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DIES AND MOULDS MAKER



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CBT CURRICULUM

National Vocational Certificate Level 2

Version 1 - August, 2019



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Introduction

Dies and Molds Makers are a class of machinists in the manufacturing industry who will make dies, molds, machine tools and cutting tools used in manufacturing processes. Depending on which area of Specialization a particular person works in, he or she may be called by variations on the name, including tool-maker, die maker, mold-maker, die-fitter, or mold fitter etc.

They produce tools used to manufacture and stamp out parts and they supply tools and dies for all manufacturing sectors such as domestic consumer goods, transportation industry, medical, electronics, automotive and aerospace. They lay out, set up, machine, fit and finish metal & plastic components. They produce items to meet exact standards.

Dies & molds makers use machining tools such as lathes, mills, saws, grinders, drills, computer numerical control (CNC) machines and Electrical Discharge Machines (EDM). They also use hand tools and measuring equipment to ensure accuracy and close tolerances. They work from sketches, drawings, computer-aided designs (CAD), specifications and their own concepts to calculate dimensions, tolerances and types of fit. They must be knowledgeable about the properties of metal and non-metallic materials such as plastic, rubber and composite materials.

Safety is important at all times. There are risks of injury working with moving machine parts, flying chips, sharp edges and extreme heat from heated materials. Tool and die makers may also be lifting and moving heavy components. Precautions are required while working with manufacturing chemicals, airborne irritants, toxic lubricants and cleaners.

Some attributes for people entering this trade are: communication skills, mechanical aptitude, attention to detail, hand-eye coordination, manual dexterity, ability to work independently and in teams, logical reasoning ability, advanced knowledge of applied science, creativity, resourcefulness, above average spatial ability and ability to plan and think sequentially. The work often requires considerable physical activity, stamina and mental ability & toughness, as tool and die makers spend long periods of time on their feet. Dies & molds makers may work with other professionals such as machinists, mold makers, industrial mechanics (millwrights), designers, programmers and engineers.

Experienced dies & molds makers may become entrepreneurs, managers or instructors. With additional training, they may transfer their skills to design and engineering responsibilities. Their skills are also transferable to related occupations such as machinist, mold maker, pattern maker, industrial mechanic (millwright) and CNC programmer.

Definition/ Description of the training program for *(Dies and Molds maker)*

The detail of the competency standards included in this qualifications are given below:

- National Vocational Certificate level 2, in “Dies & Molds Maker”

Comply personal health and safety guidelines

Perform bench works

Perform lathe operations

Perform milling operations

Perform grinding operations

Communicate the workplace policy and procedure

Perform basic communication skills

Perform basic computer application

- National Vocational Certificate level 3, in “Dies & Molds Maker”

Apply work health and safety practices

Identify and implement workplace policies and procedures

Perform EDM operations

Perform wire cut operations

Perform CNC lathe operations

Perform CNC milling operations

Perform heat treatment

Communicate at workplace

Perform computer application skills

Manage personal finances

- National Vocational Certificate level 4, in “Dies & Molds Maker”

Contribute to work related health and safety initiatives

Comply with workplace policy and procedures

Finalize dies & molds

Fabricate a die

Fabricate a mold

Carry out maintenance of dies & molds

Perform advanced communication

Develop advance computer application skills

Manage human resource services

Develop entrepreneurial skills

Purpose of the training program

The purpose of the Dies and Molds Maker course is to engage young people in a programme of development that will provide them with the knowledge, skills and understanding to start their careers in Pakistan. Upon completion of the Dies and Molds Maker qualification, trainees will be ready to join the workforce with a healthy number of options in the production, manufacturing and light engineering sector.

The core purpose of this qualification is to produce employable Dies & Molds Makers who could perform relevant operations according to national and international standards. In addition, this qualification will prepare unemployable youth to be employed in the light engineering and manufacturing sector.

Overall objectives of training program

The overall objectives of the Dies and Molds maker program are:

- Managing a dies and molds workshop (technically and economically)
- Selecting tools and equipment used to fabricate, dies and molds
- Selecting tools, equipment and consumables accurately according to Job specification
- Sequencing the different stages of preparation, development, fabrication and maintenance
- Working safely and professionally

Competencies to be gained after completion of course

At the end of the course, the trainee must have attained the following competencies.

1. Comply personal health and safety guidelines
2. Perform bench works
3. Perform lathe operations
4. Perform milling operations
5. Perform grinding operations
6. Communicate the workplace policy and procedure
7. Perform basic communication skills
8. Perform basic computer application

Possible job opportunities available immediately and later in the future

Dies and Mold Makers are employed in the manufacturing engineering and production sector especially in automobile, house hold goods, electrical and electronics appliances etc. Experienced Dies and mold makers may advance through promotions with the same employer or by moving to more advanced positions with other employers. They can become:

Conventional Machine Operator

- Bench fitter
- Turner
- Milling machine operator
- Grinding machine operator

Some experienced Dies and molds makers achieve a highly respected level of salaries. There are good prospects for travel both within Pakistan and abroad. The employment outlook in this occupation will be influenced by a wide variety of factors including:

- Trends and events affecting overall employment (especially in the manufacturing industry)
- Location in Pakistan
- Employment turnover (work opportunities generated by people leaving existing positions)
- Occupational growth (work opportunities resulting from the creation of new positions that never existed before)
- Size of the industry
- Flexibility of the applicant (concerning location and schedule of work)

Trainee entry level

The entry for National Vocational Certificate level 2, in “Dies & Molds Maker” are given below:

| Title | Entry Requirements |
|---|--|
| National Vocational Certificate level 2, in “Dies & Molds Maker” | Entry for assessment for this qualification is open. However, entry into formal training institutes, based on this qualification may require skills and knowledge equivalent to Middle |

Minimum qualification of trainer

Should hold at least NVQF level 3 qualification in Dies and Molds Maker / Machinist with D.A.E / B-Tech Mechanical and having 3 years academic experience & at least 2 years industrial experience

He/she should hold or be working towards a formal teaching qualification.

Other formal qualifications in the manufacturing industry would be useful in addition to the above.

Recommended trainer: trainee ratio

The recommended maximum trainer: trainee ratio for this program is 1 trainer for 20 trainees.

Medium of instruction i.e. language of instruction

Instructions will be in Urdu and in English

Duration of the course (Total time, Theory & Practical time)

This curriculum comprises of eight different modules. The recommended delivery time (for one level) is 500-600 hours. Delivery of the course could therefore be full time, 6 days a week, for 6 months. Training providers are at liberty to develop other models of delivery, including part-time and evening delivery.

The full structure of the course is as follows:

| Module | Theory hours | Workplace hours | Total hours |
|---|--------------|-----------------|-------------|
| Module 1: Comply personal health and safety guidelines | | | 30 |
| Module 2: Perform bench works | 10 | 90 | 100 |
| Module 3: Perform lathe operation | 20 | 100 | 120 |
| Module 4: Perform milling operations | 10 | 90 | 100 |
| Module 5: Perform grinding operations | 10 | 70 | 80 |
| Module 6 Communicate the workplace policy and procedure | | | 20 |
| Module 7: Perform basic communication | | | 30 |
| Module 8: Perform basic computer application | | | 40 |

Sequence of the modules

This qualification is made up of 8 modules.

Module 1: Comply personal health & safety guidelines covers various aspects related to occupational health & safety that are required for the students to understand in order to work in a safe environment.

Module 02: Perform bench work, covers the basic methods and activities related to bench work including sawing, drilling, reaming etc.

Module 03: Perform Lathe Operations,

Module 04: Perform Milling Operations,

Module 05: Perform grinding cover the processes and procedures that a Dies and Molds maker must learn and understand in order to become an effective professional. A suggested distribution of these modules is presented overleaf. This is not prescriptive and training providers may modify this if they wish.

There are two further modules relating to general skills that a Dies & Molds maker must have Module 6: Perform basic communication skills and

Module 7: Dispose the waste material This can be delivered in parallel and is illustrated in the distribution table.

Module 8: Perform basic computer application

The distribution table also suggests that four further modules, Module 02: Perform Bench work; and Module 03: Perform lathe operations, Module 4: Perform milling and Module 05: Perform grinding that can also be delivered in parallel respectively.

Each module covers a range of learning components. These are intended to provide detailed guidance to teachers (for example the Learning Elements component) and give them additional support for preparing their lessons (for example the Materials Required component). The detail provided by each module will contribute to a standardized approach to teaching, ensuring that training providers in different parts of the country have clear information on what should be taught.

The distribution table is shown below:

| | | |
|--|--|--|
| Module 02: Perform bench work 100 hours | Module 07: Perform basic communication 30 hours | Module 01: Comply personal health & safety 30 hours |
| Module 03: Perform lathe operations 120 hours | | |
| Module 04: Perform milling operations 100 hours | Module 08: Perform basic computer applications 40 hours | Module 06: Communicate the workplace policies & procedures 20 hours |
| Module 05: Perform grinding operations 80 hours | | |

| Module Title and Aim | Learning Units | Theory Days/hours | Workplace Days/hours | Timeframe of modules |
|--|---|-------------------|----------------------|----------------------|
| <p>Module 1: Comply with Perform Personal Health and Safety Guidelines</p> <p>Aim: This competency standard identifies the competencies required to protect/apply occupational Safety, health and Environment at workplace according to the industry's approved guidelines, procedures and interpret environmental rules/regulations. Trainee will be expected to identify and use Personal Protective Equipment (PPE) according to the work place requirements. The underpinning knowledge regarding Observe Occupational Safety and Health (OSH) will be sufficient to provide the basis for the job at workplace.</p> | <p>LU1: Identify Personal hazards at Workplace</p> <p>LU2: Apply Personal Protective and Safety Equipment (PPE).</p> <p>LU3: Comply Occupational Safety and Health (OSH)</p> <p>LU4: Dispose of hazardous Waste/materials from the designated area.</p> | | | 30 |

| Module Title and Aim | Learning Units | Theory Days/hours | Workplace Days/hours | Timeframe of modules |
|--|---|-------------------|----------------------|----------------------|
| <p>Module 2: Perform bench Work</p> <p>Aim: This competency standard covers the skills and knowledge required to perform bench work operations including sawing, filing, drilling, tapping, reaming, countersinking, counter boring, polishing & grinding.</p> | <p>LU1: Perform sawing LU2: Perform filing LU3: Perform drilling LU4: Perform hand tapping LU5: Perform hand reaming LU6: Perform counter boring LU7: Perform counter sinking LU8: Perform polishing LU9: Perform hand grinding LU10: Demonstrate safe working conditions and & housekeeping</p> | 10 | 90 | 100 |

| Module Title and Aim | Learning Units | Theory Days/hours | Workplace Days/hours | Timeframe of modules |
|---|---|-------------------|----------------------|----------------------|
| <p>Module 3: Perform lathe operations</p> <p>Aim: This competency standard covers the skills and knowledge required to perform different processes on lathe machines including facing, turning, parting, threading, knurling, and drilling.</p> | <p>LU1: Set tools and lathe machine LU2: Perform workpiece setting LU3: Perform facing LU4: Perform turning LU5: Perform thread cutting LU6: Perform parting LU7: Perform drilling / Boring LU8: Perform knurling LU9: Perform final inspection LU10: Demonstrate safe working practice & housekeeping</p> | 20 | 100 | 120 |
| <p>Module 4: Perform milling operations</p> <p>Aim: This competency standard covers the skills and knowledge required to perform different processes on milling machines including pocketing, contouring, reaming, indexing, and drilling/boring.</p> | <p>LU1: Set tools and milling machine LU2: Perform workpiece setting LU3: Perform pocketing LU4: Perform contouring LU5: Perform drilling / boring LU6: Perform reaming LU7: Perform indexing LU8: Perform final inspection LU9: Demonstrate safe working practice & housekeeping</p> | 10 | 90 | 100 |

| Module Title and Aim | Learning Units | Theory Days/hours | Workplace Days/hours | Timeframe of modules |
|--|---|-------------------|----------------------|----------------------|
| <p>Module 5: Perform grinding operation</p> <p>Aim: The standard defines the competencies in accordance with approved procedures. Student able to perform different type of grinding, which includes surface, cylindrical & tool & cutter grinders. Able to use with all safety requirements. Understand pinning knowledge will be sufficient to provide the basic work.</p> | <p>LU1: Set grinding machine LU2: Perform work piece setting LU3: Perform surface grinding LU4: Perform cylindrical grinding LU5: Perform final inspection LU6: Demonstrate safe working practice & housekeeping</p> | 10 | 70 | 80 |

| Module Title and Aim | Learning Units | Theory Days/hours | Workplace Days/hours | Timeframe of modules |
|--|---|-------------------|----------------------|----------------------|
| <p>Module 6: 041700839 Communicate the Workplace Policy and Procedure</p> <p>Aim: This unit describes the performance outcomes, skills and knowledge required to develop communication skills in the workplace. It covers gathering, conveying and receiving information, along with completing assigned written information under direct supervision.</p> | <p>LU1: Identify workplace communication procedures LU2: Communicate at workplace LU3: Draft Written Information LU4: Review Documents</p> | | | 20 |

| Module Title and Aim | Learning Units | Theory Days/hours | Workplace Days/hours | Timeframe of modules |
|---|---|-------------------|----------------------|----------------------|
| <p>Module 7: 001100851 Perform Basic Communication (Specific) Aim: This unit describes the skills and knowledge required to assist in the development of communication competence by providing information regarding different forms of communication and their appropriate use.</p> <p>By the end of this program, learners will be able, to communicate more effectively and efficiently by: working in a team, follow supervisor's instructions and develop generic communication work skills at workplace</p> | <p>LU1: Communicate in a team to achieve intended outcomes LU2: Follow Supervisor's instructions as per organizational SOPs LU3: Develop Generic communication skills at workplace</p> | | | 30 |

| Module Title and Aim | Learning Units | Theory Days/hours | Workplace Days/hours | Timeframe of modules |
|---|---|-------------------|----------------------|----------------------|
| <p>Module 8: 061100856 Perform Basic Computer Application (Specific)</p> <p>Aim: This unit describes the skills and knowledge required to use spreadsheet to prepare a page of document, develops familiarity with Word, Excel, Access, PowerPoint, email, and computer graphics basics.</p> <p>It applies to individuals who perform a range of routine tasks in the workplace using a fundamental knowledge of spreadsheets, Microsoft office and computer graphics in under direct supervision or with limited responsibility.</p> | <p>LU1: Create Word Documents LU2: Use internet for Browsing</p> | | | 40 |

Modules

Module 1: 102200844 Comply with Perform Personal Health and Safety Guidelines.

Objective of the module: This competency standard identifies the competencies required to protect/apply occupational Safety, health and environment at workplace according to the industry's approved guidelines, procedures and interpret environmental rules/regulations. Trainee will be expected to identify and use Personal Protective Equipment (PPE) according to the work place requirements. The underpinning knowledge regarding Observe Occupational Safety and Health (OSH) will be sufficient to provide the basis for the job at workplace.

Duration: 30

Theory:

Practical:

| Learning Unit | Learning Outcomes | Learning Elements | Duration | Materials Required | Learning Place |
|--|--|-------------------|--|--------------------|-------------------------------------|
| LU1: Identify Personal Hazards at Workplace | The trainee will be able to: Identify risk to personal health Identify hygiene and safety at work place Identify processes Identify tools, equipment and consumable materials that have the potential to cause harm Report, identified risk to Health, hygiene and safety to concerned | | Total: Theory: Practical: | | Class room Work place / workshop |

| | | | | | |
|---|---|--|--|--|--|
| <p>LU2:</p> <p>Apply Personal Protective and Safety Equipment (PPE)</p> | <p>The trainee will be able to:</p> <p>List the Personal Protective equipment</p> <p>Select personal protective equipment in terms of type and quantity according to work orders.</p> <p>Wear personal protective equipment according to job requirements.</p> <p>Clean personal protective equipment</p> <p>Stored Personal Protective equipment in proper place after use.</p> | | <p>Total</p> <p>Theory:</p> <p>Practical:</p> | | <p>Class room</p> |
| <p>LU3:</p> <p>Comply Occupational Safety and Health (OSH)</p> | <p>The trainee will be able to:</p> <p>Maintain cleanliness and hygiene as per organizational policy</p> <p>Comply with Health, hygiene and safety precautions before starting work</p> <p>Comply organizational</p> | | <p>Total</p> <p>Theory:</p> <p>Practical:</p> | | <p>Class room</p> <p>Work place / Workshop</p> |

| | | | | | |
|---|---|--|--|--|-------------------|
| | <p>Health, hygiene and safety guidelines during work</p> <p>Deal with resolvable problems according to prescribed procedures</p> <p>Report un resolvable problems to concerned</p> <p>Place the tools equipment etc at their prescribed place after</p> | | | | |
| <p>LU4:</p> <p>Dispose of hazardous Waste/materials from the designated area.</p> | <p>The trainee will be able to:</p> <p>Identify hazardous waste materials which needs to be disposed off</p> <p>Segregate hazardous or non-hazardous waste carefully from the designated area as per approved procedure</p> <p>Use proper disposal hazardous containers for dispose-off hazardous waste as per procedure</p> | | <p>Total</p> <p>Theory:</p> <p>Practical:</p> | | <p>Work place</p> |

| | | | | | |
|--|---|--|--|--|--|
| | Take necessary precautions like putting masks and gloves while disposing hazardous waste/ materials as per standard operating procedure | | | | |
|--|---|--|--|--|--|

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Module-2

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Module 2: 071500966 Perform Bench Work

Objective of the module: This competency standard covers the skills and knowledge required to perform bench work operations including sawing, filing, drilling, tapping, reaming, countersinking, counter boring, polishing & grinding

Duration:100

Theory:10

Practical:90

| Learning Unit | Learning Outcomes | Learning Elements | Duration | Materials Required | Learning Place |
|-------------------------------|--|--|--|--|------------------------|
| LU1: Perform sawing | The trainee will be able to: Select appropriate blade according to the material and set in hacksaw frame Select appropriate marking tool and mark the job as per drawing Select appropriate clamping device and clamp the work piece Perform sawing as per standard procedures Verify the final job with the given drawing | Types of hacksaw frames: <ul style="list-style-type: none"> • Fixed • adjustable Types of hacksaw blades i.e. <ul style="list-style-type: none"> • Rigid • flexible TPI of hacksaw blades i.e. <ul style="list-style-type: none"> • 14 TPI • 18 TPI • 24 TPI • 32 TPI Measuring and marking tools: Measuring tools: Steel rule, measuring tape, Vernier caliper. Marking tools: Marking ink, try square, scriber, punches, divider, hammer | Total: 5 hrs Theory: 01 hrs Practical: 04 hrs | MS flat / round Hack saw frames Hacksaw blade Steel rule Measuring tape Vernier caliper Marking ink Try square Scriber Punches divider hammer | Class room workshop |

| | | | | | |
|---|--|--|--|---|-----------------------------------|
| | | <p>Workpiece clamping device:</p> <p>Bench vice, machine vice, v-blocks, c-clamps, Toggle clamps etc.</p> <p>Standard procedure for sawing i.e. gestures, griping, stroking etc.</p> <p>Interpretation of drawing.</p> | | | |
| <p>LU2:</p> <p>Perform filing</p> | <p>The trainee will be able to:</p> <p>Select appropriate file type according to the material & profile</p> <p>Select appropriate marking tool and mark the job as per drawing</p> <p>Select appropriate clamping device and clamp the work piece</p> <p>Perform filing as per standard procedures</p> <p>Verify the final job with the given drawing</p> | <p>Classification of files:</p> <ul style="list-style-type: none"> • Cross section / profile • Length • Cut • Coarseness <p>Workpiece clamping device:</p> <p>Devices: Bench vice, machine vice, v-blocks, c-clamps, toggle clamps etc.</p> <p>Standard procedure for filing i.e. gesture, griping, stroking etc.</p> | <p>Total:</p> <p>35 hrs</p> <p>Theory:</p> <p>01 hrs</p> <p>Practical:</p> <p>34 hrs</p> | <p>MS flat bar</p> <p>Files of different shapes, size, cut and coarseness</p> <p>Bench vice</p> <p>Machine vice</p> <p>C-clamp</p> <p>V-blocks</p> <p>Toggle clamps</p> | <p>Class room</p> <p>Workshop</p> |

| | | | | | |
|--|--|--|---|--|-----------------------------------|
| <p>LU3: Perform drilling</p> | <p>The trainee will be able to:</p> <p>Select appropriate drilling bit according to drawing and material</p> <p>Select appropriate marking tool and mark the job as per drawing</p> <p>Select appropriate clamping device and clamp the work piece</p> <p>Set the machine RPM according to the drill size and work piece material</p> <p>Perform drilling as per standard procedures</p> <p>Perform post drilling operations</p> <p>Verify the final job with the given drawing</p> | <p>Types of drill machines i.e. bench type, pillar type, column type, radial type etc.</p> <p>Major functional parts of a drill machine.</p> <p>Parts: machine head, work table, speed pulley, feed lever, spindle / quill, drill chuck, sleeves etc.</p> <p>Identify Types of metal i.e. Ferrous and non-ferrous.</p> <p>Types of drill bits: straight shank and taper shank.</p> <p>Cutting speed of common engineering materials.</p> <p>Materials: Aluminum, mild steels, cast iron, carbon steels, copper, brass etc.</p> <p>Calculation method for RPM.</p> <p>Steps to perform drilling.</p> <p>Post drilling operations i.e. chamfering, bur removing etc.</p> | <p>Total: 07</p> <p>Theory: 01 hrs</p> <p>Practical: 06 hrs</p> | <p>MS flat bar</p> <p>Straight and taper shank drill bits, center drill etc.</p> <p>Material sample for aluminum, mild steel, cast iron, carbon steel, copper, brass</p> <p>Bench type drill machine</p> <p>Pedestal grinding machine</p> <p>Rose bit</p> <p>Coolant</p> | <p>Class room</p> <p>Workshop</p> |
| <p>LU4: Perform hand tapping</p> | <p>The trainee will be able to:</p> <p>Select appropriate tap according to the job specification</p> <p>Select appropriate</p> | <p>Types of tapping: machine tapping and hand tapping</p> <p>Utility of taps:</p> <ul style="list-style-type: none"> • Internal threading • Cleaning threads | <p>Total: 08 hrs</p> <p>Theory:</p> | <p>MS flat bar</p> <p>HSS drill bit</p> <p>Hand Tap set</p> <p>Machine tap</p> | <p>Class room</p> <p>Workshop</p> |

| | | | | | |
|---|--|--|---|--|-----------------------------------|
| | <p>marking tool and mark the job as per drawing</p> <p>Select appropriate clamping device and clamp the work piece</p> <p>Perform drilling to produce hole according to tap size</p> <p>Perform tapping as per job specification</p> <p>Verify the final job with given drawing</p> | <ul style="list-style-type: none"> • Maintenance of threads • Extraction of tap <p>Marking tools: marking ink, try square, scriber, punches, divider, hammer</p> <p>Clamping Devices: Bench vice, Machine vice, V-blocks, C-clamps, Toggle clamps etc.</p> <p>Process steps for hand tapping.</p> | <p>01 hr</p> <p>Practical:</p> <p>07 hrs</p> | <p>Tap handle</p> <p>Tap extractor</p> <p>Coolant</p> | |
| <p>LU5:</p> <p>Perform hand reaming</p> | <p>The trainee will be able to:</p> <p>Select appropriate reamer according to the job specification</p> <p>Select appropriate marking tool and mark the job as per drawing</p> <p>Select appropriate clamping device and clamp the work piece</p> <p>Perform drilling to produce hole according to the size of reamer</p> <p>Perform reaming as per job specification</p> | <p>Types of reamers i.e.</p> <ul style="list-style-type: none"> • Machine reamer • Hand reamer <p>Marking tools: Marking ink, try square, scriber, punches, divider, hammer</p> <p>Clamping Devices: Bench vice, machine vice, v-blocks, c-clamps, toggle clamps etc.</p> <p>Purpose of reamers:</p> <ul style="list-style-type: none"> • Size as per tolerance • Roundness of holes • Surface finish of holes <p>Process steps for hand or machine reaming</p> | <p>Total:</p> <p>06 hrs</p> <p>Theory:</p> <p>01 hr</p> <p>Practical:</p> <p>05 hrs</p> | <p>MS flat bar</p> <p>HSS drill bit</p> <p>Hand reamer</p> <p>Machine reamer</p> <p>Reamer handle</p> <p>Coolant</p> | <p>Class room</p> <p>Workshop</p> |

| | | | | | |
|--|--|--|--|---|-----------------------------------|
| | Verify the final job with given drawing | Knowledge of tolerances and fits. | | | |
| LU6: Perform counter boring | <p>The trainee will be able to:</p> <p>Select appropriate counter boring tool according to the drawing</p> <p>Select appropriate marking tool and mark the job as per drawing</p> <p>Select appropriate clamping device and clamp the work piece</p> <p>Perform drilling operation as per drawing</p> <p>Set the machine RPM according to the bore size and work piece material</p> <p>Perform counter boring as per standard procedures</p> <p>Perform post drilling operations</p> <p>Verify the final job with the given drawing</p> | <p>Purpose of counter bore</p> <p>Marking tools: marking ink, try square, scribe, punches, divider, hammer</p> <p>Clamping Devices: Bench vice, machine vice, v-blocks, c-clamps, toggle clamps etc.</p> <p>Process steps for counter boring</p> <p>Calculation method for RPM.</p> <p>Steps to perform drilling.</p> <p>Post drilling operations i.e. chamfering, bur removing etc.</p> | <p>Total: 06 hrs</p> <p>Theory: 01 hr</p> <p>Practical: 05 hrs</p> | <p>MS flat bar</p> <p>HSS drill bit</p> <p>Counter bore of different sizes</p> <p>Coolant</p> | <p>Class room</p> <p>Workshop</p> |

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| <p>LU7:</p> <p>Perform counter sinking</p> | <p>The trainee will be able to:</p> <p>Select appropriate counter sinking tool according to the drawing</p> <p>Select appropriate marking tool and mark the job as per drawing</p> <p>Select appropriate clamping device and clamp the work piece</p> <p>Perform drilling operation as per drawing</p> <p>Set the machine RPM according to the counter sink size and work piece material</p> <p>Perform counter sinking as per standard procedures</p> <p>Verify the final job with the given drawing</p> | <p>Purpose of counter sink</p> <p>Process steps for counter sinking</p> <p>Calculation method for RPM.</p> <p>Steps to perform drilling.</p> <p>Steps to perform counter sinking.</p> <p>Post drilling operations i.e. chamfering, de-buring.</p> | <p>Total:</p> <p>05 hrs</p> <p>Theory:</p> <p>01 hr</p> <p>Practical:</p> <p>04 hrs</p> | <p>MS flat bar</p> <p>Drill bit</p> <p>Counter sink tool of different sizes</p> | <p>Class room</p> <p>Workshop</p> |
| <p>LU8:</p> <p>Perform polishing</p> | <p>The trainee will be able to:</p> <p>Select appropriate polishing aid as per specification</p> <p>Prepare the surface for</p> | <p>Concept of surface finish: radii, peeks etc.</p> <p>Polishing aids:</p> <ul style="list-style-type: none"> • Emery cloth • Oil stones • Polishing abrasive • Polishing paste | <p>Total:</p> <p>20 hrs</p> <p>Theory:</p> | <p>Hardened carbon steel bar</p> <p>Emery clothes rough to fine grades</p> | <p>Class room</p> <p>Workshop</p> |

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| | <p>polishing</p> <p>Perform polishing as per required standards</p> <p>Perform post polishing operations</p> <p>Verify the final job with the given drawing</p> | <ul style="list-style-type: none"> • Pin grinding wheels • Rotary burs • Buffing • Lapping <p>Knowledge of post polishing methods</p> | <p>01 hr</p> <p>Practical:</p> <p>19 hrs</p> | <p>Oil stones</p> <p>Polishing abrasive</p> <p>Polishing paste</p> <p>Pin grinding wheel</p> <p>Rotary burs</p> <p>Pin grinder</p> <p>Hand buffing cloth</p> | |
| <p>LU9:</p> <p>Perform hand grinding</p> | <p>The trainee will be able to:</p> <p>Select appropriate hand grinder & grinding wheel / disk as per job specifications</p> <p>Mount the grinding wheel / disk as per standard procedure</p> <p>Perform grinding as per standard procedures</p> | <p>Knowledge of hand grinders / pin grinders machines and types of wheels / disc.</p> <p>Method of mounting disc / wheel / rotary bur on hand grinder.</p> <p>Knowledge of safe operating procedure for portable grinder.</p> | <p>Total:</p> <p>06 hrs</p> <p>Theory:</p> <p>01 hr</p> <p>Practical:</p> <p>05 hrs</p> | <p>Pedestal grinding machine</p> <p>Hand grinder</p> <p>Grinding disc</p> <p>Pin grinder</p> <p>Pin grinding wheels</p> | <p>Class room</p> <p>Workshop</p> |

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| <p>LU10:</p> <p>Demonstrate safe working conditions and housekeeping</p> | <p>The trainee will be able to:</p> <p>Select & use appropriate PPEs</p> <p>Maintain cleanliness at workplace</p> <p>Practice safe storage of tools & equipment</p> <p>Prepare checklist of daily housekeeping activities</p> | <p>Importance of using PPEs</p> <p>PPEs: Goggle, face shield, gas mask, apron, safety shoes, cotton gloves, leather gloves, hard cape etc.</p> <p>Importance of housekeeping and safe storage of tools and equipment</p> <p>Importance of making check list</p> | <p>Total:</p> <p>02 hrs</p> <p>Theory:</p> <p>01 hr</p> <p>Practical:</p> <p>01 hrs</p> | <p>General machine shop PPEs</p> | <p>Class room</p> <p>Workshop</p> |
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DIES AND MOULDS MAKER



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Module-3

CBT CURRICULUM

National Vocational Certificate Level 2

Version 1 - August, 2019

Module 3: 071500967 Perform lathe Operations

Objective of the module: This competency standard covers the skills and knowledge required to perform different processes on lathe machines including: Facing, turning, parting, threading, knurling, and drilling.

Duration: 120 hrs

Theory: 20 hrs

Practical: 100 hrs

| Learning Unit | Learning Outcomes | Learning Elements | Duration | Materials Required | Learning Place |
|--|--|---|--|--|-----------------------------------|
| LU1: Set tool and lathe machine | <p>The trainee will be able to:</p> <p>Identify & select machine.</p> <p>Manage the required measuring equipment</p> <p>Set machine & other attachments if required.</p> <p>Select proper tool according to job specifications.</p> <p>Clamp the tool as per standard procedures.</p> <p>Set machine parameters</p> <p>Follow relevant safety procedures.</p> | <p>Knowledge of the types of lathe machine:</p> <p>Types: Bench lathe, speed lathe, engine lathe, tool room lathe, Turret lathe, automatic lathe, special purpose lathe</p> <p>Knowledge of major functional parts of a lathe machine.</p> <p>Parts: machine bed, head stock, speed changing lever, tailstock, lead screw etc.</p> <p>Know the use of precision measuring tools:</p> <p>Tools: Vernier caliper, external micrometer, internal micrometer etc.</p> <p>Know types of cutting tools.</p> <p>Cutting tools: HSS, carbide tips, carbide inserts</p> <p>Knowledge of tools clamping methods</p> <p>Method of setting machine parameters i.e. speed, feed etc.</p> | <p>Total:</p> <p>10 hrs</p> <p>Theory:</p> <p>03 hrs</p> <p>Practical:</p> <p>07 hrs</p> | <p>Center lathe</p> <p>Vernier caliper</p> <p>External micro meter</p> <p>Internal micrometer</p> <p>HSS tool bit</p> <p>Carbide tips</p> <p>Carbide inserts</p> | <p>Class room</p> <p>Workshop</p> |

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| <p>LU2:</p> <p>Perform workpiece setting</p> | <p>The trainee will be able to:</p> <p>Prepare work piece for machining operations</p> <p>Clamp the work pieces as per standard procedures</p> <p>Dial the work piece & ensure final clamping</p> | <p>Workpiece clamping devices:</p> <p>Devices: concentric chuck, four jaws chuck, face plate and tail stock, collets.</p> <p>Use of dial indicators i.e. dial indicator, lever gauge, magnetic stand.</p> <p>Methods of workpiece clamping i.e. three jaw chuck, four jaw chuck, between centers, use of face plate etc.</p> <p>Methods of dialing</p> | <p>Total:</p> <p>10 hrs</p> <p>Theory:</p> <p>03 hrs</p> <p>Practical:</p> <p>07 hrs</p> | <p>MS shaft</p> <p>Three and four jaws chuck</p> <p>Face plate</p> <p>Driving plate</p> <p>Lathe dog</p> <p>Lathe machine tail stock</p> <p>Collet set</p> <p>Dial indicator with magnetic stand</p> <p>Lever gauge</p> <p>Dead center</p> <p>Revolving center</p> | <p>Class room</p> <p>Workshop</p> |
| <p>LU3:</p> <p>Perform facing</p> | <p>The trainee will be able to:</p> <p>Select appropriate tool for facing</p> <p>Clamp the tool in tool post & set in required angle</p> | <p>Tool angles and their application for different materials.</p> <p>Tool angles: Rack angle, clearance angle, wedge angle, face clearance etc.</p> <p>Knowledge of tool post and carriage.</p> <p>RPM calculating and setting on machine.</p> | <p>Total:</p> <p>10 hrs</p> <p>Theory:</p> <p>01 hrs</p> | <p>MS shaft</p> <p>HSS tool bit</p> <p>Vernier caliper</p> | <p>Class room</p> <p>workshop</p> |

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| | <p>Set machine parameter as per job specifications</p> <p>Dial the work piece & ensure final clamping</p> <p>Carry out machining operation for facing as per standard procedure</p> | <p>Understand speed and feed rate.</p> | <p>Practical:</p> <p>09 hrs</p> | | |
| <p>LU4:</p> <p>Perform turning</p> | <p>The trainee will be able to:</p> <p>Select appropriate tool for turning</p> <p>Clamp the tool in tool post & set in required angle</p> <p>Set machine parameter as per job specifications</p> <p>Dial the work piece & ensure final clamping</p> <p>Carry out machining operation for turning as per standard procedure</p> | <p>Knowledge of turning / between center turning</p> <p>Tool angles and their application for different materials.</p> <p>Tool angles: rack angle, clearance angle, wedge angle, face clearance etc.</p> <p>Knowledge of tool post and carriage.</p> <p>RPM calculating and setting on machine.</p> <p>Understand speed and feed rate.</p> | <p>Total:</p> <p>20 hrs</p> <p>Theory:</p> <p>02 hrs</p> <p>Practical:</p> <p>18 hrs</p> | <p>HSS tool bit</p> <p>MS shaft</p> <p>External micro meter</p> <p>Vernier</p> <p>Micrometer</p> <p>Dial indicator</p> <p>Revolving center</p> <p>Dead center</p> <p>Driving plate</p> | <p>Class room</p> <p>Workshop</p> |
| <p>LU5:</p> <p>Perform thread cutting</p> | <p>The trainee will be able to:</p> <p>Select & prepare appropriate tool for thread cutting</p> | <p>Types of threads.</p> <p>Types: Metric, British, square, acme, buttress</p> <p>Knowledge of multi start threads.</p> | <p>Total:</p> <p>25 hrs.</p> <p>Theory:</p> | <p>MS shaft</p> <p>Thread samples</p> <p>Thread cutting tool HSS</p> | <p>Class room</p> <p>workshop</p> |

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| | <p>Clamp & set the tool in tool post</p> <p>Set machine parameters as per job specifications</p> <p>Dial the work piece & ensure final clamping</p> <p>Carry out machining operation for thread cutting as per standard procedure</p> | <p>Thread cutting procedure.</p> <p>Thread cutting parameters: lead screw, gear train, feed rate etc.</p> <p>Safe operating procedures for lathe machine.</p> | <p>03 hrs</p> <p>Practical:</p> <p>22 hrs</p> | <p>Thread pitch gauge</p> <p>Vernier</p> <p>Micrometer</p> <p>Dial indicator</p> <p>Revolving center</p> <p>Dead center</p> <p>Driving plate</p> | |
| <p>LU6:</p> <p>Perform parting</p> | <p>The trainee will be able to:</p> <p>Select appropriate tool for parting</p> <p>Clamp & set the tool in tool post.</p> <p>Set machine parameter as per job specifications</p> <p>Dial the work piece & ensure final clamping</p> <p>Carry out machining operation for parting as per standard procedure</p> | <p>Angles: Rack angle, clearance angle, wedge angle, face clearance etc.</p> <p>Know the tools for straight parting and Parting</p> <p>Clamping method of parting tool</p> <p>Setting machine parameter i.e. workpiece rpm.</p> <p>Safe procedures for parting</p> | <p>Total:</p> <p>06 hrs</p> <p>Theory:</p> <p>01 hrs</p> <p>Practical:</p> <p>05 hrs</p> | <p>HSS Parting tool</p> <p>MS shaft</p> <p>Vernier caliper</p> | <p>Class room</p> <p>Workshop</p> |
| <p>LU7:</p> <p>Perform drilling</p> | <p>The trainee will be able to:</p> <p>Select appropriate tool</p> | <p>Knowledge of boring tools and boring bars for lathe machine.</p> | <p>Total:</p> <p>25 hrs</p> | <p>MS shaft</p> <p>HSS boring tool</p> | <p>Class room</p> <p>Workshop</p> |

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| <p>/ boring</p> | <p>for drilling / boring as per drawing</p> <p>Set machine parameter as per job specifications</p> <p>Clamp drill bit in drill chuck Perform drilling to produce appropriate hole size for boring</p> <p>Clamp the boring tool in the tool post.</p> <p>Carry out machining operation for Boring as per standard procedure</p> | <p>Setting of workpiece RPM</p> <p>Method of using drill chuck in a lathe machine</p> <p>Clamping method of boring tools</p> <p>Knowledge of drilling steps: center drill, pilot drill, final drill etc.</p> | <p>Theory: 03 hrs</p> <p>Practical: 22 hrs</p> | <p>Boring bar</p> <p>Bore gauge</p> <p>Vernier caliper / Internal micrometer</p> <p>Drill chuck</p> <p>Drill bit set</p> <p>Center drill</p> <p>Internal caliper</p> | |
| <p>LU8:</p> <p>Perform knurling</p> | <p>The trainee will be able to:</p> <p>Select appropriate tool for knurling</p> <p>Clamp the tool in tool post.</p> <p>Set machine parameter as per job specifications</p> <p>Dial the work piece & ensure final clamping</p> <p>Carry out machining operation for Knurling as</p> | <p>Types of knurling tools i.e. straight and diamond knurling.</p> <p>Method of clamping knurling tools</p> <p>Workpiece RPM for knurling</p> <p>Use of dial indicators</p> <p>Safe procedure of knurling</p> | <p>Total: 05 hrs</p> <p>Theory: 01 hrs</p> <p>Practical: 04 hrs</p> | <p>MS shaft</p> <p>Knurling tool</p> <p>Lubricant</p> <p>Revolving center</p> | <p>Class room</p> <p>Workshop</p> |

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| | per standard procedure | | | | |
| LU9: Perform final inspection | The trainee will be able to: Prepare the work piece for inspection Visually inspect the work piece Manage the required measuring tools Perform the required inspection as per drawing | Knowledge of tolerance i.e. upper limits and lower limits, basic hole and shaft system Knowledge of inspection tools. Tools: Ring gauge, plug gauge, thread pitch gauge, internal micrometer, external micrometer, Checking parallelism | Total: 07 hrs Theory: 02 hrs Practical: 05 hrs | Prepared lathe machine job Ring gauge Plug gauge Thread pitch gauge Thread plug gauge Internal and external micrometer Dial indicator with magnetic stand Internal and external caliper | Class room Workshop |
| LU10: Demonstrate safe working practice & housekeeping | The trainee will be able to: Select & use appropriate PPEs. Maintain cleanliness at the workplace | Benefits of good house keeping Health and safety relevant to lathe machine | Total: 02 hrs Theory: 01 hrs Practical: 01 hrs | Cleaning cloth / cotton rages Lubricant oil | Class room Workshop |

DIES AND MOULDS MAKER



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Module-4

CBT CURRICULUM

National Vocational Certificate Level 2

Version 1 - August, 2019

Module 4: 071500968 Perform Milling Operations

Objective of the module: This competency standard covers the skills and knowledge required to perform different processes on milling machines including pocketing, contouring, reaming, indexing, and drilling/boring

Duration: 100 hrs

Theory: 10 hrs

Practical: 90 hrs

| Learning Unit | Learning Outcomes | Learning Elements | Duration | Materials Required | Learning Place |
|--|--|--|--|---|-----------------------------------|
| LU1: Set tool and milling machine | <p>The trainee will be able to:</p> <p>Identify & select milling machine according to the job specifications</p> <p>Select appropriate tool & clamping device according to the job specifications</p> <p>Mount the tool as per standard procedure</p> <p>Set machine parameters according to the job specifications</p> <p>Select & set cutting fluid as per job specifications</p> | <p>Types of milling machines i.e. vertical, horizontal and universal.</p> <p>Major functional parts of a milling machine.</p> <p>Parts: machine bed, head, speed control lever, bed travel</p> <p>Knowledge of tool clamping devices i.e. Collets, long and short arbors etc.</p> <p>Knowledge of RPM setting, auto feed rate</p> <p>Knowledge of milling cutters types:</p> <p>Types: End mill, shell end mill, face mill, profile cutters</p> <p>Know the use and types of cutting fluid</p> | <p>Total: 05 hrs</p> <p>Theory: 01 hrs</p> <p>Practical: 04 hrs</p> | <p>Milling machine</p> <p>Collet set with adopter</p> <p>Arbors</p> <p>Milling machine cutters</p> <p>Dial indicators</p> | <p>Class room</p> <p>workshop</p> |

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| <p>LU2:</p> <p>Perform workpiece setting</p> | <p>The trainee will be able to:</p> <p>Interpret drawing and arrange the material for milling operation according to the job requirement</p> <p>Prepare work piece for machining operations</p> <p>Check and verify the dimension of raw material according to drawing.</p> <p>Identify & select appropriate clamping device</p> <p>Clamp the workpiece as per standard procedure</p> | <p>Interpret different drawing views.</p> <p>Views: Isometric, orthographic</p> <p>Preparing bill of material (BOM) from drawing i.e. finish size, raw material with machining allowance etc.</p> <p>Knowledge of clamping devices for milling.</p> <p>Devices: Machine vice, step clamps, parallel blocks etc.</p> <p>Health and safety relevant to milling machine / shop.</p> | <p>Total:</p> <p>05 hrs</p> <p>Theory:</p> <p>01 hrs</p> <p>Practical:</p> <p>04 hrs</p> | <p>Machining drawing</p> <p>MS plate</p> <p>Machine vice</p> <p>Strap clamp set</p> <p>Parallel block set</p> <p>Dial indicators with magnetic stand</p> <p>Lever type dial indicator</p> <p>Vernier caliper</p> <p>Micrometer</p> <p>Mallets</p> | <p>Class room</p> <p>Workshop</p> |
| <p>LU3:</p> <p>Perform pocketing</p> | <p>The trainee will be able to:</p> <p>Select appropriate tool & clamping device as per job specifications</p> <p>Mount the tool as per standard procedures</p> <p>Set machine parameters as per job specifications</p> | <p>Knowledge of milling machine axis travelling.</p> <p>Knowledge of machining pockets using milling machine.</p> <p>Know the effect of milling direction i.e. conventional and climb milling.</p> <p>Workpiece dialing devices i.e. dial indicator, lever gauge etc.</p> | <p>Total:</p> <p>20 hrs</p> <p>Theory:</p> <p>01 hrs</p> <p>Practical:</p> <p>19 hrs</p> | <p>MS plate</p> <p>Milling cutter</p> <p>Dial indicator with magnetic stand</p> <p>Lever gauge</p> <p>Machine vice</p> <p>Step clamps</p> | |

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| | <p>Select appropriate clamping device/method for work piece.</p> <p>Dial the work piece & ensure final clamping</p> <p>Carry out machining operation for pocketing as per standard procedure</p> | | | <p>Parallel blocks</p> <p>Vernier caliper</p> <p>Cutting fluid</p> <p>Slot drill cutter</p> | |
| <p>LU4:</p> <p>Perform contouring</p> | <p>The trainee will be able to:</p> <p>Select appropriate tool & clamping device as per job specifications</p> <p>Mount the tool as per standard procedures</p> <p>Set machine parameters as per job specifications</p> <p>Select appropriate clamping device/method for work piece.</p> <p>Dial the work piece & ensure final clamping</p> <p>Carry out machining operation for contouring as per standard procedure</p> | <p>Knowledge of contouring tools i.e. ball nose, single lip V tool, grooving tool, radius tool</p> | <p>Total:</p> <p>20 hrs</p> <p>Theory:</p> <p>01 hrs</p> <p>Practical:</p> <p>19 hrs</p> | <p>MS plate</p> <p>Contouring tools</p> <p>Horizontal milling machine</p> <p>Dial indicators with magnetic stand</p> <p>Strap clamps</p> | <p>Class room</p> <p>Workshop</p> |

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| <p>LU5: Perform drilling / boring</p> | <p>The trainee will be able to:</p> <p>Select appropriate tool & clamping device as per job specifications</p> <p>Mount the tool as per standard procedures</p> <p>Set machine parameters as per job specifications</p> <p>Select appropriate clamping device/method for work piece.</p> <p>Dial the work piece & ensure final clamping</p> <p>Carry out machining operation for drilling/boring as per standard procedure</p> | <p>Knowledge of boring tools i.e. boring head, boring bars etc.</p> <p>Method of mounting tool on a boring bar and boring head</p> <p>Calculating and setting of boring bar RPM and feed</p> <p>Work piece clamping devices for milling i.e. machine vice, step clamps, toggle clamps etc.</p> <p>Safe procedure sequence for boring.</p> | <p>Total: 14 hrs</p> <p>Theory: 01 hrs</p> <p>Practical: 13 hrs</p> | <p>MS plate</p> <p>Drill bits</p> <p>Drill chuck</p> <p>Centre drill</p> <p>Collet set</p> <p>Boring head</p> <p>Boring bar</p> <p>Sleeves</p> <p>HSS tool bit</p> | <p>Class room</p> <p>Workshop</p> |
| <p>LU6: Perform reaming</p> | <p>The trainee will be able to:</p> <p>Select appropriate tool & clamping device as per job specifications</p> <p>Mount the tool as per standard procedures</p> | <p>Purpose: roundness, size to tolerance, surface finish etc.</p> <p>Tool mounting devices i.e. drill chuck, collets etc.</p> <p>Setting speed and feed for reamer</p> <p>Knowledge of using machine reaming i.e. step for reaming.</p> | <p>Total: 10 hrs</p> <p>Theory: 01 hrs</p> <p>Practical:</p> | <p>MS plate</p> <p>Dial indicator with stand</p> <p>Drill bits</p> <p>Center drill</p> <p>Rose bit</p> | <p>Class room</p> <p>Workshop</p> |

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| | <p>Set machine parameter as per job specifications</p> <p>Select appropriate clamping device/method for work piece.</p> <p>Dial the work piece & ensure final clamping</p> <p>Carry out machining operation for reaming as per standard procedure</p> | <p>Steps: marking, center drilling, pilot drilling, drilling as per reaming requirement, chamfering, reaming.</p> | 09 hrs | <p>Cutting fluid</p> <p>Reamer</p> <p>Plug gauge</p> <p>Pin gauge</p> | |
| <p>LU7:</p> <p>Perform indexing</p> | <p>The trainee will be able to:</p> <p>Select appropriate tool & clamping device as per job specifications</p> <p>Mount the tool as per standard procedures</p> <p>Set machine parameters as per job specifications</p> <p>Select and mount appropriate indexing head on machine table</p> <p>Select appropriate clamping device/method for work piece.</p> | <p>Use of indexing head i.e. producing polygon shapes, gear</p> <p>Knowledge of types of milling cutters.</p> <p>Types: end mill, shell end mill, face mill, module cutter</p> <p>Methods of tool clamping i.e. collet, arbor</p> <p>Dialing methods for indexing</p> <p>Know essential parts of indexing head to perform calculation for indexing i.e. indexing plate, worm wheel, formula, interpretation of answer etc.</p> <p>Safe procedure sequence for indexing</p> | <p>Total:</p> <p>22 hrs</p> <p>Theory:</p> <p>02 hrs</p> <p>Practical:</p> <p>20 hrs</p> | <p>MS plate or disc</p> <p>Indexing head with tailstock</p> <p>Dial indicator with stand</p> <p>Milling cutter</p> <p>Cutting fluid</p> <p>Vernier caliper</p> | <p>Class room</p> <p>Workshop</p> |

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| | <p>Dial the work piece & ensure final clamping</p> <p>Perform calculations & select appropriate disc for indexing</p> <p>Carry out machining operation for indexing as per standard procedure</p> | | | | |
| <p>LU8:</p> <p>Perform final inspection</p> | <p>The trainee will be able to:</p> <p>Prepare the work piece for inspection</p> <p>Visually Inspect the work piece</p> <p>Manage the required measuring tools</p> <p>Perform the required inspection as per drawing</p> | <p>Post milling operations: deburring, chamfering, cleaning etc.</p> <p>Use of datum to measure different components.</p> <p>Datum: Edge datum, surface datum, point datum, line datum etc.</p> | <p>Total:</p> <p>02 hrs</p> <p>Theory:</p> <p>01 hrs</p> <p>Practical:</p> <p>01 hrs</p> | <p>Workpiece prepared on a milling machine</p> <p>Inspection tools</p> | <p>Class room</p> <p>Workshop</p> |
| <p>LU9:</p> <p>Demonstrate safe working practice & housekeeping</p> | <p>The trainee will be able to:</p> <p>Select & use appropriate PPEs.</p> <p>Maintain cleanliness at the workplace</p> | <p>Potential hazard associated with milling operations</p> <p>PPEs for a milling machine</p> <p>Maintaining housekeeping on a milling machine</p> | <p>Total:</p> <p>02 hrs</p> <p>Theory:</p> <p>01 hrs</p> <p>Practical:</p> <p>01 hrs</p> | <p>PPEs</p> <p>Tool cabinet</p> <p>Milling tools</p> | <p>Class room</p> <p>Workshop</p> |
| | <p>Ensure relevant safety procedure for milling operations</p> | | <p>Practical:</p> <p>01 hrs</p> | | |

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Module-5
CBT CURRICULUM
National Vocational Certificate Level 2

Version 1 - August, 2019

Module 5: 071500969 Perform Grinding Operation

Objective of the module: The standard defines the competencies in accordance with approved procedures. Trainees are able to perform different type of grinding, which includes surface, cylindrical & tool & cutter Grinders.

Duration: 80 hrs

Theory: 10 hrs

Practical: 70 hrs

| Learning Unit | Learning Outcomes | Learning Elements | Duration | Materials Required | Learning Place |
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| LU1: Set grinding machine | <p>The trainee will be able to:</p> <p>Identify & select grinding machine according to the job specifications</p> <p>Select appropriate grinding wheel according to the work piece material</p> <p>Mount the grinding wheel as per standard procedure</p> <p>Dress the grinding wheel as per standard procedure</p> <p>Select & set coolant as per job specifications</p> | <p>Know the types of grinding machines i.e. surface grinding machine and cylindrical grinding machine</p> <p>Knowledge of grinding wheel specification.</p> <p>Standard procedure for wheel balancing, mounting and dressing</p> <p>Advantages of using coolant on grinding wheels</p> | <p>Total: 05 hrs</p> <p>Theory: 02 hrs</p> <p>Practical: 03 hrs</p> | <p>Surface grinding machine</p> <p>Cylindrical grinding machine</p> <p>Grinding wheels</p> <p>Grinding wheel balancing device</p> <p>Diamond dresser</p> <p>Ferrous material flat plates and round bars</p> | <p>Class room</p> <p>Workshop</p> |

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| LU2: Perform workpiece setting | The trainee will be able to: Select and use appropriate clamping device Prepare workpiece for clamping Clamp the work piece as per standard procedure Set travel length of machine bed as per workpiece | Clamping devices for surface grinding i.e. grinding vice, magnetic table. Clamping devices for cylindrical grinder. Devices: collets, face plate with dog clamp, dead center, half center, revolving center etc. Method of using workpiece clamping devices. Method of setting table travel / movement | Total: 05 hrs Theory: 02 hrs Practical: 03 hrs | MS shaft Grinding wheel Collet set Faceplate with dog clamp Tailstock Dead center Half center Revolving center Driving plates with driving dogs | Class room Workshop |
| LU3: Perform surface grinding | The trainee will be able to: Select appropriate grinding wheel according to the work piece material Set the table travel according to the work piece. Maintain safe distance between work piece & grinding wheel | Knowledge of grinding machine operational parts i.e. magnetic table, table movement limit switches, feed drum etc. Knowledge of grinding wheel specification. Setting of safe table travel length Advantages of applying coolant on grinding wheels Safe procedure sequence to perform grinding Use of rust prevention techniques i.e. oiling | Total: 30 hrs Theory: 02 hrs Practical: 28 hrs | Surface grinding machine MS plate Grinding wheel Diamond dresser Micro meter | Class room Workshop |

| | | | | | |
|---|---|---|--|---|-----------------------------------|
| | <p>Apply coolant on surface grinding process</p> <p>Perform grinding as per standard procedure.</p> <p>Lubricate & debur the workpiece</p> <p>Verify parallelism</p> | <p>greasing etc.</p> <p>Use of dial indicators for checking parallelism</p> | | | |
| <p>LU4:</p> <p>Perform cylindrical grinding</p> | <p>The trainee will be able to:</p> <p>Select appropriate grinding wheel according to the work piece material</p> <p>Mount the work piece in chuck or collet between centres as per Requirement.</p> <p>Set the appropriate RPM of work piece</p> <p>Set the table travel according to the work piece</p> <p>Apply coolant on cylindrical grinding process</p> | <p>Cylindrical grinder machine major operational parts.</p> <p>Parts: Headstock, tailstock, feed, bed travel limit switch etc.</p> <p>Knowledge of grinding wheel specification.</p> <p>Knowledge of work holding devices i.e. chuck, collet, between centers etc.</p> <p>Setting of safe table travel length</p> <p>Knowledge of wheel speed and workpiece speed</p> <p>Advantages of applying coolant on grinding wheels</p> <p>Safe procedure for operating cylindrical grinders</p> <p>Use of rust prevention techniques i.e. oiling greasing etc.</p> | <p>Total:</p> <p>35 hrs</p> <p>Theory:</p> <p>02 hrs</p> <p>Practical:</p> <p>33 hrs</p> | <p>Cylindrical grinding machine</p> <p>Hardened shaft</p> <p>Cylindrical grinder machine accessories</p> <p>Micro meter</p> <p>Lubrication oil</p> <p>Coolant oil</p> <p>Driving plates with driving dogs</p> | <p>Class room</p> <p>Workshop</p> |

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|---|---|--|--|--|-----------------------------------|
| | <p>Perform grinding as per standard procedure</p> <p>Lubricate & debur the work piece.</p> <p>Verify parallelism</p> | <p>Use of dial indicators for checking parallelism</p> | | | |
| <p>LU5:</p> <p>Perform final inspection</p> | <p>The trainee will be able to:</p> <p>Prepare the work piece for inspection</p> <p>Visually Inspect the work piece</p> <p>Manage the required measuring tools</p> <p>Perform the required inspection as per drawing</p> | <p>Knowledge of tolerance i.e. upper limits and lower limits, basic hole and shaft system</p> <p>Knowledge of inspection tools.</p> <p>Tools: Ring gauge, plug gauge, thread pitch gauge, internal micrometer, external micrometer,</p> <p>Checking parallelism</p> | <p>Total:</p> <p>03 hrs</p> <p>Theory:</p> <p>01 hrs</p> <p>Practical:</p> <p>02 hrs</p> | <p>Micrometer</p> <p>Dial indicator gauge</p> | <p>Class room</p> <p>Workshop</p> |
| <p>LU6:</p> <p>Demonstrate safe working practice & housekeeping</p> | <p>The trainee will be able to:</p> <p>Select & use appropriate PPEs.</p> <p>Maintain cleanliness at the workplace</p> <p>Ensure relevant safety procedure for grinding operations</p> | <p>Health and safety relevant to grinding machines</p> <p>Benefits of good house keeping</p> | <p>Total:</p> <p>02 hrs</p> <p>Theory:</p> <p>01 hrs</p> <p>Practical:</p> <p>01 hrs</p> | <p>PPEs</p> <p>Cylindrical grinding machine with all tools and accessories</p> | <p>Class room</p> <p>Workshop</p> |

DIES AND MOULDS MAKER



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Module-6

CBT CURRICULUM

National Vocational Certificate Level 2

Version 1 - August, 2019

Module 6: 041700839 Communicate the Workplace Policy and Procedure

Objective of the module: This unit describes the performance outcomes, skills and knowledge required to develop communication skills in the workplace. It covers gathering, conveying and receiving information, along with completing assigned written information under direct supervision.

Duration:20

Theory:

Practical:

| Learning Unit | Learning Outcomes | Learning Elements | Duration | Materials Required | Learning Place |
|---|--|-------------------|---|--------------------|----------------|
| LU1: Identify workplace communication procedures | The trainee will be able to: Identify organizational communication requirements and workplace procedures with assistance from relevant authority Identify appropriate lines of communication with supervisors and colleagues. Seek advice on the communication method/equipment most appropriate for the task. | | Total Theory: Practical: | | Class room |

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|---|---|--|--|--|-------------------|
| <p>LU2: Communicate at workplace</p> | <p>The trainee will be able to:</p> <p>Use effective questioning, and active listening and speaking skills to gather and convey information</p> <p>Use appropriate non-verbal behavior at all times</p> <p>Encourage, acknowledge and act upon constructive feedback</p> | | <p>Total</p> <p>Theory:</p> <p>Practical:</p> | | <p>Class room</p> |
| <p>LU3: Draft Written Information</p> | <p>The trainee will be able to:</p> <p>Identify and comply with required range of written materials in accordance with organizational policy and procedures</p> | | <p>Total</p> <p>Theory:</p> <p>Practical:</p> | <p>Computer with Office applications</p> | <p>Class room</p> |

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|---|--|--|---|--|--|
| | <p>Draft and present assigned written information for approval, ensuring it is written clearly, concisely and within designated timeframes.</p> <p>Ensure written information meets required standards of style, format and detail.</p> <p>Seek assistance and/or feedback to aid communication skills development</p> | | | | |
| <p>LU3: Draft Written Information</p> | <p>The trainee will be able to: Check draft for suitability of tone for audience, purpose, format and communication style</p> | | <p>Total</p> <p>Theory:</p> <p>Practical</p> | | |

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|--|---|--|--|--|--|
| | <p>Check draft for readability, grammar, spelling, sentence and paragraph construction and correct any inaccuracies or gaps in content.</p> <p>Check draft for sequencing and structure</p> <p>Check draft to ensure it meets organizational requirements</p> | | | | |
|--|---|--|--|--|--|

DIES AND MOULDS MAKER



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Module-7
CBT CURRICULUM
National Vocational Certificate Level 2

Version 1 - August, 2019

Module 7: 001100851 Perform Basic Communication (Specific)

Objective of the module: This unit describes the skills and knowledge required to assist in the development of communication competence by providing information regarding different forms of communication and their appropriate use.

By the end of this program, learners will be able, to communicate more effectively and efficiently by: working in a team, follow supervisor's instructions and develop generic communication work skills at workplace

Duration:30

Theory:

Practical:

| Learning Unit | Learning Outcomes | Learning Elements | Duration | Materials Required | Learning Place |
|--|--|-------------------|---|------------------------------------|----------------|
| LU1: Communicate in a team to achieve intended outcomes | The trainee will be able to: Treat team members with respect Maintain positive relationships to achieve common organizational goals Get work related information from team Identify interrelated work | | Total Theory: Practical: | Different types of waste materials | |

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|--|--|--|--|--|--|
| | <p>activities to avoid confusion</p> <p>Adopt communication skills, which are designed in a team.</p> <p>Identify problems in communication with a team</p> <p>Resolve Communication barrier through discussion and mutual agreement</p> | | | | |
| <p>LU2:</p> <p>Follow Supervisor's instructions as per organizational SOPs</p> | <p>The trainee will be able to:</p> <p>Receive the instructions from Supervisor</p> <p>Carry out the instructions of the supervisor</p> <p>Report to the supervisor as per organizational</p> | | <p>Total</p> <p>Theory:</p> <p>Practical:</p> | | |

| | | | | | |
|---|---|--|--|--|--|
| | SOPs | | | | |
| LU3. Develop Generic communication skills at workplace | The trainee will be able to: Develop basic reading skills Develop Basic writing Skills Develop basic listening skills | | | | |

DIES AND MOULDS MAKER



Module-8

CBT CURRICULUM

National Vocational Certificate Level 2

Version 1 - August, 2019

Module 8: 061100856 Perform Basic Computer Application (Specific)

Objective of the module: This unit describes the skills and knowledge required to use spreadsheet to prepare a page of document, develops familiarity with Word, Excel, Access, PowerPoint, email, and computer graphics basics.

It applies to individuals who perform a range of routine tasks in the workplace using a fundamental knowledge of spreadsheets, Microsoft office and computer graphics in under direct supervision or with limited responsibility.

Duration:40

Theory:

Practical:

| Learning Unit | Learning Outcomes | Learning Elements | Duration | Materials Required | Learning Place |
|---|---|-------------------|---|--------------------|----------------|
| LU1: Create Word Documents | The trainee will be able to: Open word processing application Create a word document Customize page layout with relevant name setting Set up page in a word document Edit word document as required Use simple formatting tools when creating the document | | Total Theory: Practical: | Standard SOPs | Class room |

| | | | | | |
|--|--|--|--|--|-------------------|
| | <p>Save word document to directory</p> <p>Insert table in a word document</p> <p>Insert appropriate images into document as necessary</p> <p>Insert header/footer in a word document</p> <p>Insert section break in a word document</p> <p>Set style in word document</p> <p>Select basic Print settings</p> <p>Print the document</p> | | | | |
| <p>LU2:</p> <p>Use internet for Browsing</p> | <p>The trainee will be able to:</p> <p>Use search engines to open website</p> <p>Search data on different topics</p> <p>Refine search to increase relevance of information or content</p> | | <p>Total</p> <p>Theory:</p> <p>Practical:</p> | | <p>Class room</p> |
| | <p>Navigate a website to access the information or content required</p> | | | | |

General assessment guidance for Dies & Molds Maker Level 2

Good practice in Pakistan makes use of sessional and final assessments, the basis of which is described below. Good practice by vocational training providers in Pakistan, is to use a combination of these sessional and final assessments, to produce the final qualification result.

Sessional assessment is going on all the time. Its purpose is to provide feedback on what students are learning:

- to the student: to identify achievement and areas for further work
- to the teacher: to evaluate the effectiveness of teaching to date, and to focus future plans.

Assessors need to devise sessional assessments for both theoretical and practical work. Guidance is provided in the assessment strategy

Final assessment is the assessment, usually on completion of a course or module, which determines whether or not the student has "passed". It is – or should be – undertaken with reference to all the objectives or outcomes of the course, and is formal. Considerations of security – ensuring that the student who gets the credit is the person who did the work – assume considerable importance in final assessment.

Methods of assessment

For lessons with a high quantity of theory, written or oral tests related to learning outcomes and/ or learning content can be conducted. For workplace lessons, assessment can focus on the quality of planning the related process, the quality of executing the process, the quality of the product and/or evaluation of the process.

Methods include direct assessment, which is the most desirable form of assessment. For this method, evidence is obtained by direct observation of the student's performance.

Examples for direct assessment of a Dies & molds Maker Lev-2 include:

- Work performances, for example performing bench work exercises
- Demonstrations, for example demonstrating to perform lathe / milling operations
- Direct questioning, where the assessor would ask question to the student to judge his understanding and knowledge

- Paper-based tests, such as multiple choice or short answer questions on bench work tools & operations and about numeracy skills. Indirect assessment is the method used where the performance could not be watched and evidence is gained indirectly.

Examples for indirect assessment of a Dies & molds maker Lev-2 include:

- Work products, such as any part prepared on lathe or milling during the training or during OJT
- Workplace documents, such as note book or practical activity journal

Indirect assessment should only be a second choice. (in some cases, it may not even be guaranteed that the work products were produced by the person being assessed.)

Principles of assessment

All assessments should be valid, reliable, fair and flexible:

Fairness means that there should be no advantages or disadvantages for any assessed person. For example, it should not happen that one student gets prior information about the type of work performance that will be assessed, while another candidate does not get any prior information.

Validity means that a valid assessment assesses what it claims to assess.

Reliability means that the assessment is consistent and reproducible.

Flexibility means that the assessor has to be flexible concerning the assessment approach. For example, if there is a mishap during the assessment, the assessor should modify the arrangements to accommodate the students' needs.

All assessment methods should be similar and comparable throughout the country:

This means, no different standards for assessment methods and assessment tools in Pakistan. A reliable, testable and validated system throughout the country to assure equal assessment conditions.

Assessment strategy for Dies & Molds Maker Level 2

This curriculum consists of 8 modules:

- Module 1. Comply personal health and safety guidelines
- Module 2. Perform bench works
- Module 3. Perform lathe operations
- Module 4. Perform milling operations
- Module 5. Perform grinding operations
- Module 6. Communicate the workplace policy and procedure
- Module 7. Perform basic communication skills
- Module 8. Perform basic computer application

Sessional assessment

The sessional assessment shall be conducted after completion of each module in two parts: theoretical assessment and practical assessment. The sessional marks shall contribute to the final qualification.

Theoretical assessment for all learning modules must consist of a written paper lasting at least 30 minute per module. This can be a combination of multiple choice and short answer questions.

For practical assessment, all procedures and methods for the modules must be assessed on a sessional basis. Guidance is provided below under Planning for assessment.

Final assessment

Final assessment shall also be in two parts: theoretical assessment and practical assessment. The final assessment marks shall contribute to the final qualification.

For the final practical assessment, each trainee shall be assessed over a period of 4-hour session. During this period, each student must be assessed on his ability to perform a complete job for Module 2 to Module 5

Module 1: Maintain personal health, hygiene & safety, Module 6: Perform basic communication skills and Module 7: Dispose the waste material and Module 8: Demonstrate basic numeracy skills are generic and shall be assessed at the time of final assessment with technical modules because they both are interdependent from technical modules. Practical work for these modules shall also be assessed on a sessional basis.

The assessment team

The number of assessors must meet the needs of the students and the training provider. For example, where two assessors are conducting the assessment, there must be a maximum of five students per assessor. In this example, a group of 20 students shall therefore require assessments to be carried out over a four-day period. For a group of only 10 students, assessments would be carried out over a two-day period only.

Planning for assessment

Sessional assessment: assessors need to plan in advance how they will conduct sessional assessments for each module. The tables on the following pages are for assessors to use to insert how many hours of theoretical and practical assessment will be conducted and what the scheduled dates are.

Final assessment: Training providers need to decide ways to combine modules into a cohesive two-day final assessment program for each group of five students. Training providers must agree the dishes for practical assessments in advance.

Complete list of tools and equipment

| S.No | Items | Qty: |
|------|---|---------|
| 1. | Vernier caliper (0-150mm) | 25 |
| 2. | Micrometer (0-25mm) | 25 |
| 3. | Steel rule (0-300mm) | 25 |
| 4. | Tri square (0-100mm) | 25 |
| 5. | Centre & dot punch | 25 each |
| 6. | Scriber | 25 |
| 7. | Second cut files 8-10 & 12" in (Flat) | 2 each |
| 8. | Second cut files 8-10 & 12" in (Square) | 2 each |
| 9. | Second cut files 8-10 & 12" in (Round) | 2 each |
| 10. | Second cut files 8-10 & 12" in (Triangle) | 2 each |
| 11. | Bench vices 4 inches | 25 Nos |
| 12. | Bench type drill machine | 02 Nos |
| 13. | Drill chuck | 04 Nos |
| 14. | Countersinking & counter boring tools (10-20mm)*2 mm increments | 2 each |
| 15. | Hand grinder (4inch & 7inch) | 04 each |
| 16. | Pin grinder (3mm) | 04 nos |
| 17. | Grinding disks & Cutting disks (4 in & 7 in) | 50 each |
| 18. | Grinding wheel for pin grinder (miscellaneous) | 30 each |
| 19. | Hand reamers with handle (8-16mm) *2 mm increments | 2 each |
| 20. | Tap set with handle (M3 to M6) | 04 each |
| 21. | Tap set with handle (M6-M12) *2 mm increments | 04 each |
| 22. | Lathe machines with all standard accessories (Tool room) | 05 nos. |

| | | |
|-----|--|-----------------------|
| 23. | T-max holders with carbide bits (different shape & 1/2 " & 3/4" sizes) | 05 set for each shape |
| 24. | Centre drills (12mm) & HSS drill bits (standard set, step set) | 5set for each shape |
| 25. | Knurling tools (straight & diamond) | 04 each |
| 26. | Thread pitch gauges (up to 2 mm) | 02 each |
| 27. | Thread ring gauge (M8-M16) *2 mm increments | 04 each |
| 28. | Dial indicator with magnetic stand (0.01mm) | 05 set |
| 29. | Radius gauge (R1 – R7.5) | 02 set |
| 30. | Radius gauge (R7.5 – R15) | 02 set |
| 31. | Plug gauges (Dia 8 to 20mm) *2 mm increments | 02 set |
| 32. | Ring gauges (Dia 8 to 20mm) *2 mm increments | 02 set |
| 33. | Universal milling machine (400 x 200 bed size) with all standard accessories | 05 nos. |
| 34. | Dial indicators (0-10mm) with magnetic stand | 10 set |
| 35. | Lever gauge (0-3mm) | 10 set |
| 36. | Parallel blocks | 08 set |
| 37. | Step clamps standard set | 08 set |
| 38. | Machine vice 5" standard size | 08 nos |
| 39. | Indexing head (worm wheel dia 40 & 60) | 02 nos. |
| 40. | Rotary table 150 mm | 03 nos. |
| 41. | Shell end mill cutter (dia 60 – 100 mm)*5 mm increments | 05 each |
| 42. | End mill cutter (dia 10- 30 mm) *5 mm increments | 05 each |
| 43. | Face mill cutter (dia 40-100 mm) *5 mm increments | 05 each |
| 44. | Surface grinding machine (400-500mm magnetic bed length) | 03 nos. |
| 45. | Cylindrical grinding machine (150mm center height) | 03 nos. |
| 46. | Grinding wheel (Aluminum oxide & silicon carbide) for surface grinder | 05 each |

| | | |
|-----|---|----------|
| 47. | Grinding wheel (Aluminum oxide & silicon carbide) for cylindrical grinder | 05 each. |
| 48. | Diamond wheel dresser with tilting stand | 05 nos. |
| 49. | Wheel balancing device with mandrel | 02 set. |
| 50. | Supporting block | 05 set. |
| 51. | 5" Grinding vice universal type | 03 nos. |
| 52. | Sine bar device | 03 nos. |
| 53. | Dial indicator (0.01mm) | 25 set. |

List of consumable supplies

| S.No. | Description |
|-------|--|
| 1. | Hacksaw blades (18 & 24teeth per inch) |
| 2. | MS plate 15 mm thickness (different sizes for bench work practice) |
| 3. | Grinding disk 4 inch |
| 4. | MS bar dia 30mm & 50mm for lathe operations practice |
| 5. | MS plate 30 mm thickness for milling operations practice |
| 6. | MS plate 15 mm thickness for grinding practice |
| 7. | MS bar dia 25 mm for cylindrical grinding |
| 8. | HSS tools (12mm x 12mm x 100mm) |
| 9. | Polishing abrasives / paste with different grits (miscellaneous) |
| 10. | Polishing sticks (miscellaneous) |
| 11. | Emery paper (200-400) |
| 12. | Drill bits of different sizes (1-13mm) |
| 13. | Drill bits of different sizes (13-20mm)*1 mm increments |
| 14. | Hammer (Ball Peen 250gm) |
| 15. | Power disc cutter (14inch) |
| 16. | Hacksaw blades (18-24 TPI) |

Credit values

The credit value of the National Vocational Certificate Level 2 in Dies & molds maker is defined by estimating the amount of time/ instruction hours required to complete each competency unit and competency standard. The NVQF uses a standard credit value of 1 credit = 10 hours of learning (Following Higher Education Commission (HEC) guidelines).

The credit values are as follows:

| Competency Standard | Estimate of hours | Credit |
|---|-------------------|--------|
| Module 1: Comply personal health and safety guidelines | 30 | 3 |
| Module 2: Perform bench works | 100 | 10 |
| Module 3: Perform lathe operation | 120 | 12 |
| Module 4: Perform milling operations | 100 | 10 |
| Module 5: Perform grinding operations | 80 | 8 |
| Module 6 Communicate the workplace policy and procedure | 20 | 2 |
| Module 7: Perform basic communication | 30 | 3 |
| Module 8: Perform basic computer application | 40 | 4 |

