



**COMPETENCY-BASED CURRICULUM**

**FOR THE TRADE OF**

**TOOL AND DIE MAKER  
(DIES AND MOULDS)**

**UNDER**

**[CRAFTSMAN TRAINING SCHEME (CTS)]**

**IN SEMESTER PATTERN**

**Government of India  
Ministry of Skill Development and Entrepreneurship**

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## 1. INTRODUCTION

India is one of the youngest nations in the world. Our youth are our strength. However, a challenge facing the country is that of skilling our youth as per the demands of the industry. Recognizing the need for quickly coordinating the skill development and entrepreneurship efforts of all concerned stakeholders, the Government of India created the Ministry of Skill Development and Entrepreneurship on 9<sup>th</sup> November, 2014. To create further convergence between the Vocational Training System through Industrial Training Institutes (ITIs) and the new skill initiatives of the Government, the Training and Apprenticeship Training divisions from the Directorate General of Employment and Training (DGET) under the Ministry of Labour and Employment stand transferred to the Ministry of Skill Development and Entrepreneurship (MSDE) with effect from 16<sup>th</sup> April, 2015. This move brings over 11000 ITIs and scores of other institutions, and the Apprenticeship and Training divisions, under the Ministry.

The Ministry of Skill Development and Entrepreneurship is an apex organization for the development and coordination of the vocational training including Women's Vocational Training in our country. The Ministry conducts the vocational training programmes through the Craftsmen Training Scheme (CTS), Apprenticeship Training Scheme (ATS), Modular Employable Scheme (MES) under the Skill Development Initiative (SDI) Scheme, and Craftsmen Instructor Training Scheme (CITS) to cater the needs of different segments of the Labour market. The National Council for Vocational Training (NCVT) acts as a central agency to advise Government of India in framing the training policy and coordinating vocational training throughout India. The day-to-day administration of the ITIs rests with the State Governments/ Union Territories.

- Training courses under the CTS is being offered through a network of more than 11000 Government and Private Industrial Training Institutes (ITIs) located all over the country with a total seating capacity of more than 16 Lakhs with an objective to provide skilled workforce to the industry in 126 trades. Skill development courses exclusively for women are also being offered under CTS and other schemes through Government and Private ITIs and Regional Vocational Training Institutes (RVTIs) for Women.
- The Apprentices Act, 1961 was enacted with the objective of regulating the program of apprenticeship training in the industry by utilizing the facilities available within for imparting on-the-job training. The Act makes it obligatory for employers in specified industries to engage apprentices in designated trades to impart on the job training for school leavers, and ITI passed outs to develop skilled manpower for the industry.
- The Ministry is implementing the Employable Scheme (MES) under the Skill Development Initiative Scheme to provide vocational training to people to develop skilled manpower for the industry through a network of Vocational Training Providers (VTPs) located across the country.

Central Staff Training and Research Institute (CSTARI), Kolkata is the nodal institute for the development/revision of curricula under all vocational training schemes of the Ministry. National Instructional Media Institute (NIMI), Chennai is to make available instructional material in various trades for the use of trainees and trainers to ensure overall improvement in the standard of institutional training under the CTS and ATS schemes. The institute is actively involved in the development, production and dissemination of instructional media Packages (IMPs) comprising of books on Trade Theory, Trade Practical, Test/Assignment, and Instructor's Guide.

The National Skills Qualification Framework (NSQF), published in the Gazette of India on 27<sup>th</sup> December, 2013, is a national framework that aims to integrate general and vocational streams of education and training. The main goal of the NSQF is to focus on competency-based qualifications, which in turn facilitate and enhance transparency, both within and between general and vocational streams. The National Skill Development Agency (NSDA) under the Ministry is responsible for anchoring and implementation of the Framework, by bringing together the key stakeholders through the National Skill Qualifications Committee (NSQC).

The competency-based framework organizes qualifications into ten levels, with the entry level being 1, and the highest level being 10. Each level of the NSQF is described by a statement of learning outcomes in five domains, known as level descriptors. These five domains are (1) Process, (2) Professional knowledge, (3) Professional skill, (4) core skill, and (5) Responsibility. The paradigm shift from learning focused on inputs to an outcome/competency-based education would help in the Recognition of Prior Learning (RPL), and simultaneously enable the alignment of the Indian qualifications with international ones. Government funding is expected to be on a preferential basis for NSQF compliant courses. The NSQF notification provides a Qualification Register, which is the official national database of all qualifications aligned to NSQF levels. Through this Register, learners can expect access to all NSQF compliant qualifications.

The Ministry has set up Mentor Councils to focus on courses under NCVT in various sectors with representation from thought leaders among different stakeholders viz., industries, innovative entrepreneurs who have proved to be game-changers, academic/professional institutions, and champion ITIs for each of the sectors. The Mentor Council for each sector reviews curriculum, admission criteria, course duration, and requirement of trainers and assessment/evaluation systems for the sector on a continuous basis and make recommendations regarding the same. Sector-wise Core Groups are formed to plan and prepare the documentation for the competency-based curricula for the courses under each sector.

## 2. GENERAL INFORMATION

1	Qualification	<b>Tool and Die Maker (Dies and Moulds)</b>
2	N.C.O./NOS Code No.	8232.10, 8232.20, 8232.25, 8232.30, 8232.70
3	NSQF Level	Level 5
4	Duration of the course/qualification	02 years
5	Entry Qualification	Passed 10 <sup>th</sup> Class with Science and Mathematics under 10+2 system of Education or its equivalent
6	Trainees per unit	16 (Supernumeraries/Ex-Trainee allowed: 5)

Note:

- i) Out of the two Instructors required for a unit of 2(1+1), one must have Degree/Diploma, and other must have NTC/NAC qualifications, in the relevant field.
- ii) Qualification of the Instructor for WCS and ED must be as per the training manual.

Distribution of notional training hours of the training per week:

Total hours /week	Trade practical	Trade theory	Workshop Cal. &Sc.	Engg. Drawing	Employability skills	Extra-curricular activity
40 Hours	25 Hours	6 Hours	2 Hours	3 Hours	2 Hours	2 Hours

### 3. COURSE STRUCTURE

Name of the Qualification: **Tool and Die Maker (Dies and Moulds)**

Total duration of the course: 24 Months

Training duration details:

<b>Course Elements</b>	<b>Hourly Distribution</b>
Professional Skills	2200 hrs
Professional Knowledge	530 hrs
Workshop Calculation & Science	180 hrs
Engineering Drawing	265 hrs
Employability Skills	110 hrs
Extra Curricular Activities	180 hrs
In-plant Training/Project Work	240 hrs
Admission & Examination	160 hrs
Total	3865 hrs.

## 4. JOB ROLES

### 4.1 Brief description

Operate and monitor machines, which knead and blend compounds to obtain plastic materials and which make various plastic components and articles. Tablet Machine Operator, Tableting Operator (Plastics) tends tablet-machine that compresses plastics powders into pellets or biscuits of specified weight and shape for use in moulding plastics products. Sets appropriate punch on cylinder and die on die setting plate; feeds hopper of machine with desired blend of plastics powders; opens gate valve to control flow of powders from hopper into machine. Turns steam valve to regulate temperature of machine according to ammeter gauge, and adjusts die pressure to attain specified hardness of pill. Examines compressed tablets to ensure that they are of required weight, size and shape. May clean, change and adjust die. May operate mixing, sieving or milling machine. May be designated, according to type of machine used, as ROTARY PERFORMER; SINGLE STROKER PERFORMER.

Extruding Machine Operator (Plastics) operates machine to extrude thermoplastic materials to form tubes, rods and film, according to specifications. Weighs and mixes pelletized, granular, or powdered thermoplastic materials and colouring pigments in tumbling machine set by Extruding Machine Setter (Plastics) couples hose to die holder to circulate steam, water, air or oil to die; fills machine hopper with mixed materials or stuffs rolls of plastic dough into machine cylinders; starts machine hand-tools; and couples hose to die holder to circulate steam, water, air or oil to die; fills machine hopper with mixed materials or stuffs rolls of plastic dough into machine cylinders; starts machine and sets controls to regulate vacuum, air pressure, sizing rings and temperature; depresses lever of machine and ensures that parison tube reaches entire length of mould or die; cuts ends of tube with scissors near nozzle and blows air into mould by operating pump; opens moulds and removes finished article. Repeats process.

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.

Compression Moulding Machine Operator (Plastics) sets up and operates compression moulding machines to mould plastics products by heat and pressure according to specifications. Installs dies on press, using clamps, bolts, and hand tools and coats dies with parting agents; sets thermostat to regulate temperature of dies; weighs premixed plastic compound and pours compound into die well, or spreads fabric on die and dumps compound over fabric; pulls lever to lower hydraulic ram that compresses compound between dies to form and cure part; removes cured part from mould, using hand tools and airhose. May mix catalysts and colouring pigments with plastic compound, using paddle and mixing machine. May operate compression moulding machines to form product under pressure only and be designated COLD - MOULDING-PRESS OPERATOR.

Moulder, Hand (Plastics) moulds plastics sheets into desired shapes in hand moulding press. Studies specifications for moulded product and assembles mould. Determines weight of charge, pressure, temperature and curing time for moulding; collects plastic sheets, cuts them to required size and heats them on electrically operated heater to soften for moulding; removes sheet when sufficiently heated and places it in female of wooden mould, fixes wooden slab of mould to keep sheet in position and inserts male block of mould; sets mould in hand press and manipulates controls to compress material and form material to shape of mould; removes moulded plastics object after specified time-interval by opening mould; examines and gauges product for conformity to plant or customer standards. May make minor adjustments in moulding procedure to eliminate defects, and remould product.

#### 4.2 NOS & QP/NCO Mapping:

- i). **NCO-2004: 8232.10**
- ii). **NCO-2004: 8232.20**
- iii). **NCO-2004: 8232.25**
- iv). **NCO-2004: 8232.30**
- v). **NCO-2004: 8232.70**

#### **NOS:-**

- i. CSC/Q 0304 (CNC Setter cum operator - Electric Discharge (Spark Erosion) Machine)
- ii. CSC/Q 0601 (Tool and Die Maker)
- iii. CSC/Q 0208 (Senior Manual Metal Arc Welding/Shielded Metal Arc Welding)
- iv. CSC/Q 0119 (CNC Setter cum Operator-Turning)
- v. CSC/Q 0401 (Sheet Metal Worker – Hand Tools and Manually Operated Machines)
- vi. CSC/Q 0109 (Operator -Conventional Surface Grinding Machines)
- vii. CSC/Q 0108 (Operator –Conventional Milling)
- viii. CSC/Q 0110 (Operator –Conventional Turning)



## NSQF LEVEL COMPLIANCE

The Broad Learning outcomes of **Tool and Die Maker (Dies and Moulds)** trade under CTS 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.

## **6. GENERAL TRAINING PLAN, EXAMINATION & PASS REGULATION**

### **General Training Plan**

The knowledge and skill components as stated in the section for 'learning outcomes' are to be imparted in accordance with the instructions in respect of the content and time structure.

### **Assessment**

The assessment for the semester-based qualification is carried out by conducting formative assessments, and end-of-semester examinations, as per the guidelines given in the Curriculum. The internal assessments for theory subjects and practical are conducted for evaluating the knowledge and skill acquired by trainees and the behavioural transformation of the trainees as per the learning outcomes. Theory examinations are conducted in Trade Theory, Workshop Calculation & Science, Engineering Drawing and Employability Skills. Trade practical examinations are conducted by the respective State Governments. The details of the examination and assessment standard are in a latter section. NCVT prepares the question papers for the Trade practical. Candidates are to demonstrate that they can:

1. Read & interpret technical parameters/documentation, plan and organize work processes, and identify necessary materials and tools,
2. Perform a task/job with due consideration to safety rules, accident prevention regulations and environmental protection stipulations,
3. Apply Professional Knowledge, Core Skills, and Employability Skills while performing the task/job.
4. Check the task/job as per the drawing for proper functioning, and identify and rectify errors in the job, if any.
5. Document the technical parameters related to the task/job.

### **Pass regulation**

For the purposes of determining the overall result, weightage of 25 percent is applied to each semester examination. The minimum pass percent for Practical is 60% & minimum pass percent for Theory subject is 40%.

## **7. LEARNING OUTCOMES**

The following are minimum broad learning outcomes after completion of the Tool & Die maker (Dies & Moulds) course of 02 year duration:

### **A. GENERIC OUTCOME**

1. Recognize & comply safe working practices, environment regulation and housekeeping.
2. Work in a team, understand and practice soft skills, technical English to communicate with required clarity.
3. Demonstrate knowledge of concept and principles of basic arithmetic, algebraic, trigonometric, statistics, co-ordinate system and apply knowledge of specific area to perform practical operations.
4. Understand and explain basic science in the field of study including basic electrical, and hydraulics & pneumatics.
5. Read and apply engineering drawing for different application in the field of work.
6. Understand and explain the concept in productivity, quality tools, and labour welfare legislation and apply such in day to day work to improve productivity & quality.
7. Explain energy conservation, global warming and pollution and contribute in day to day work by optimally using available resources.
8. Explain personnel finance, entrepreneurship and manage/organize related task in day to day work for personal & societal growth.
9. Understand and apply basic computer working, basic operating system, simulate part programme using simulation software and uses internet services to get accustomed & take benefit of IT developments in the industry.

### **B. SPECIFIC OUTCOME**

#### **SEMESTER - I**

10. Perform marking out the components for sawing, filing, drilling, tapping, fitting and allied operations with clear choice of procedures.
11. Plan and organize the work for different types of fitting operations and check for work result.
12. Understand and explain the constructional features and working principles of drilling machine and lathe machine and set up different work and tool holding devices required to accomplish tasks with required alignment.
13. Grind single point cutting tool, centre punch and twist drills using pedestal grinding machine to maintain close tolerance as per drawing.

#### **SEMESTER - II**

14. Understand and explain the constructional features and working principles of milling machine and set up different work and tool holding devices required to accomplish tasks on these machines with required alignment.
15. Demonstrate practical skills involved in different operation on milling machine by setting work piece and using different cutting tools.
16. Produce finished components on a milling machine and check for accuracy without any assistance.

17. Understand and explain the constructional features and working principles of surface grinding and cylindrical grinding machine and set up different work and tool holding devices required to accomplish tasks on these machines with required alignment.
18. Produce finished components on a surface and cylindrical grinding machines and check for accuracy without any assistance.
19. Understand and explain the welding techniques and execute die welding.

### **SEMESTER - III**

20. Understand and explain the constructional features and working principles of Pantograph machine and wire cut machine and execute different operation on Pantograph EDM wire cut.
21. Understand and explain the constructional features and working principles of different types of injection molding machines and injection moulds.
22. Manufacture and assemble different types of moulds viz., hand injection mould, two cavity injection mould, single compression mould and plunger type transfer mould.

### **SEMESTER – IV**

23. Understand and explain the constructional features and working principles of Tool and cutter grinding machine and grind/ sharpen of single point and multipoint cutting tools. (different types of milling cutters)
24. Manufacture and assemble different injection moulds and pressure die casting.
25. Identify and explain the function of cylinder, valve, actuator and filters in the machines available in work shop like hydraulic press, surface and cylindrical grinder. .
26. Preparation part programme using G codes and M codes to produce different components on CNC machine and test the program by simulation.
27. Develop /draw different elements of dies and moulds using CAD/CAM software.

## 8. ASSESSABLE OUTCOMES WITH ASSESSMENT CRITERIA

**Note:**

1. The training shall be conducted as per the syllabus.
2. The trainee shall demonstrate the competencies that are defined below in the assessable outcomes highlighted below.
3. The trainee shall be assessed for his/her achievement levels in all the assessable outcomes on the basis of the formative assessment, Theory & Practical examinations, observation, and viva-voce.
4. The trainee shall be assessed for his/her achievement levels in all the assessable outcomes of the Employability Skills, Workshop Calculation & Science, and Engineering Drawing, on the basis of Theory Examinations, and for his/her ability to apply the concepts in Practical.
5. The assessable outcomes and assessment criteria will serve as a set of guidelines for Trainers, Paper setters, Moderators, and Assessors.

**Assessable outcomes along with assessment criteria to be achieved after each semester and completion of qualification:**

**Generic assessable outcomes:**

ASSESSABLE OUTCOMES	ASSESSMENT CRITERIA
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 and according to site policy.
	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 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 the avoidance of instances of environmental pollution.
	1.13 Deploy environmental protection legislation & regulations
	1.14 Take opportunities to use energy and materials in an environmentally friendly manner
	1.15 Avoid waste and dispose waste as per procedure
	1.16 Recognize different components of 5S and apply the same in the working environment.
2. Work in a team, understand and practice soft skills, technical English to communicate with required clarity.	2.1 Obtain sources of information and recognize information.
	2.2 Use and draw up technical drawings and documents.
	2.3 Use documents and technical regulations and occupationally related provisions.
	2.4 Conduct appropriate and target oriented discussions with higher authority and within the team.
	2.5 Present facts and circumstances, possible solutions & use English special terminology.
	2.6 Resolve disputes within the team
	2.7 Conduct written communication.
3. Demonstrate knowledge of concept and principles of basic arithmetic, algebraic, trigonometric, statistics, co-ordinate system and apply knowledge of specific area to perform practical operations.	3.1 Semester examination to test basic skills on arithmetic, algebra, trigonometry and statistics.
	3.2 Their applications will also be assessed during execution of assessable outcome and also tested during theory and practical examination
4. Understand and explain basic science in the field of study including basic electrical, and hydraulics & pneumatics.	4.1 Semester examination to test basic skills on science in the field of study including basic electrical and hydraulics & pneumatics.
	4.1 Their applications will also be assessed during execution of assessable outcome and also tested during theory and practical examination.
5. Read and apply engineering drawing for different application in the field of work.	5.1 Semester examination to test basic skills on engineering drawing.
	5.2 Their applications will also be assessed during execution of assessable outcome and also tested during theory and practical examination.
6. Understand and explain the concept in productivity, quality tools, and labour	6.1 6.1 Semester examination to test the concept in productivity, quality tools and labour welfare legislation.

welfare legislation and apply such in day to day work to improve productivity & quality.	6.2 Their applications will also be assessed during execution of assessable outcome
7. Explain energy conservation, global warming and pollution and contribute in day to day work by optimally using available resources.	7.1 Semester examination to test knowledge on energy conservation, global warming and pollution.
	7.2 Their applications will also be assessed during execution of assessable outcome.
8. Explain personnel finance, entrepreneurship and manage/organize related task in day to day work for personal & societal growth.	8.1 Semester examination to test knowledge on personnel finance, entrepreneurship.
	8.2 Their applications will also be assessed during execution of assessable outcome
9. Understand and apply basic computer working, basic operating system, simulate part programme using simulation software and uses internet services to get accustomed & take benefit of IT developments in the industry.	9.1 Semester examination to test knowledge on basic computer working, basic operating system and uses internet services.
	9.2 Their applications will also be assessed during execution of assessable outcome

### Specific assessable outcomes:

#### Semester-I

ASSESSABLE OUTCOME	ASSESSMENT CRITERIA
10. Perform marking out the components for sawing, filing, drilling, fitting and allied operations with clear choice of procedures.	10.1 Identify tools and equipment's for measuring and use of these tools.
	10.2 Select raw material and visual inspect for defects.
	10.3 Identify basic hand tools for sawing, filing, drilling, fitting operations and use these tools for different applications.
	10.4 Mark according to drawing.
	10.5 Follow relevant legislation, industry guidelines and enterprises policies / procedures.
	10.6 Check all dimensions in accordance with drawing.
11. Plan and organize the work for different types of fitting operations and check for work result.	11.1 Plan and select tools and equipment for fitting operation.
	11.2 Mark according to drawing by using marking tools on flat and round surfaces.
	11.3 File the job using different methods and perform in accordance with standard specifications and tolerances.

	11.4 Drill on flat and round surfaces.
	11.5 Identify & use hand tools for threading (internal and external) with dies and taps.
	11.6 Measure all dimensions in accordance with standard specifications and tolerances.
12. Understand and explain the constructional features and working principles of drilling machine and lathe machine and set up different work and tool holding devices required to accomplish tasks with required alignment.	12.1 Acquaintance of basic working principles and safety aspect of drilling and lathe machine.
	12.1 Explain functional application of different levers, stoppers, adjustment etc.
	12.1 Identify different lubrication points of drilling and lathe machine.
	12.1 Identify different types lubricants and their usage for application in drilling and lathe machine as for machine manual.
	12.1 Identify different work and tool holding devices and acquaint with functional application of each device.
	12.1 Mount the work and tool holding devices with required alignment and check for its functional usage to perform drilling and lathe operations.
	12.1 Solve problem by applying basic methods, tools, materials and information during setting.
	12.1 Observe safety procedure during mounting as per standard norms.
13. Grind single point cutting tool, centre punch and twist drills using pedestal grinding machine to maintain close tolerance as per the drawing.	13.1 plan and select appropriate tools and equipment to produce components as per drawing.
	13.2 Measure all dimensions to check for accuracy with respect to the drawing
	13.3 Solve problem by applying basic methods, tools, materials and information during machining.
	13.4 Observe safety precaution during operation on grinding machine..

## Semester-II

14. Understand and explain the constructional features and working principles of milling machine and set up different work and tool holding devices required to accomplish tasks on these machines with required alignment	14.1 Acquaintance of basic working principles and safety aspect of milling machine.
	14.2 Explain functional application of different levers, stoppers, adjustment etc.
	14.3 Identify different lubrication points of milling machine.
	14.4 Identify lubricants and their usage for milling machine as for machine manual.
	14.5 Identify different work and tool holding devices and acquaint with functional application of each device.
	14.6 Mount the work and tool holding devices with required alignment and check for its functional usage to perform milling operations.
	14.7 Solve problem by applying basic methods, tools, materials and information during setting.



	14.8 Observe safety procedure during mounting of work and
	14.9 tool holding devices as per standard norms.
15. Demonstrate practical skills involved in different operation on milling machine by setting work piece and using different cutting tools. .	15.1 Ascertain and select tools, equipment and materials for the aligning / truing operation and make this available for use in a timely manner.
	15.2 Plan work in compliance with standard safety norms.
	15.3 Set up job on milling machine in accordance with standard operating procedure.
	15.4 Check the alignment of job to machine as per standard procedure using dial gauge indicator
16. Produce finished components on a milling machine and check for accuracy without any assistance.	16.1 Select appropriate tools and equipment and operate the machine to procedure components as per required dimension.
	16.2 Mount the work and tool holding devices with required alignment and check for its functional usage to perform milling operations.
	16.3 Solve problem by applying basic methods, tools, materials and information during machining
	16.4 Check all dimensions as per drawing.
17. understand and explain the constructional features and working principles of surface and cylindrical grinding machine and set up different work and tool holding devoices to accomplish tasks on these machines with require alignment	17.1 Acquaintance of basic working principle and safety aspect of surface and cylindrical grinding machines
	17.2 identify different lubricant points of surface and cylindrical grinding machines
	17.3 Identify different work and tool holding devices and acquaint with functional application of each devices..
	17.4 Check the alignment of job to machine as per standard procedure using dial gauge indicator.
18. Produce finished component on a surface and cylindrical grinding machines and check for accuracy without any assistance.	18.1 Select appropriate tools and equipments and operate the machine to produce the components as per required dimensions.
	18.2 Solve problem by applying basic methods, tools, materials and information during machining
	18.3 Mount the work and tool holding devices with required alignment and check for its functional usage to perform grinding operations.
19. Understand and explain the welding techniques and execute die welding.	19.1 Set and able to operate gas and arc welding equipments for simple welding operations.
	19.2 Able to weld on hard die blocks as well as die castings
	19.3 Demonstrate and produce different types of welding joints, die welding techniques.
	19.4 Observe safety procedure during mounting of work and tools as per standard norms.

### Semester-III

Assessable outcomes	Assessment criteria
20. Understand and explain the constructional features and working principles of Pantograph machine and wire cut machine and execute different operation on Pantograph and EDM wire cut.	20.1 Acquaintance of basic working principles and safety aspect of pantograph machine and wire cut machine.
	20.2 Explain functional application of different adjustment of pantograph machine and wirecut machine.
	20.3 Identify different lubrication points of pantograph machine and wire cut machine.
	20.4 Identify lubricants and their usage for application in pantograph and wirecut machine as for machine manual.
	20.5 Identify different work and tool holding devices and acquaint with functional application of each device.
	20.6 Mount the work and tool holding devices with required alignment and check for its functional usage to perform pantograph machine and wirecut operations.
	20.7 Solve problem by applying basic methods, tools, materials and information during setting.
	20.8 Observe safety procedure during mounting as per standard norms
21. Understand and explain the constructional features and working principles of different types of injection molding machines and injection moulds	21.1 Acquaintance of basic working principles of different injection molding machines and injection moulds
	21.2 Explain functional application of different parts of machine and mould.
	21.3 Identify different lubrication points of injection moulding machine.
	21.4 Identify different types of lubricants and applications.
	21.5 Solve problems by applying basic methods and principles of moulds during setting and operations.
	21.6 Observe safety precaution during mounting of dies and moulds on machines.
22.Manufacture and assemble different types of moulds viz., hand injection mould, two cavity injection mould, single compression mould and plunger type transfer mould	22.1 Plan and select tools, equipments and machine to produce mould components.
	22.2 Apply desired mathematical skills, collect and organize information to work out the machining parameters
	22.3 Produce and assemble the components as per

	guide lines in the drawing.
	22.4 Measure the dimensions as per the drawing and check functionality.
	22.5 Avoid waste and dispose the waste as per procedure..

## Semester-IV

Assessable outcomes	Assessment criteria
23. Understand and explain the constructional features and working principles of Tool and cutter grinding machine and grind/resharpen of single point and multipoint cutting tools. (different types of milling cutters)	23.1 Acquaintance of basic working principles and safety aspect of tool and cutter grinder machine.
	23.2 Explain the functional application of different levers, stoppers, adjustment etc.
	23.3 Identify different lubrication points of tool and grinder.
	23.4 Identify lubricants and their usage in tools and cutter grinder as per the information in manual.
	23.5 Plan and select appropriate method to grind the tool bit and milling cutters.
	23.6 Grind the cutting tool as per standard operating practice.
	23.7 Check for desired performance.
	23.8 Observe safety precautions during tool and grinding machine operations.
24. Manufacture and assemble different injection moulds and pressure die casting.	24.1 Plan and select tools, equipments and machine to produce mould components.
	24.2 Apply desired mathematical skills, collect and organize information to work out the machining parameters
	24.3 Produce and assemble the components as per guide lines in the drawing.
	24.4 Measure the dimensions as per the drawing and check functionality.
	24.5 Avoid waste and dispose the waste as per procedure..
	24.6 Plan and select tools, equipments and machine to produce mould components.
25. Understand and explain basic principles of hydraulics and pneumatics and apply in day to day practical application.	25.1 Acquaintance of basic working principles and safety aspect of hydraulics and pneumatics systems.
	25.2 Explain functional application of different cylinders, valves, actuators and filters.
	25.3 Identify different parts in Hydraulics and Pneumatics systems.
	25.4 Apply in day to day practical applications and process.
26. Preparation part programme using G codes and M codes to produce different components on	26.1 Plan and prepare part programme as per drawing applying range of cognitive and practical skills.
	26.2 Simulate for its correctness and tool path

CNC machine and test the program by simulation.	verification with simulation software.
	26.3 Demonstrate possible solutions within the team.
27. Develop /draw different elements of dies and moulds using CAD/CAM software.	27.1 Plan and develop/ draw as per drawing of different components using CAD/CAM software.
	27.2 Verify for its correctness with CAD/ CAM software.

## 9. SYLLABUS CONTENT WITH TIME STRUCTURE

### SYLLABUS FOR THE TRADE OF TDM (Dies & Moulds) **First and Second semesters are common for both TDM (Dies & Moulds and Press Tool, Jig & Fixtures)**

#### 9.1 Syllabus Content for Professional Skill & Knowledge

First Semester (Semester Code No. TDM(DM) – 01)

Duration: Six Months

#### Learning Objectives (1<sup>st</sup> Semester)

1. Apply safe working practices.
2. Comply environment regulation and housekeeping.
3. Interpret & use Company terminology and technical communication.
4. Perform basic fitting operations used in industrial workshop practices and inspection of dimensions.
5. Operate drill machine and lathe.
6. Sharpening of single point cutting tools to close tolerance.

#### Detailed Syllabus:

Week No.	Trade Practical	Trade Theory
1.	<p>Importance of trade training, List of tools &amp; Machinery used in the trade.            Health &amp; Safety: Introduction to safety equipments and their uses. Introduction of first aid, operation of Electrical mains.</p> <p><b>Occupational Safety &amp; Health</b>  <b>Importance of housekeeping &amp; good shop floor practices.</b>            Health, Safety and Environment guidelines, legislations &amp; regulations as applicable. Disposal procedure of waste materials like cotton waste, metal chips/burrs etc. Basic safety introduction, Personal protective Equipments(PPE):- Basic injury prevention, Basic first aid, Hazard identification and avoidance, safety signs for Danger, Warning, caution &amp; personal safety message.            Preventive measures for electrical accidents &amp; steps to be taken in such accidents.</p>	<p>Importance of safety and general precautions observed in the in the industry/shop floor. All necessary guidance to be provided to the new comers to become familiar with the working of Industrial Training Institute system including stores procedures. <b>Soft Skills: its importance and Job area after completion of training.</b> Introduction of First aid. Operation of electrical mains. Introduction of PPEs. Introduction to 5S concept &amp; its application.            Response to emergencies eg; power failure, fire, and system failure.</p>

	Use of Fire extinguishers.	
2 - 4	<p><b>Bench work:</b></p> <p>Identification of tools &amp; equipments as per desired specifications for marking &amp; sawing.</p> <p>Holding rectangular piece of material in bench vice -filing flat surfaces and edges by maintain 90<sup>0</sup> angles between all surfaces and edges - checking the dimensions and angles with steel rule and try square.</p> <p>Marking out of parallel lines using odd leg caliper, punching. Hack sawing to a different length as per marking (for step filing). Marking out of parallel lines using odd leg caliper, punching. Hack sawing to a different length as per marking (for step filing).</p> <p>Identification of tools &amp; equipments as per desired specifications for filing. File steps and finish with smooth file with in the accuracy of <math>\pm 0.5\text{mm}</math>. Filing 45° chamfer at all the edges Filing external radius and check with radius gauge.</p>	<p>Bench vice construction –types, uses, care and maintenance. Hacksaw frames – its types, hacksaw blade – description, material, specifications and uses.</p> <p>Method of using hacksaw. Steel rule, calipers- its type, surface plate, surface gauge, scribes, punches – its types, hammer –its types. Metric and FPS system of measurement.</p> <p>Introduction of file, types, materials, classification, filing techniques and operations. Applications of files.</p>
5 - 6	<p>Identification of tools &amp; equipments as per desired specifications for drilling and tapping. Making rectangular parallel block and drilling practice for through holes, blind holes, Counter drilling, Counter sinking, chain drilling and tapping.</p>	<p>Drilling machine description – its types, Selection of cutting speed for different materials. Calculation of rotation per minute (rpm), drilling time for drilling. Description of twist drill, counter boring tool, counter sinking tool. Drill material, type (taper shank, straight shank), parts and size. Description and uses of taps, dies and reamers. Care to be taken while using taps, dies and reamers.</p>
7 - 9	<p>Practice of step fitting having curvature/radius fitting</p>	<p>Vernier caliper, micrometer (inside &amp; outside), height gauge, bevel protector – working principle – construction, graduations, calculation of least count, readings-uses and care</p> <p>Introduction to Limit, Fits, Tolerance, Allowance – its application in interchangeable system.</p> <p>Introduction of chisel and scraper - its material, parts, type and method of chipping</p>

		and scraping.  Study of different types of gauges and templates used in fitting.
10.	Practice of Chipping & Scraping	Study of tools used in chipping and scraping. Introduction about metals, difference between Metal and Non Metal, properties of metal, Classification of metals and its applications. Heat treatment of metals, process- such as annealing, nitriding, hardening, tempering, case hardening, carburizing, cyaniding, flame hardening, induction hardening, purposes and its effects on the properties of steel.
11	Prepare three piece Assembly fitting with Filing flat and radius, drilling, countersinking, counter boring and tapping. Identify potential problems in preparation process and suggest appropriate solutions	Manufacturing process of ferrous metals and its classification, uses of wrought iron, cast iron and steel. Alloying elements of steel and its effects on the properties of steel. Types of steels used in cutting tool and their specifications,
12- 13	Dressing of grinding wheels. Grinding of chisel, punch in Pedestal Grinder. Practice of twist drill grinding. Practice of single point turning tools grinding.	Description of pedestal grinder, procedure for mounting the grinding wheel and its application. Introduction to dressing and its importance. Description of single point cutting tool. Tool angles and its importance. Effect of tool setting and tool angles.
14	<b>Lathe:</b>  Setting of job in four jaws chuck, truing. Setting of cutting tool on tool post, at centre height. and its effect on metal cutting.  Practicals on plain turning and facing.	<b>Lathe:</b>  Introduction to lathe machine and its types, specifications, description of main parts – bed, headstock, carriage, tail-stock, feed mechanism and thread cutting mechanisms. Safety precautions while working on lathe. Lathe machine
15.	Lathe operations - step turning, shouldering, undercut, chamfering, grooving, fillet radius within an accuracy of $\pm 0.1$ mm and its checking of squareness, diameter, length, chamfer, fillets radius using micrometer, vernier caliper and gauges.	Lathe accessories and attachments. Chuck – its types, face plates, lathe dogs, lathe centers - its types, and lathe steady. Coolants and lubricants-its difference and use .
16	Lathe operations – drilling, boring, counter boring, thread making using die and tap.	Nomenclature of Lathe cutting tool - its shapes cutting angles for different lathe operations. Influence of cutting tool angles on metal cutting. Recommended cutting tool materials

		for lathe operations.
17- 18	Practice of eccentric turning.  Practice between centre - plain turning, checking the parallelism and aligning/setting of tailstock and head stock centers – using micrometer, dial test indicator etc.	Different simple lathe operations – parallel/straight turning, step turning, grooving, radius forming, drilling and boring, counter boring. Calculation of cutting speed, feed and turning time.
19- 20	Practice of different taper turning methods on lathe (internal and external).	Different taper turning methods and its calculations.
21-22	Practice screw thread cutting - whit worth/metric (Internal & external)	Definition of screw thread, types, forms and its applications. Calculation of gear train for screw thread cutting on lathe. Change gear and its calculation.
23-25	<b>Revision</b>	
26	<b>Examination</b>	

## Second Semester (Semester Code No. **TDM(DM) – 02**)

Duration: Six Months

### Learning Objectives (2<sup>nd</sup> Semester)

1. Apply safe working practices.
2. Comply environment regulation and housekeeping
3. Produce different components on milling machine.
4. Produce components on surface & cylindrical grinding machine.
5. Execute die welding.

### Detailed Syllabus:

Week No.	Trade Practical	Trade Theory
01	<b>Milling:</b>  Preparation of rectangular block by milling – selection of cutters for plain milling, mounting of milling cutters. Milling a block within an accuracy of $\pm 0.2$ mm and check the dimensions.	<b>Milling:</b>  Introduction to milling machine, construction, types. Safety precaution followed during milling operation.



02 - 03	Step milling operation within an accuracy of $\pm 0.2\text{mm}$	Milling machine attachments – vertical milling attachment, universal milling attachment, circular milling attachment, dividing head attachment etc.  Different types of milling cutters used in milling operations.
04	Angular milling.	Nomenclature of milling cutters, different milling cutter angles, Milling cutter materials.
05 - 06	Dovetail milling	Milling cutter holding devices, work holding devices, milling process – Up milling and Down milling.  Calculation of cutting speed, feed, machining time for milling machine. Milling machine operations.
07 - 08	Milling Operation using rotary table. T- Slot Milling.  Basic programming of CNC Milling	Dividing head – Introduction, construction, types. Simple and universal dividing head.  G code M code, co-ordinates, basic programming for CNC
09	Concave and convex radius milling.	Indexing methods – direct indexing, simple indexing, angular indexing, differential indexing and its calculations.
10.	Milling key ways or spline.  Diagnose common problems in the machine based on visual inspection, sound, temperature etc.	Gears – types, calculation for spur, helical and bevel gears. Holding of gear blanks. Setting method of cutters and gear blanks.
11.	Gear Cutting (spur)  Carryout housekeeping work	-do-
12.	<b>Grinding:</b>  Procedure for holding of job, setting of machine stroke length. Practice of wheel balancing. Grinding of parallel and perpendicular surfaces with in the accuracy of $\pm 0.02\text{mm}$	<b>Grinding:</b>  Grinding machine – introduction, description, types – surface grinding and cylindrical grinding machines. Safety precautions followed while working on grinding machines.
13– 14	Grinding of angular surfaces within an accuracy of $\pm 5$ arc minutes using universal vice  Grinding of angular surfaces of die block	Grinding wheels – abrasives, bond and bonding process, grit, grade, and structure of grinding wheels.  Use of sine table and related calculations

	using sine table.	
15– 17	<p>Setting of machine for internal &amp; external cylindrical grinding surfaces within an accuracy of <math>\pm 0.02\text{mm}</math>.</p> <p>Grinding internal &amp; external steps on cylindrical surfaces within <math>\pm 0.02\text{mm}</math> accuracy.</p> <p>Achieving interference fit of guide pillar and bush.</p>	<p>Grinding wheel shapes and sizes. Standard marking system. Selection of grinding wheel.</p> <p>Procedure for mounting of grinding wheels, balancing of grinding wheels, dressing and truing of grinding wheels, glazing and loading in grinding wheel.</p> <p>Calculation for cutting speed and work speed, feed, depth of cut and machining time.</p>
18	Prepare different types of documentation as per industrial need by different methods of recording information	Importance of Technical English terms used in industry – (in simple definition only) - Technical forms, process charts, activity logs, in required formats of industry, estimation, cycle time, productivity reports, job cards
19– 20	<p><b>EDM:</b></p> <p>Machining practice / observation on EDM Machine (Spark Erosion m/c )</p> <p>Preparing simple electrodes from Copper, Graphite.</p>	<p><b>EDM:</b></p> <p>Electrical discharge machining (EDM) – Introduction, principle of operation, advantages &amp; disadvantages and its applications.</p>
21	<p><b>Welding:</b></p> <p>Introduction to gas welding equipment/arc welding equipment, Simple welding practice. Practice on brazing.</p> <p>Practice on die welding. Welding on Hard die block as well as on die casting.</p>	<p><b>Welding:</b></p> <p>Explanation of gas welding and arc welding techniques. Description of welding equipment, types of welding joints.</p> <p>Knowledge about flux, filler rod material.</p> <p>Die welding techniques.</p>
22-23	<b>Implant training / Project work (work in a team)</b>	
24 - 25	<b>Revision</b>	
26	<b>Examination</b>	

### Third Semester (Semester Code No. **TDM(DM) - 03**)

Duration: Six Month

#### Learning Objectives (2nd Semester)

1. Apply safe working practices.
2. Comply environment regulation and housekeeping
3. Interpret & use Company terminology and technical communication

4. Operate Pantograph and EDM wire cut machine.
5. Manufacture and assemble different types of moulds.

### Detailed Syllabus:

Week No.	Trade Practical	Trade Theory
01-02	<b>Pantograph machine:</b> - Practice for setting of job on machine vice, setting of cutter, setting of stylus, master and template, depth of cut. Practice of removing material from work piece i.e. from - Engraving, sunk and raised letters, die sinking.	<b>Pantograph machine:</b> - Introduction, types, parts, working principle, advantages for using of pantograph milling m/c, its applications. Setting of enlarging and reducing ratios between master/template and work piece for Engraving, sunk and raised letters, die sinking.
03-04	<b>Wire Cut</b> Machining practice / observation on machine	<b>Wire Cut</b> Electrical wire cut machining – Introduction, principle of operation, advantages & disadvantages and its applications.
05-07	<b>Hand Injection Mould</b> Manufacture of Hand Injection Mould.	<b>Hand Injection Mould</b> Constructional details of a basic injection mould (Hand injection mould). Constructional details of a single cavity two plate injection mould. Introduction to tooling: Brief description of press tools, moulds for plastics, die-casting, jigs and fixtures. Constructional features of a simple injection mould Differentiating between thermosetting plastics. Properties and uses of commonly used thermoset plastics, fillers and additives, reinforced plastics mould release agents. Identification of common thermoplastics. Surface treatment of plastics, screen printing, Heat transfer in mould decorating, two colour moulding. Electroplating and vacuum metalizing of plastics. Importance of mould polishing, advantages of chrome plating, method of mould polishing.

08-12	<p><b>Two cavity injection Mould</b> Manufacture of two cavity injection mould.</p>	<p>Constructional features of injection moulding machine. Specification of injection moulding machine. Calculation of shot weight. Plasticising capacity, minimum cycle time, Clamping.</p> <p>Description of parts of system Runner functions. Different types of runner cross-sections. Selection of best runner cross section. Functions and types of gates selection of gate. Calculation of runner and gate size.</p> <p>Different parts of ejection system functioning of ejection system ejector return system. Ejection methods. Actuations methods for stripper plates. Ejection from fixed half. Function and type of spruce pullers.</p>
13-17	<p><b>Single Compression Mould</b> Manufacture of single compression mould.</p>	<p>Types of parting surface. Selection of parting surface shrink-age factors, governing shrink-age determination of core and cavity dimensions Importance of temperature controlling in moulds. Method for controlling different parts of moulds. Cooling channel and their positions, mould cooling calculations.</p> <p>Constructional details of two cavity injection mould. Necessity of split in a mould, method of operation of split, split locking method, split locking arrangements, side core and side cavity assembly details of side core and side cavity. Methods used in actuating side core and side cavity. Constructional details of an injection mould with side core movement by dog legged cam</p>
18-21	<p><b>Plunger Type Transfer Mould</b> Manufacture of plunger type transfer mould.</p>	<p>Different methods used in moulding internal undercuts. Factors to be considered while designing moulds for components with threads. Methods employed in the removal of internally and externally threaded components.</p> <p>Different between single daylight mould and multi day light mould. Under feed moulds, Feed system in multi day light moulds. Triple daylight moulds.</p> <p>Elements of mould cycle. Importance of mould cycle diagram.</p> <p>Construction/design details of injection mould (plate ejection)</p>
22-23	<b>In-plant training / Project work (Work in a team)</b>	
24-25	Revision	
26	<b>Examination</b>	

## Fourth Semester (Semester Code No. TDM(DM) – 04)

Duration: Six Month

### Learning Objectives (4<sup>th</sup> Semester)

1. Apply safe working practices.
2. Comply environment regulation and housekeeping
3. Interpret & use Company terminology and technical communication
4. Grind/ re-sharpen cutting tools in Tool and Cutter Grinding machine.
5. Manufacture different injection moulds and pressure die casting.
6. Explain function of different elements of hydraulic and pneumatic system
7. Prepare part programme using G codes and M codes.
8. Develop different elements of dies and moulds using CAD/ CAM software.

### Detailed Syllabus:

Week No.	Trade Practical	Trade Theory
01-04	<b>Tool &amp; Cutter Grinder:</b>  Grinding of single point cutting tool blank.  Grinding of plain and face milling cutter.	<b>Tool &amp; Cutter Grinder:</b>  Description of tool and cutter grinding machine. Work (cutting tool) holding device for tool & cutter grinder machine.  Setting process of cutting tools and grinding wheel on tool & cutter grinding machine.
05-08	Manufacture of two cavity injection mould with side cores.  Ensure that total range of checks are regularly and consistently perform  Identify potential causes for non conformities to quality assurance standards	Identification of common moulding defects that occur during injection moulding, reasons for defect in the component.  Compression moulding process. Procedure of compression moulding. Identification of common defect that occur during compression moulding  Transfer moulding process, advantages of transfer moulding.  Identification of common moulding defects. Reasons for the defects in the component.  Compression and transfer mould calculations. Construction – design details of simple compression mould. Construction design details of simple transfer mould.  Introduction to blow moulding, thermo forming, rotational moulding, extrusion process

09-12	Manufacture of pressure die casting die.	<p>Die casting, hot chamber process and cold chamber process. Basic designs of a die casting die.</p> <p>Effect of metal on die casting process. Effect of die casting machine on process. Effect of die in process.</p> <p>Flow system in a die-casting die. Goose neck nozzle, sprue, runner system from sprue to gate, shock absorbers, gating, air vents, over flow. Ejection system in a die-casting die.</p> <p>Moving cores. Actuation of moving cores.</p> <p>Cold type defects, hot types defects, miscellaneous defects.</p>
13-15.	<p><b><u>Hydraulics &amp; Pneumatics</u></b></p> <p>Identification and familiarisation of various types of hydraulic &amp; pneumatic elements. such as cylinder, valves, actuators and filters.</p> <p>Study of simple hydraulic &amp; pneumatic circuit.</p>	<p><b><u>Hydraulics &amp; Pneumatics</u></b></p> <p>Basic principles of Hydraulic Pneumatic system.</p> <p>Advantages &amp; disadvantages of hydraulic and pneumatic system. Theory of Pascal's law, Brahma's press, pressure &amp; flow.</p> <p>Type of valves used in hydraulic and pneumatic system.</p>
16.	Prepare different types of documentation as per industrial need by different methods of recording information.	Importance of Technical English terms used in industry –(in simple definition only) Technical forms, process charts, activity logs, in required formats of industry, estimation, cycle time, productivity reports, job cards.
17-21	Program generation & Simulation with CAD/CAM software for dies & moulds.	<p>Concepts of CAD/CAM</p> <p>Basic concepts of inspection of 3D surfaces.</p> <p>Part program generation and setting up the machine for producing punch/dies.</p>
22-23	<b>Implant training / Project work (work in a team)</b>	
24-25	<b>Revision</b>	
26	<b>Examination</b>	

## 9.2 SYLLABUS CONTENT OF CORE SKILLS

**First Semester** (Semester Code No **TDM(DM) - 01**)

Duration: Six Month

### Learning Objectives (1<sup>st</sup> Semester)

1. Demonstrate basic arithmetic to derive value of unknown quantity / variable.
2. Understand & apply engineering material, their classification, properties and applications in the day to day technical application.
3. Explain & apply speed, velocity, work, power & energy for application in field of work.
4. Understand & explain importance of engineering drawing, drawing instruments, their standard & uses.
5. Draw lines, geometrical figures, free hand sketches.
6. Understand and apply sizes & layout of drawing sheet, method of presentation of engineering drawing & symbolic representation as per BIS standards

Sl. No.	Professional Knowledge	Professional Knowledge & Skills
	Workshop Calculation and Science	Engineering Drawing
1.	<b>Unit:</b> Systems of unit- FPS, CGS, MKS/SI unit, unit of length, Mass and time, Conversion of units	Engineering Drawing: Introduction and its importance <ul style="list-style-type: none"> <li>- Relationship to other technical drawing types</li> <li>- Conventions</li> <li>- Viewing of engineering drawing sheets.</li> <li>- Method of Folding of printed Drawing Sheet as per BIS SP:46-2003</li> </ul>
2.	<b>Fractions:</b> Fractions, Decimal fraction, L.C.M., H.C.F., Multiplication and Division of Fractions and Decimals, conversion of Fraction to Decimal and vice versa. Simple problems using Scientific Calculator.	Drawing Instruments : their Standard and uses <ul style="list-style-type: none"> <li>- 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.</li> </ul>
3.	<b>Square Root:</b> Square and Square Root, method of finding out square roots, Simple problem using calculator.	Lines : <ul style="list-style-type: none"> <li>- Definition, types and applications in Drawing as per BIS SP:46-2003</li> <li>- Classification of lines (Hidden, centre, construction, Extension, Dimension, Section)</li> <li>- Drawing lines of given length (Straight, curved)</li> <li>- Drawing of parallel lines, perpendicular line</li> <li>- Methods of Division of line segment</li> </ul>
4.	<b>Ratio &amp; Proportion:</b> Simple calculation on related problems.	Drawing of Geometrical Figures: Definition, nomenclature and practice of <ul style="list-style-type: none"> <li>- Angle: Measurement and its types, method of bisecting.</li> </ul>

		<ul style="list-style-type: none"> <li>- Triangle -different types</li> <li>- Rectangle, Square, Rhombus, Parallelogram.</li> <li>- Circle and its elements.</li> </ul>
5.	<b>Percentage:</b> Introduction, Simple calculation. Changing percentage to decimal and fraction and vice-versa.	Lettering and Numbering as per BIS SP46-2003: <ul style="list-style-type: none"> <li>- Single Stroke, Double Stroke, inclined, Upper case and Lower case.</li> </ul>
6.	<b>Material Science</b> : properties -Physical & Mechanical, Types –Ferrous & Non-Ferrous, difference between Ferrous and Non-Ferrous metals, introduction of Iron, Cast Iron, Wrought Iron, Steel, difference between Iron and Steel, Alloy steel, carbon steel, stainless steel, Non-Ferrous metals, Non-Ferrous Alloys.	Dimensioning: <ul style="list-style-type: none"> <li>- Definition, types and methods of dimensioning (functional, non-functional and auxiliary)</li> <li>- Types of arrowhead</li> <li>- Leader Line with text</li> </ul>
7.	<b>Mass, Weight and Density:</b> Mass, Unit of Mass, Weight, difference between mass and weight, Density, unit of density, specific gravity of metals.	Free hand drawing of <ul style="list-style-type: none"> <li>- Lines, polygons, ellipse, etc.</li> <li>- geometrical figures and blocks with dimension</li> <li>- Transferring measurement from the given object to the free hand sketches.</li> </ul>
8.	<b>Speed and Velocity:</b> Rest and motion, speed, velocity, difference between speed and velocity, acceleration, retardation, equations of motions, simple related problems.	Sizes and Layout of Drawing Sheets <ul style="list-style-type: none"> <li>- Basic principle of Sheet Size</li> <li>- Designation of sizes</li> <li>- Selection of sizes</li> <li>- Title Block, its position and content</li> <li>- Borders and Frames (Orientation marks and graduations)</li> <li>- Grid Reference</li> <li>- Item Reference on Drawing Sheet (Item List)</li> </ul>
9.	<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.	Method of presentation of Engineering Drawing <ul style="list-style-type: none"> <li>- Pictorial View</li> <li>- Orthogonal View</li> <li>- Isometric view</li> </ul>
10.	-----	Symbolic Representation (as per BIS SP:46-2003) of : <ul style="list-style-type: none"> <li>- Fastener (Rivets, Bolts and Nuts)</li> <li>- Bars and profile sections</li> <li>- Weld, brazed and soldered joints.</li> <li>- Electrical and electronics element</li> <li>- Piping joints and fittings</li> </ul>



## Second Semester (Semester Code No TDM(DM) - 02)

Duration: Six Months

### Learning Objectives (2<sup>nd</sup> Semester)

1. Demonstrate basic algebraic, mensuration, trigonometric facts and formulas to derive value of unknown quantity / variable.
2. Apply the factual knowledge of basic heat & temperature, basic electricity for day to day practical application.
3. Explain & apply principles of simple machine & levers for mechanical advantage, efficiency for practical application.
4. Draw & practice dimensioning, construction of solid figures and projections as per IS specifications.

Sl. No.	Professional Knowledge	Professional Knowledge & Skills
	Workshop Calculation and Science	Engineering Drawing
1.	<b>Algebra:</b> Addition, Subtraction, Multiplication, Division, Algebraic formula, Linear equations (with two variables).	Construction of Scales and diagonal scale
2.	<b>Mensuration :</b> Area and perimeter of square, rectangle, parallelogram, triangle, circle, semi-circle,  Volume of solids – cube, cuboids, cylinder and Sphere.  Surface area of solids – cube, cuboids, cylinder and Sphere.	Practice of Lettering and Title Block
3.	<b>Trigonometry:</b> Trigonometrical ratios, measurement of angles.  Trigonometric tables	Dimensioning practice: <ul style="list-style-type: none"> <li>- Position of dimensioning (unidirectional, aligned, oblique as per BIS SP:46-2003)</li> <li>- Symbols preceding the value of dimension and dimensional tolerance.</li> <li>- Text of dimension of repeated features, equidistance elements, circumferential objects.</li> </ul>
4.	<b>Heat &amp; Temperature:</b> 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.	Construction of Geometrical Drawing Figures: <ul style="list-style-type: none"> <li>- Different Polygons and their values of included angles. Inscribed and Circumscribed polygons.</li> <li>- Conic Sections (Ellipse&amp; Parabola)</li> </ul>
5.	<b>Basic Electricity:</b> Introduction, use of electricity, how electricity is produced, Types	Drawing of Solid figures (Cube, Cuboids, Cone, Prism, Pyramid, Frustum of Cone and Pyramid.) with

	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.	dimensions.
<b>6.</b>	<b><u>Levers and Simple Machines:</u></b> levers and its types.  Simple Machines, Effort and Load, Mechanical Advantage, Velocity Ratio, Efficiency of machine, Relationship between Efficiency, velocity ratio and Mechanical Advantage.	Free Hand sketch of hand tools and measuring tools used in respective trades.
<b>7.</b>		Projections:  <ul style="list-style-type: none"> <li>- Concept of axes plane and quadrant.</li> <li>- Orthographic projections</li> <li>- Method of first angle and third angle projections (definition and difference)</li> <li>- Symbol of 1<sup>st</sup> angle and 3<sup>rd</sup> angle projection as per IS specification.</li> </ul>
<b>8.</b>		Drawing of Orthographic projection from isometric/3D view of blocks
<b>9.</b>		Orthographic Drawing of simple fastener (Rivet, Bolts, Nuts & Screw)
<b>10.</b>		Drawing details of two simple mating blocks and assembled view.

### Third Semester (Semester Code No. **TDM(DM) - 03**)

Duration: Six Months

#### Learning Objectives (3<sup>rd</sup> Semester)

1. Demonstrate & apply calculation of area of cut-out regular & irregular surfaces, Volume of geometrical shapes and their cut section in related shop floor problems.
2. Calculate value of unknown sides and angles of geometrical shapes by trigonometrical methods and apply in shop floor problems.
3. Understand & apply concept of forces, stress & strain, factor of safety for practical application.
4. Factual knowledge of thermal conductivity, temperature measuring instruments, average velocity and circular motion for day to day application.
5. Understanding drawing of machined components & related symbols for use in manufacturing purpose.
6. Draw free hand sketches for fasteners, hand tools and components.
7. Prepare simple assembly drawings & their details.

Sl. No.	Professional Knowledge	Professional Knowledge & Skills
	Workshop Calculation and Science	Engineering Drawing
1.	- Geometrical construction & theorem: division of line segment, parallel lines, similar angles, perpendicular lines, isosceles triangle and right angled triangle.	- Revision of first year topics.
2.	- Area of cut-out regular surfaces: circle and segment and sector of circle.	- Machined components; concept of fillet & chamfer; surface finish symbols.
3.	- Area of irregular surfaces. - Application related to shop problems.	- Screw thread, their standard forms as per BIS, external and internal thread, conventions on the features for drawing as per BIS.
4.	- Volume of cut-out solids: hollow cylinders, frustum of cone, block section. - Volume of simple machine blocks.	- Free hand Sketches for bolts, nuts, screws and other screwed members.
5.	- Material weight and cost problems related to trade.	- Free hand Sketching of foundation bolts and types of washers.
6.	- Finding the value of unknown sides and angles of a triangle by Trigonometrical method.	- Standard rivet forms as per BIS (Six types).
7.	- Finding height and distance by trigonometry.	- Riveted joints-Butt & Lap (Drawing one for each type).
8.	- Application of trigonometry in shop problems. (viz. taper angle calculation).	- Orthogonal views of keys of different types

<b>9.</b>	<ul style="list-style-type: none"> <li>- Forces definition.</li> <li>- Compressive, tensile, shear forces and simple problems.</li> <li>-Stress, strain, ultimate strength, factor of safety.</li> <li>-Basic study of stress-strain curve for MS.</li> </ul>	- Free hand Sketches for simple pipe, unions with simple pipe line drawings.
<b>10.</b>	<ul style="list-style-type: none"> <li>- Temperature measuring instruments.</li> <li>Specific heats of solids &amp; liquids.</li> </ul>	- Concept of preparation of assembly drawing and detailing. Preparation of simple assemblies & their details of trade related tools/job/exercises with the dimensions from the given sample or models.
<b>11.</b>	<ul style="list-style-type: none"> <li>- Thermal Conductivity, Heat loss and heat gain.</li> </ul>	-Free hand sketch of trade related components / parts (viz., single tool post for the lathe, etc.)
<b>12.</b>	<ul style="list-style-type: none"> <li>- Average Velocity, Acceleration &amp; Retardation.</li> <li>- Related problems.</li> </ul>	- Study of assembled views of Vee-blocks with clamps.
<b>13.</b>	<ul style="list-style-type: none"> <li>- Circular Motion: Relation between circular motion and Linear motion, Centrifugal force, Centripetal force</li> </ul>	- Study of assembled views of shaft and pulley.
<b>14.</b>		- Study of assembled views of bush bearing.
<b>15.</b>		- Study of assembled views of a simple coupling.
<b>16.</b>		- Free hand Sketching of different gear wheels and nomenclature.

## Fourth Semester (Semester Code No. **TDM(DM) - 04**)

Duration: Six Months

### Learning Objectives (4<sup>th</sup> Semester)

1. Read & interpret different types graphs.
2. Solve simple statistical problem and apply sampling method for inspection purpose.
3. Factual knowledge of friction, magnetism and their application and affects.
4. Understand the application of electrical insulating materials & concept of earthing.
5. Understand & apply transmission of power, heat treatment & their advantages.
6. Factual knowledge of pressure, its units and measuring system and understand basic concept of pneumatics & hydraulic system.
7. Draw free hand sketches of bench vice and bearing.
8. Understand & identify missing lines, symbols & views.
9. Estimate material required as per drawing.

Sl. No.	Professional Knowledge	Professional Knowledge & Skills
	Workshop Calculation and Science	Engineering Drawing
1.	<b>Graph:</b> - Read images, graphs, diagrams - Bar chart, pie chart. - Graphs: abscissa and ordinates, graphs of straight line, related to two sets of varying quantities.	- Free hand Details and assembly of simple bench vice.
2.	Simple problem on Statistics: - Frequency distribution table - Calculation of Mean value. - Examples on mass scale productions. -Cumulative frequency -Arithmetic mean	- Reading of drawing. Simple exercises related to missing lines, dimensions. How to make queries.
3.	Acceptance of lot by sampling method (within specified limit size) with simple examples (not more than 20 samples).	- Simple exercises relating missing symbols. - Missing views
4.	- Friction- co-efficient of friction, application and effects of friction in Workshop practice.  <b>Centre of gravity</b> and its practical application.	- Simple exercises related to missing section.
5.	- Magnetic substances- natural and artificial magnets. - Method of magnetization. Use of magnets.	-Free hand sketching of different types of bearings and its conventional representation.

<b>6.</b>	- Electrical insulating materials. - Basic concept of earthing.	- Free hand sketching of different gear wheels and nomenclature/ Simple duct (for RAC). Free hand sketch of Reciprocating compressor – open type (for RAC)
<b>7.</b>	- Transmission of power by belt, pulleys & gear drive. - Calculation of Transmission of power by belt pulley and gear drive.	- Solution of NCVT test. - Simple exercises related to trade related symbols. - Basic electrical and electronic symbols
<b>8.</b>	- Heat treatment and advantages.	- Study of drawing & Estimation of materials.
<b>9.</b>	Concept of pressure – units of pressure, atmospheric pressure, absolute pressure, gauge pressure – gauges used for measuring pressure	- Solution of NCVT test papers.
<b>10.</b>	Introduction to pneumatics & hydraulics systems.	

## 10. SYLLABUS CONTENT OF EMPLOYABILITY SKILLS

### General Information

Name of the subject	: EMPLOYABILITY SKILLS
Applicability	: CTS- Mandatory for all trades ATS- Mandatory for fresher only
Hours of Instruction	110 Hrs.
Examination	: The examination shall be held at the end of semesters.
Instructor Qualification	<ul style="list-style-type: none"> <li>• MBA or BBA with two years' experience or Graduate in Sociology/ Social Welfare/ Economics with Two years' experience or Graduate/ Diploma with Two years' experience and trained in Employability Skills from ITIs and</li> <li>• Must have studied English/ Communication Skills and Basic Computer at 12th / Diploma level and above or</li> <li>• Existing Social Studies Instructors duly trained in Employability Skills from DGET institutes</li> </ul>
Instructor	<ul style="list-style-type: none"> <li>• One full-time instructor is required for 1000 seats and above</li> <li>• For seats less than 1000, the instructor may be out sourced/ hired on contract basis.</li> </ul>

### Semester-wise Distribution of Topics (Employability Skill)

Course Duration	Topics		Examination
	Semester 1	Semester 2	
01 Year (Two semesters)	1. English Literacy 2. I.T. Literacy 3. Communication Skills	1. Entrepreneurship Skills 2. Productivity 3. Occupational Safety , Health, and Environment Education 4. Labour Welfare Legislation 5. Quality Tools	Final examination at the end of second semester

## Syllabus Content for Employability Skills

### Semester 1

#### Learning Objectives (1<sup>st</sup> semester)

1. Read, write and communicate in English language for day to day work.
2. Communicate in written and oral and with required clarity ensuring that the information communicated is clear, concise and accurate.
3. Understand and apply basic computer working, basic operating system and uses internet services to get accustomed & take benefit of IT developments in the industry.

<b>1. English Literacy</b>	
<b>Hours of Instruction: 20 Hrs.</b>	
<b>Marks Allotted: 09</b>	
<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 known, 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>	
<b>Hours of Instruction: 20 Hrs.</b>	
<b>Marks Allotted: 09</b>	
<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>	<p>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), 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>
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**3. Communication Skills**  
**Hour of Instruction: 15 Hrs. Marks Allotted: 07**

Topic	Contents
<b>Introduction to Communication Skills</b>	Communication and its importance
	Principles of Effective communication
	Types of communication – verbal, nonverbal, written, email, talking on phone.
	Nonverbal communication –characteristics, components-Para-language
	Body – language
	Barriers to communication and dealing with barriers.
	Handling nervousness/ discomfort.
<b>Listening Skills</b>	Listening-hearing and listening, effective listening, barriers to effective listening guidelines for effective listening.
	Triple- A Listening – Attitude, Attention & Adjustment.
	Active Listening Skills.
<b>Motivational Training</b>	Characteristics Essential to Achieving Success
	The Power of Positive Attitude
	Self-awareness
	Importance of Commitment
	Ethics and Values
	Ways to Motivate Oneself
	Personal Goal setting and Employability Planning.
<b>Facing Interviews</b>	Manners, Etiquettes, Dress code for an interview
	Do's & Don'ts for an interview
<b>Behavioral Skills</b>	Problem Solving
	Confidence Building
	Attitude

## Semester 2

### Learning Objectives (2<sup>nd</sup> Semester)

1. Knowledge of business activities, ability to interact with consumers for development of businesses.
2. Understand and apply productivity, its benefits and factors affecting the productivity.
3. Follow and maintain procedures to achieve a safe working environment in line with occupational health, safety, environment regulations and Labour welfare legislation and requirements.
4. Understand and apply quality concepts as per ISO and BIS system and its importance.
5. Recognize different components of 5S and apply the same in the working environment.

<b>4. Entrepreneurship skill</b> <b>Hour of Instruction: 15 Hrs.Marks Allotted: 06</b>	
<b>Topic</b>	<b>Content</b>
<b>Business &amp; Consumer:</b>	Types of business in different trades and the importance of skill, Understanding the consumer, market through consumer behavior, market survey, Methods of Marketing, publicity and advertisement
<b>Self-Employment:</b>	Need and scope for self-employment, Qualities of a good Entrepreneur (values attitude, motive, etc.), SWOT and Risk Analysis
<b>Govt Institutions :</b>	Role of various Schemes and Institutes for self-employment i.e. DIC, SIDBI, MSME, NSIC, Financial institutions and banks
<b>Initiation Formalities :</b>	Project Formation, Feasibility, Legal formalities i.e., Shop Act, Estimation & Costing, Investment Procedure - Loan Procurement - Agencies - banking Process
<b>5. Productivity</b> <b>Hour of Instruction: 10 Hrs. Marks Allotted: 05</b>	
Productivity	Definition, Necessity, Meaning of GDP.
Benefits	Personal / Workman – Incentive, Production linked Bonus, Improvement in living standard. Industry Nation.
Affecting Factors	Skills, Working Aids, Automation, Environment, Motivation How improves or slows down.

Comparison with developed countries	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.
Personal Finance Management	Banking processes, Handling ATM, KYC registration, safe cash handling, Personal risk and Insurance.
<b>6. Occupational Safety, Health &amp; Environment</b> <b>Hour of Instruction: 15 Hrs. Marks Allotted: 06</b>	
<b>Safety &amp; Health :</b>	Introduction to Occupational Safety and Health and its importance at workplace
<b>Occupational Hazards :</b>	Occupational health, Occupational hygiene, Occupational Diseases/ Disorders & its prevention
<b>Accident &amp; safety :</b>	Accident prevention techniques- control of accidents and safety measures
<b>First Aid :</b>	Care of injured & Sick at the workplaces, First-aid & Transportation of sick person
<b>Basic Provisions :</b>	Idea of basic provisions of safety, health, welfare under legislation of India
<b>7.Labour Welfare Legislation</b> <b>Hour of Instruction: 05 Hrs. Marks Allotted: 03</b>	
<b>Labour Welfare Legislation</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> <b>Hour of Instruction: 10 Hrs. Marks Allotted: 05</b>	
<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 Functions 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 Housekeeping, Practice of good Housekeeping.5S Principles of Housekeeping: SEIRI – Segregation, SEITON – Arrangement, SEISO – Cleaning, SEIKETSU – maintenance of Standards, SHITSUKE - Discipline

## 11. INFRASTRUCTURE

1. Instructors' Qualification	Degree in Mechanical Engineering from recognized Engineering College /university with one year experience in the relevant field.  OR  Diploma in Mechanical Engineering/Tool and Die Making from recognized board of technical education with two years' experience in the relevant field.  OR  10th Class Pass + NTC/NAC in the Trade of "Tool & Die Maker (Dies & Moulds)" With 3 years post-qualification experience in the relevant field.
Desirable qualification	Preference will be given to a candidate with CIC (Craft Instructor Certificate) in Tool & Die Maker (Dies & Moulds) Trade.
3. Space Norms	130Sq.m
4. Power Norms	29.6 KW
5.Tools, Equipment & General Machinery	(As per Annexure II)

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Note:

- i) Out of two Instructors required for the unit of 2(1+1), one must have Degree/Diploma, and other must have NTC/NAC qualifications.
- ii) Instructor qualification for WCS and E.D, as per the training manual.
- iii) The list of Tools, Equipment & General Machinery listed in Annexure – II is for a particular trade Tool & Die Maker (Dies & Moulds) comprising of four semesters and not for a single semester.

## 12. ASSESSMENT STANDARD

### 12.1ASSESSMENT GUIDELINES:

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 the assessment. Due consideration shall be given while assessing for teamwork, avoidance/reduction of scrap/wastage and disposal of scarp/wastage as per procedure, behavioral attitude, sensitive to environment and regularity in training. The sensitivity towards OSHE and self-learning attitude shall be considered while assessing competency.

Assessment shall be evidence based comprising the following:

- 1) Job carried out in labs/workshop
- 2) Record book/ daily diary
- 3) Answer sheet for assessment
- 4) Viva-voce
- 5) Progress Chart
- 6) Attendance and punctuality
- 7) Assignment
- 8) Project work

Evidence of internal assessment should be preserved for an appropriate period of time for audit and verification by examination body.

The following marking pattern to be adopted while assessing:

a) Weightage in the range of 60-75% to be allotted during assessment under following performance level:

For performance in this grade, the candidate with occasional guidance and showing due regard for safety procedures and practices, has produced work that demonstrates attainment of an acceptable standard of craftsmanship. In this work there is evidence of:

- Demonstration of good skill in the use of hand tools, machine tools, and workshop equipment
- Below 70% tolerance dimension achieved while undertaking different work with those demanded by the component/job.
- A fairly good level of neatness and consistency in the finish
- Occasional support in completing the project/job.

b) Weightage in the range of above75%- 90% to be allotted during assessment under following performance level:

For this grade, the candidate, with little guidance and showing due regard for safety procedures and practices, has produced work that demonstrates attainment of a reasonable standard of craftsmanship. In this work there is evidence of:

- Good skill levels in the use of hand tools, machine tools, and workshop equipment

- 70-80% tolerance dimension achieved while undertaking different work with those demanded by the component/job.
- A good level of neatness and consistency in the finish
- Little support in completing the project/job

c) Weightage in the range of above 90% to be allotted during assessment under following performance level:

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. In this work there is evidence of:

- High skill levels in the use of hand tools, machine tools, and workshop equipment
- Above 80% tolerance dimension achieved while undertaking different work with those demanded by the component/job.
- A high level of neatness and consistency in the finish.
- Minimal or no support in completing the project.

## 12.2. INTERNAL ASSESSMENT (FORMATIVE ASSESSMENT)

Comp. No.	ASSESSABLE OUTCOME	INTERNAL ASSESSMENT Marks
GENERIC		
1.	Recognize & comply safe working practices, environment regulation and housekeeping.	
2.	Work in a team, understand and practice soft skills, technical English to communicate with required clarity.	
3.	Demonstrate knowledge of concept and principles of basic arithmetic, algebraic, trigonometric, statistics, co-ordinate system and apply knowledge of specific area to perform practical operations.	
4.	Understand and explain basic science in the field of study including basic electrical, and hydraulics & pneumatics.	
5.	Read and apply engineering drawing for different application in the field of work.	
6.	Understand and explain the concept in productivity, quality tools, and labour welfare legislation and apply such in day to day work to improve productivity & quality.	
7.	Explain energy conservation, global warming and pollution and contribute in day to day work by optimally using available resources.	
8.	Explain personnel finance, entrepreneurship and manage/organize related task in day to day work for personal & societal growth.	
9.	Understand and apply basic computer working, basic operating system, simulate part programme using simulation software and uses internet services to get accustomed & take benefit of IT developments in the industry.	
SPECIFIC		
10.	Perform marking out the components for sawing, filing, drilling, tapping, fitting and allied operations with clear choice of procedures.	
11.	Plan and organize the work for different types of fitting operations and check for work result.	
12.	Understand and explain the constructional features and working principles of drilling machine and lathe machine and set up different work and tool holding devices required to accomplish tasks with required alignment.	
13.	Grind single point cutting tool, centre punch and twist drills using pedestal grinding machine to maintain close tolerance as per drawing.	
<b>Sub-Total of Internal assessment for Semester- I</b>		<b>100</b>
14.	Understand and explain the constructional features and working principles of milling machine and set up different work and tool holding devices required to accomplish tasks on these machines with required alignment.	
15.	Demonstrate practical skills involved in different operation on milling machine by setting work piece and using different cutting tools.	
16.	Produce finished components on a milling machine and check for accuracy without any assistance.	

17.	Understand and explain the constructional features and working principles of surface grinding and cylindrical grinding machine and set up different work and tool holding devices required to accomplish tasks on these machines with required alignment.	
18.	Produce finished components on a surface and cylindrical grinding machines and check for accuracy without any assistance.	
19.	Understand and explain the welding techniques and execute die welding.	
	<b>Sub-Total of Internal assessment for Semester- II</b>	<b>100</b>
20.	Understand and explain the constructional features and working principles of Pantograph machine and wire cut machine and execute different operation on Pantograph EDM wire cut.	
21.	Understand and explain the constructional features and working principles of different types of injection molding machines and injection moulds.	
22.	Manufacture and assemble different types of moulds viz., hand injection mould, two cavity injection mould, single compression mould and plunger type transfer mould.	
	<b>Sub-Total of Internal assessment for Semester- III</b>	<b>100</b>
23.	Understand and explain the constructional features and working principles of Tool and cutter grinding machine and grind/ resharpen of single point and multipoint cutting tools. (different types of milling cutters)	
24.	Manufacture and assemble different injection moulds and pressure die casting.	
25.	Identify and explain the function of cylinder, valve, actuator and filters in the machines available in work shop like hydraulic press, surface and cylindrical grinder. .	
26.	Preparation part programme using G codes and M codes to produce different components on CNC machine and test the program by simulation.	
27.	Develop /draw different elements of dies and moulds using CAD/CAM software.	
	<b>Sub-Total of Internal Assessment for Semester- IV</b>	<b>100</b>
	<b>Total of Internal Assessment</b>	<b>400</b>

Note: The generic outcome to be assessed along with the specific outcome.



### 12.3 FINAL ASSESSMENT- All India Trade TEST (SUMMATIVE ASSESSMENT)

- There shall be a single objective type Examination paper for the subjects Engineering Drawing and Workshop Calculation & Science.
- There shall be a single objective type Examination paper for the subjects Trade Theory and Employability Skills.
- The two objective type Examination papers as mentioned above shall be conducted by National Council for Vocational Training (NCVT), whereas examination for the subject Trade Practical shall be conducted by the State Governments. NCVT shall supply the Question Paper for the subject Trade Practical.

<b>MARKING PATTERN</b>		
<b>Sl. No.</b>	<b>Subject for the trade test</b>	<b>Maximum marks for the each subject</b>
	Practical	300
	Trade Theory	200 Objective type Written Test of 200 marks (Trade Theory 150 Marks & Employability Skills 50 marks)
	Employability Skills	
	Workshop Calculation and Science.	100 Objective Type Written test of 100 marks (Engineering Drawing 50 marks & Workshop Calculation and Science 50 marks)
	Engineering Drawing	
	Internal assessment	100
<b>TOTAL:</b>		<b>700</b>

### 13. LIST OF TRADE COMMITTEE MEMBERS

Sl. No.	Name & Designation Sh/Mr./Ms.	Organization	Mentor Council Designation
Members of Sector Mentor council			
1.	A. D. Shahane, Vice-President, (Corporate Trg.)	Larsen & Tourbo Ltd., Mumbai:400001	Chairman
2.	Dr. P.K.Jain, Professor	IIT, Roorkee, Roorkee- 247667, Uttarakhand	Member
3.	N. Ramakrishnan, Professor	IIT Gandhinagar, Gujarat- 382424	Member
4.	Dr. P.V.Rao, Professor	IIT Delhi, New Delhi-110016	Member
5.	Dr. Debdas Roy, Asstt. Professor	NIFFT, Hatia, Ranchi- 834003, Jharkhand	Member
6.	Dr. Anil Kumar Singh, Professor	NIFFT, Hatia, Ranchi- 834003, Jharkhand	Member
7.	Dr. P.P.Bandyopadhyay Professor	IIT Kharagpur, Kharagpur- 721302, West Bengal	Member
8.	Dr. P.K.Ray, Professor	IIT Kharagpur, Kharagpur- 721302, West Bengal	Member
9.	S. S. Maity, MD	Central Tool Room & Training Centre (CTTC), Bhubaneswar	Member
10.	Dr. Ramesh Babu N, Professor	IIT Madras, Chennai	Member
11.	R.K. Sridharan, Manager/HRDC	Bharat Heavy Electricals Ltd, Ranipet, Tamil Nadu	Member
12.	N. Krishna Murthy Principal Scientific Officer	CQA(Heavy Vehicles), DGQA, Chennai, Tamil Nadu	Member
13.	Sunil Khodke Training Manager	Bobst India Pvt. Ltd., Pune	Member
14.	Ajay Dhuri	TATA Motors, Pune	Member
15.	UdayApte	TATA Motors, Pune	Member
16.	H B Jagadeesh, Sr. Manager	HMT, Bengaluru	Member
17.	K Venugopal Director & COO	NTTF, Peenya, Bengaluru	Member
18.	B.A.Damahe, Principal L&T Institute of Technology	L&T Institute of Technology, Mumbai	Member
19.	Lakshmanan. R Senior Manager	BOSCH Ltd., Bengaluru	Member
20.	R C Agnihotri Principal	Indo- Swiss Training Centre Chandigarh, 160030	Member
Mentor			

21.	Sunil Kumar Gupta (Director)	DGET HQ, New Delhi.	Mentor
Members of Core Group			
22.	N. Nath. (ADT)	CSTARI, Kolkata	Co-ordinator
23.	H.Charles (TO)	NIMI, Chennai.	Member
24.	Sukhdev Singh (JDT)	ATI Kanpur	Team Leader
25.	Ravi Pandey (V.I)	ATI Kanpur	Member
26.	A.K. Nasakar (T.O)	ATI Kolkata	Member
27.	Samir Sarkar (T.O)	ATI Kolkata	Member
28.	J. Ram Eswara Rao (T.O)	RDAT Hyderabad	Member
29.	T.G. Kadam (T.O)	ATI Mumbai	Member
30.	K. Mahendar (DDT)	ATI Chennai	Member
31.	Shrikant S Sonnavane (T.O)	ATI Mumbai	Member
32.	K. Nagasrinivas(DDT)	ATI Hyderabad	Member
33.	G.N. Eswarappa (DDT)	FTI Bangalore	Member
34.	G. Govindan, Sr. Draughtsman	ATI Chennai	Member
35.	M.N.Renukaradhya, Dy.Director/Principal Grade I.,	Govt. ITI, Tumkur Road, Banglore, Karnataka	Member
36.	B.V.Venkatesh Reddy. JTO	Govt. ITI, Tumkur Road, Banglore, Karnataka	Member
37.	N.M.Kajale, Principal,	Govt. ITI Velhe, Distt: Pune, Maharashtra	Member
38.	SubrataPolley, Instructor	ITI Howrah Homes, West Bengal	Member
39.	VINOD KUMAR.R Sr.Instructor	Govt.ITIDhanuvachapuram Trivandrum, Dist., Kerala	Member
40.	M. Anbalagan, B.E., Assistant Training Officer	Govt. ITI Coimbatore, Tamil Nadu	Member
41.	K. Lakshmi Narayanan, T.O.	DET, Tamil Nadu	Member
42.	R. N. Manna, TO	CSTARI, Kolkata	Member
Other industry representatives			
43.	VenugopalParvatikar	Skill Sonics, Bangalore	Member
44.	VenkataDasari	Skill Sonics, Bangalore	Member
45.	Srihari, D	CADEM Tech. Pvt. Ltd., Bengaluru	Member
46.	Dasarathi.G.V.	CADEM Tech. Pvt. Ltd., Bengaluru	Member
47.	L.R.S.Mani	Ohm Shakti Industries, Bengaluru	Member

**TRADE: TOOL AND DIE MAKER (DIES AND MOULDS)****LIST OF TOOLS & EQUIPMENTS FOR 16 TRAINEES+1****A : Trainee's Tool Kit :**

Sl. No.	Description of Tools	For Instructor	For a batch of 20	Total
1	Steel Rule 150 mm English and Metric combined	1	16 nos.	17 nos.
2	Engineer's Square 150 mm with knife edge	1	16 nos.	17 nos.
3	Hacksaw frame adjustable with pistol grip for 200-300 mm blade	1	16 nos.	17 nos.
4	Centre punch 100 mm	1	16 nos.	17 nos.
5	Prick punch 150 mm	1	16 nos.	17 nos.
6	File flat bastard 300 mm	1	16 nos.	17 nos.
7	File flat 2 <sup>nd</sup> cut 250 mm	1	16 nos.	17 nos.
8	File flat safe edge 200 mm	1	16 nos.	17 nos.
9	File triangular smooth 200 mm	1	16 nos.	17 nos.

**B: Tools and Equipments:**

Sl. No.	Name of Tools and Equipments	Quantity
1	Caliper inside spring type-150 mm	4 nos.
2	Caliper outside spring type-150 mm	4 nos.
3	Divider spring type – 150 mm	4 nos.
4	Odd leg caliper firm joint 0- 150 mm	2 nos.
5	Screw driver – 150 mm	1 no.
6	Screw driver – 200 mm	1 no.
8	Centre gauge 55 <sup>o</sup> and 60 <sup>o</sup>	2 nos.
9	Oil can 250 ml	1 no.
10	File flat smooth 200 mm	4 nos.
11	File flat smooth with safe edge 200 mm	4 nos.
12	File half round bastard 300 mm	4 nos.
13	File half round smooth 250 mm	4 nos.
14	File triangular bastard 250 mm	4 nos.
15	File triangular smooth 200 mm	4 nos.
16	File round bastard 250 mm	4 nos.
17	File square bastard 300 mm	4 nos.
18	File square smooth 250 mm	4 nos.
19	Knife edge file 150 mm	4 nos.
20	Needle file assorted (12 nos.) 150 mm	4 sets
21	File card	4 nos.

22	Scraper flat 250 mm	4 nos.
23	Hammer Ball Peen 0.5 kg with handle	4 nos.
24	Hammer Cross Peen 0.75 kg with handle	4 nos.
25	Chisel cold flat 18 x 150 mm	4 nos.
26	Chisel Cross Cut 10 x 3 x 200 mm	4 nos.
27	Chisel Half Round 10 x 250 mm	4 nos.
28	Chisel diamond point 10 x 200 mm	4 nos.
29	Scribing block universal 300 mm	2 nos.
30	C.I. Surface plate 300 x 300 mm	1 no.
31	Granite Surface plate 600 x 600x80 mm	1 no
32	Tap extractor 3 mm to 12 mm x 1.5 mm (ezzy out)	1 set
33	Screw extractor sizes 1 to 8	1 set
34	Taps and dies metric 5 mm to 12 mm complete set in a box	2 sets
35	Twist Drill with St. Shank Ø 5 to Ø 12 mm in steps of 0.5 mm	1 set
36	Twist Drill St. Shank Ø 8 mm to Ø 12 mm in steps of 2 mm	1 set
37	Taper shank drills Ø 6 mm to Ø 20 mm in steps of 1 mm	1 set
38	D.E spanners 3-4 , 6-8, 10-12, 13-14, 15-16, 18-19, 20-22, 24-26 ( 8 spanners)	2 sets
39	Letter punch 5 mm set	1 set
40	Number punch 5 mm set	1 set
41	Drill chuck 12 mm capacity with key	1 no.
42	Allen key metric 3 to 12 mm set	2 sets
43	Centre drills 3, 4,5 mm	2 each
44	Parallel hand reamer 6 mm to 12 mm in steps of 1 mm	1 set
45	Star dresser	2 nos.
46	Diamond dresser with holder	2 nos.
47	Safety goggles (Personal Protective Equipments)	4 nos.
48	Demagnetizer	1 no.
49	Snips 200 mm blade	1 no.
50	Workbench 240 cm x 120 cm x 75 cm with 150 mm vice (Each bench fitted with 4 vices)	4 nos.
51	Bench Vice 150 mm	16 nos.
52	Steel lockers for 16 trainees (Pigeon Cup Board)	2 nos.
53	Steel cupboard 180 cm x 60 cm x 45 cm	6 nos.
54	Metal rack 180 cm x 60 cm x 45 cm	1 nos.
55	Fire extinguisher	2 nos.
56	Fire buckets with stand	4 nos.
57	Feeler gauge 0.05 mm to 0.3 mm by 0.05 and 0.4 mm to 1 mm by 0.1 mm (13 leaves)	1 set
58	Metric Screw pitch gauge-Range 0.4 -6 mm pitch 60 <sup>0</sup> (21 leaves)	1 set
59	Radius gauge 1 - 3 mm by 0. 25 mm and 3.5-7mm by 0.5 mm (34 leaves)	1 no.
60	Vernier height gauge - Range 300 mm, with 0.02 mm least count	1 no.
61	Universal vernier caliper-Range 200 mm, with 0.02 mm least count	2 nos.
62	Dial vernier caliper 0-200 mm, with 0.02 mm least count	1 no.
63	Vernier caliper-Range 300 mm Vernier scale 0.02 mm	2 nos.
64	Vernier bevel protractor-Blade range 150 and 300 mm, dial 1 <sup>0</sup> , least count	1 no.

	5' (min.) with head, Acute Angle attachment	
65	Outside micrometer 0-25 mm, with 0.01 mm least count	2 nos.
66	Outside micrometer 25-50 mm, with 0.01 mm least count	1 no.
67	Outside micrometer 50-75mm, with 0.01 mm least count	1 no.
68	Combination square sets-300 mm blade with square head, centre head, protractor head	1 set
69	Telescopic gauge range 8 -150 mm (6 pcs/set)	1 set
70	Sine bar 150 mm with stopper plate	1 no.
71	Sine table 200 mm length with magnetic bed	1 no.
72	Slip Gauge Box (workshop grade) -87 pieces per set	1 set
73	Gauge block accessories consisting holders, half round jaws, scriber point, centre point , triangular straight edge (14 pcs/set)	1 set
74	Central square – Size 400 x 250 mm blade	1 no.
75	V-Block-Approx. 32 x 32 x 41 mm with clamping capacity of 25 mm with clamps	2 pairs
76	V-Block-Approx 65x65x80 mm with clamping capacity of 50 mm with clamps	1 pairs
77	Magnetic V-Block 100x100x125 mm	2 pairs
78	Angle plate 150 x 150 x 200 mm	1 no.
79	Angle plate-adjustable 250x250x300 mm	1no.
80	Inside micrometer – Range 50-63 mm with std extension rods upto 200mm..	1 set
81	Depth micrometer – Range 0-25 mm, accuracy 0.01 mm with std set of extension rods.	1set.
82	Magnetic stand with magnetic base 60 x 47.5 mm and with universal swivel clamp, dial holding rod (150 mm) scriber	2 nos.
83	Dial test indicator-Lever type- Range 0-0.8 mm –Graduation 0.01mm, reading 0-50-0 with accessories	1 nos.
84	Dial test indicator – Plunger type-Range 0-10 mm , Graduation 0.01 mm, Reading 0-100 with revolution counter	1 nos.
85	Bore gauge with dial indicator (1 mm range, 0-0.01 mm graduation)- Range of bore gauge 18-150 mm	1 set
86	Straight edge-Single beveled-Size 150 mm and 250 mm	1 each
87	Tool makers clamp 50 mm & 75 mm	2 nos. each
88	C – clamp- 50 mm & 75 mm	2 nos. each

### C : Cutting Tools :

Sl. No.	Name of Tools and Equipments	Quantity
1	Side and face milling cutter Ø 100 x 10 X Ø 25 mm	2 nos.
2	Side and face cutter Ø 80 x 10 X Ø 27 mm	2 nos.
3	Cylindrical milling cutter Ø 63 x 70 x Ø 27 mm	2 nos.
4	Slitting Saw cutter Ø 75 x 3 X Ø 27 mm	2 nos.
5	Slitting Saw cutter Ø 100 x 6 X Ø 27 mm	2 nos.
6	Single angle cutter Ø 75 x 16 x Ø 27mm - 60 <sup>0</sup>	2 nos.

7	Single angle cutter $\text{Ø} 75 \times 20 \times \text{Ø} 27 - 45^\circ$	2 nos
8	Equal angle cutter $\text{Ø} 75 \times 30 \times \text{Ø} 27 - 90^\circ$	2 nos
9	Shell End Mill $\text{Ø} 50 \times 36 \times \text{Ø} 22$ (preferably inserted tip type)	2 nos.
10	Shell End Mill $\text{Ø} 75 \text{ mm} \times 50 \times \text{Ø} 22$ (preferably inserted tip type)	2 nos.
11	Parallel shank end mills $\text{Ø} 6, \text{Ø} 10$ and $\text{Ø} 16$ are (double fluted), $\text{Ø} 20 \text{ mm}$ & $\text{Ø} 25 \text{ mm}$ (four fluted)	4 nos. each
12	'T' slot cutter with parallel shank- $\text{Ø} 17.5 \times 8 \text{ mm}$ width x dia. of shank 8 mm	2 nos.
13	Concave Milling cutter $\text{Ø} 63 \times 6 \text{ radius} \times \text{Ø} 27 \text{ mm}$	1 nos.
14	Convex Milling cutter $\text{Ø} 63 \times 6 \text{ radius} \times \text{Ø} 27 \text{ mm}$	1 nos.
15	Disc type form milling cutter (involute form -2 module, $20^\circ$ pressure angle)	1 set
16	Tool holder (straight) to suit 6, 8 mm sq. bit size	2 nos. each
17	Parting tool holders to suit 3 and 4 mm thick tool blade.	2 nos.
18	Boring bars with holders to accommodate 4, 6 and 8 mm HSS tool bits	3 each
19	Knurling tool (straight & diamond)	2 nos. each

#### D : General Machinery & Installation:

(Note: The specification given under “General Machinery & Installation” can be considered to the nearest size according to the availability in the Indian Market.)

Sl. No.	Name of Machineries and Equipment	Qty.
1.	Sensitive drilling machine - capacity 12 mm Motorized –with drill chuck and key etc.	1No.
2.	Pillar/column type Drilling machine – 25 mm capacity-motorized with drill chuck, key etc.	1No.
3.	Radial Drill machine to drill up to 32 mm diameter.	1No.
4.	Power hacksaw machine to accommodate 21” or more length blade.	1no.
5.	Double ended Pedestal Grinder with 178 mm wheels(one fine and one rough wheel)	1 no.
6.	SS and SC centre lathe (all geared) with centre height 150 mm and centre distance 1000 mm along with 3 jaws, 4 jaw chuck, auto feed system, taper turning attachment, coolant pump, safety guard and machine light arrangement.	3 nos.
7.	Shearing machine (lever type)hand operated complete with 300 mm blade length	1 no.
8.	Arc and gas welding and cutting equipment ( <b>Not required if Welding Trade is available in the Institute</b> )	1No.
	(i) Transformer welding set 300 amps-continuous welding current with all accessories and electrode holder	1 set
	(ii) Welding cable to carry 400 amps 50 meter with flexible rubber cover.	12 nos.
	(iii) Lugs for cable	2 nos.





	Max. admit between centers Max. length of cutting edges ground	230 mm 120 mm	
	With standard equipment like adaptor bushes, cutter head holder assembly, adaptors, extension spindle, flanges fro grinding wheel, etc.		
13.	Universal cylindrical Grinding Machine		1No.
	Max. dia ground (effective) Max. grinding length Height of centre Max. distance between centers	250 mm 300 mm 130 mm 340 mm	
	With special accessories like face plate, steady, radius and face dressers, find hand feed attachment etc.		
14.	Pantograph / Engraving 3D machine		1No.
	Working area (rectangle) Max. height of work <b>Work table traverse:</b> Longitudinal x Transverse Work clamping area	320 x 145 mm 380 mm 160 x300 mm 360x200 mm	
	With attachment like index head, roll engraving attachment, type template holders, circular table, raised and sunk letters etc.		
15.	Muffle Furnace – Heating Chamber 300 x 300 x 450 mm for 1050 <sup>0</sup> C Quenching tank-600 x600 x 600 mm		1No.
16.	Rockwell Hardness Testing Machine with standard accessories		1No.
17.	Spark erosion EDM with standard accessories		1 No.
18.	Polishing kit		1 No.
19.	Hand Injection Moulding Machine 103 hand injection		1 No.
20.	Hand Compression Moulds: Compression moulding process (Mechanical for 50 gms) Minimum 25 Ton capacity.		1 No.
21.	Screw Type Injection Moulding Machine (capacity 50 gms) (Not required if plastic processing operator trade is available in the institute)		1 No.
22.	Blow Moulding Machine (Not required if plastic processing operator trade is available in the institute)		1 No.
23.	CAD/CAM software (Program generation and simulation software for moulds and dies)		4 nos.
24.	Desktop computers with latest configuration suitable for CAD/CAM software with necessary furniture		5 sets
25.	Vertical machining centre (VMC) (Optional)		01
26.	Co-ordinate measuring machine (Optional)		01
27.	Profile projector (Optional)		01

Note: Any institute not having the optional machines may tie up with an industry having the above machine for exposure.

**GUIDELINES FOR INSTRUCTORS AND PAPER SETTERS**

1. All questions of theory paper for the trade will be in objective type format.
2. Due care to be taken for proper & inclusive delivery among the batch. Some of the following method of delivery may be adopted:
  - a. Lecture
  - b. Lesson
  - c. Demonstration
  - d. Practice
  - e. Group discussion
  - f. Discussion with peer group
  - g. Project work
  - h. Industrial visit
3. Maximum utilization of latest form of training viz., audio visual aids, integration of IT, etc. May be adopted.
4. The total hours to be devoted against each topic may be decided with due diligence to safety & with prioritizing transfer of required skills.
5. Questions may be set based on following instructions:-

Sl. No.	Question on different aspect	Weightage in %age	Key Words may be like
1	Information received	25	What, Who, When
2	Knowledge	50	Define, Identify, Recall, State, Write, List & Name
3	Understanding	15	Describe, Distinguish, Explain, Interpret & Summarize
4	Application	10	Apply, Compare, Demonstrate, Examine, Solve & Use

6. Due weightage to be given to all the topics under the syllabus while setting the question paper.