100 Ethernet Card, Modem. |                   | 9 Nos.      |
| 78.                                   | Centralized UPS                                                                                                                                                                                                                   | 5KVA capacity     | 1 No.       |
| 79.                                   | Laser Printer                                                                                                                                                                                                                     |                   | 1 No.       |
| 80.                                   | Dot Matrix Pinter                                                                                                                                                                                                                 |                   | 1 No.       |
| 81.                                   | Windows XP operating system                                                                                                                                                                                                       |                   | 09 No.      |
| 82.                                   | MS – Office 2000                                                                                                                                                                                                                  |                   | 09 No.      |
| <b>General plant and machinery: -</b> |                                                                                                                                                                                                                                   |                   |             |
| 1.                                    | Automatic Injection moulding machine                                                                                                                                                                                              | 40 T.cap          | 1 No.       |
| 2.                                    | Micro processor Injection moulding machines                                                                                                                                                                                       | 140 T.cap         | 1 No.       |
| 3.                                    | Granulate small & Big size                                                                                                                                                                                                        |                   | 1 each      |
| 4.                                    | Master Batch Mixing unit                                                                                                                                                                                                          |                   | 1 No.       |
| 5.                                    | Hand operated compression moulding machine                                                                                                                                                                                        | 40 T. cap         | 2 nos.      |
| 6.                                    | Automatic compression moulding machine –                                                                                                                                                                                          | 100 T cap         | 1no         |
| 7.                                    | Pipe extrusion machine                                                                                                                                                                                                            |                   | 1 No.       |
| 8.                                    | Extrusion for Blow film single layer                                                                                                                                                                                              |                   | 1 No.       |
| 9.                                    | Printing Machine with oxidizing Treatment nut                                                                                                                                                                                     |                   | 1 No.       |
| 10.                                   | Hand operated Blow moulding M/C with accessories. Different sizes                                                                                                                                                                 |                   | 4 Nos.      |
| 11.                                   | Full Automatic Double stage Blow moulding machine with Multilayer extrusion with Accessories.                                                                                                                                     |                   | 1 No.       |
| 12.                                   | Semi-Automatic Moulding Machine-80T                                                                                                                                                                                               |                   | 1 No.       |
| 13.                                   | Scrap Cutter Grinder                                                                                                                                                                                                              |                   | 1 No.       |
| 14.                                   | Moulds/die and accessories for different machines                                                                                                                                                                                 |                   | As required |
| <b>Furniture – Computer Lab</b>       |                                                                                                                                                                                                                                   |                   |             |
| 1.                                    | Suitable Computer Tables                                                                                                                                                                                                          |                   | As required |
| 2.                                    | Computer Chairs                                                                                                                                                                                                                   |                   | 20 Nos.     |
| 3.                                    | Shoe Rack                                                                                                                                                                                                                         |                   | As required |
| 4.                                    | Vacuum cleaner                                                                                                                                                                                                                    |                   | 1 No.       |

## ***Injection Moulding Machine Operator***

### **INFRASTRUCTURE FOR WORKSHOP CALCULATION & SCIENCE AND ENGINEERING DRAWING**

#### **TRADE: Injection Moulding Machine Operator**

#### **LIST OF TOOLS& EQUIPMENTS FOR -20APPRENTICES**

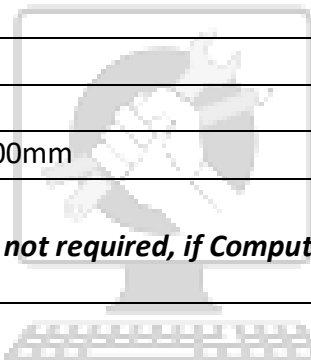
1) **Space Norms** : 45 Sq. m.(For Engineering Drawing)

2) **Infrastructure:**

| <b>A : TRAINEES TOOL KIT:-</b> |                                    |                      |                 |
|--------------------------------|------------------------------------|----------------------|-----------------|
| <b>Sl. No.</b>                 | <b>Name of the items</b>           | <b>Specification</b> | <b>Quantity</b> |
| 1.                             | Draughtsman drawing instrument box |                      | 20+1 set        |
| 2.                             | Set square celluloid 45°           | (250 X 1.5 mm)       | 20+1 set        |
| 3.                             | Set square celluloid 30°-60°       | (250 X 1.5 mm)       | 20+1 set        |
| 4.                             | Mini drafter                       |                      | 20+1 set        |
| 5.                             | Drawing board IS: 1444             | (700mm x500 mm)      | 20+1 set        |
| <b>B : Furniture Required</b>  |                                    |                      |                 |
| <b>Sl. No.</b>                 | <b>Name of the items</b>           | <b>Specification</b> | <b>Quantity</b> |
| 1                              | Drawing Board                      |                      | 20              |
| 2                              | Models : Solid & cut section       |                      | as required     |
| 3                              | Drawing Table for trainees         |                      | as required     |
| 4                              | Stool for trainees                 |                      | as required     |
| 5                              | Cupboard (big)                     |                      | 01              |
| 6                              | White Board (size: 8ft. x 4ft.)    |                      | 01              |
| 7                              | Trainer's Table                    |                      | 01              |
| 8                              | Trainer's Chair                    |                      | 01              |

## ***Injection Moulding Machine Operator***

| <b>TOOLS &amp; EQUIPMENTS FOR EMPLOYABILITY SKILLS</b>                                                   |                                                                                                                                                    |                 |
|----------------------------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------|-----------------|
| <b>Sl. No.</b>                                                                                           | <b>Name of the Equipment</b>                                                                                                                       | <b>Quantity</b> |
| 1.                                                                                                       | Computer (PC) with latest configurations and Internet connection with standard operating system and standard word processor and worksheet software | 10 Nos.         |
| 2.                                                                                                       | UPS - 500VA                                                                                                                                        | 10 Nos.         |
| 3.                                                                                                       | Scanner cum Printer                                                                                                                                | 1 No.           |
| 4.                                                                                                       | Computer Tables                                                                                                                                    | 10 Nos.         |
| 5.                                                                                                       | Computer Chairs                                                                                                                                    | 20 Nos.         |
| 6.                                                                                                       | LCD Projector                                                                                                                                      | 1 No.           |
| 7.                                                                                                       | White Board 1200mm x 900mm                                                                                                                         | 1 No.           |
| <b>Note: - Above Tools &amp; Equipments not required, if Computer LAB is available in the institute.</b> |                                                                                                                                                    |                 |



**Skill India**  
कौशल भारत - कुशल भारत

## ANNEXURE-II

### FORMAT FOR INTERNAL ASSESSMENT

| Name & Address of the Assessor :     |                                 |                        |                      |                   |                         | Year of Enrollment :                            |                          |                                    |                             |                     |                        |                                 |              |
|--------------------------------------|---------------------------------|------------------------|----------------------|-------------------|-------------------------|-------------------------------------------------|--------------------------|------------------------------------|-----------------------------|---------------------|------------------------|---------------------------------|--------------|
| Name & Address of ITI (Govt./Pvt.) : |                                 |                        |                      |                   |                         | Date of Assessment :                            |                          |                                    |                             |                     |                        |                                 |              |
| Name & Address of the Industry :     |                                 |                        |                      |                   |                         | Assessment location: Industry / ITI             |                          |                                    |                             |                     |                        |                                 |              |
| Trade Name :                         |                                 |                        | Semester:            |                   |                         | Duration of the Trade/course:                   |                          |                                    |                             |                     |                        |                                 |              |
| Learning Outcome:                    |                                 |                        |                      |                   |                         |                                                 |                          |                                    |                             |                     |                        |                                 |              |
| Sl. No                               | Maximum Marks (Total 100 Marks) | 15                     | 5                    | 10                | 5                       | 10                                              | 10                       | 5                                  | 10                          | 15                  | 15                     | Total internal assessment Marks | Result (Y/N) |
|                                      | Candidate Name                  | Father's/Mother's Name | Safety consciousness | Workplace hygiene | Attendance/ Punctuality | Ability to follow Manuals/ Written instructions | Application of Knowledge | Skills to handle tools & equipment | Economical use of materials | Speed in doing work | Quality in workmanship | VIVA                            |              |
| 1                                    |                                 |                        |                      |                   |                         |                                                 |                          |                                    |                             |                     |                        |                                 |              |
| 2                                    |                                 |                        |                      |                   |                         |                                                 |                          |                                    |                             |                     |                        |                                 |              |