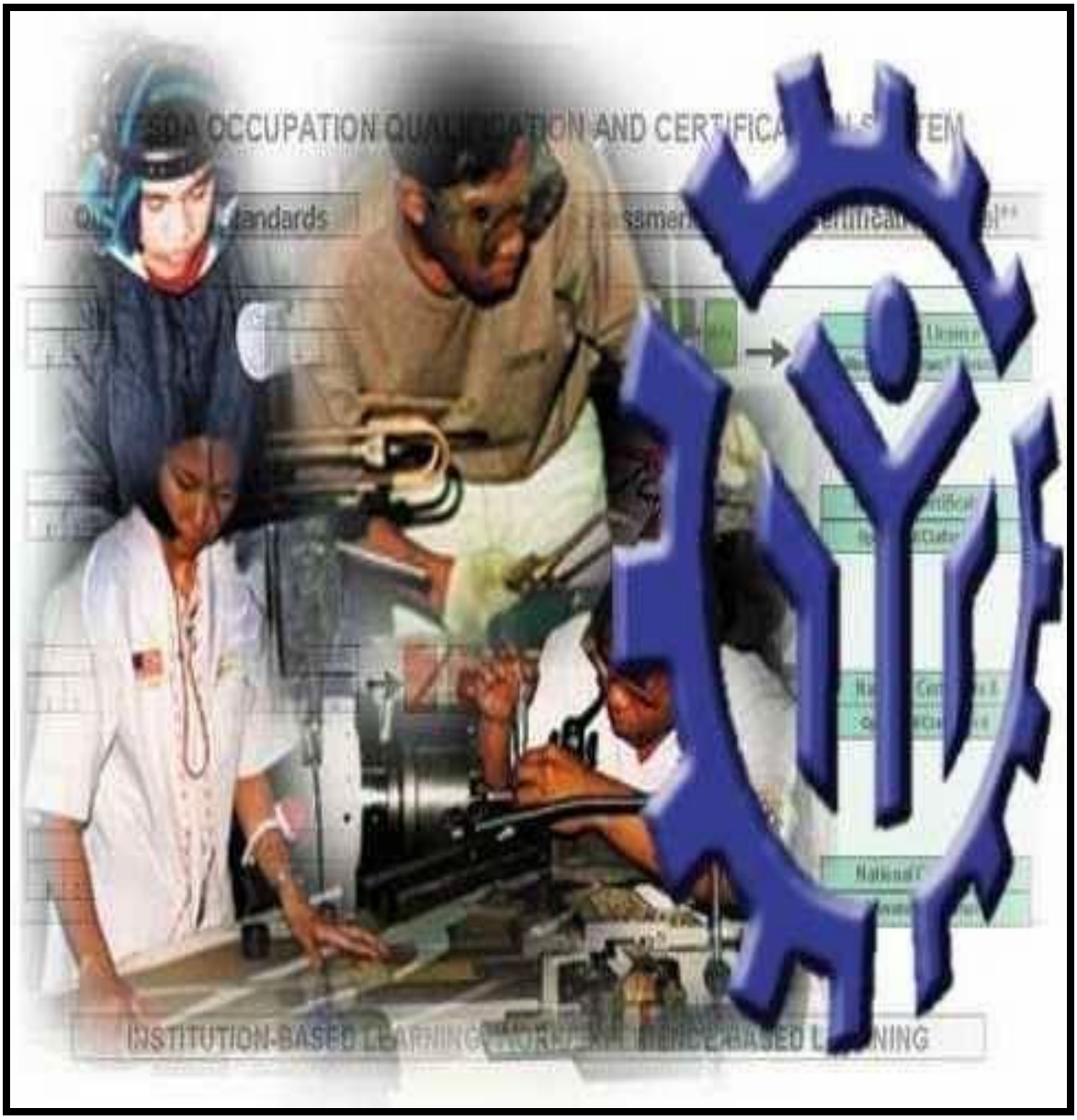
TRAINING REGULATIONS

MACHINING NC II



METALS AND ENGINEERING SECTOR

Technical Education and Skills Development Authority
East Service Road, South Superhighway, Taguig, Metro Manila

Technical Education and Skills Development Act of 1994
(Republic Act No. 7796)

Section 22, "Establishment and Administration of the National Trade Skills Standards" of the RA 7796 known as the TESDA Act mandates TESDA to establish national occupational skill standards. The Authority shall develop and implement a certification and accreditation program in which private industry group and trade associations are accredited to conduct approved trade tests, and the local government units to promote such trade testing activities in their respective areas in accordance with the guidelines to be set by the Authority.

The Training Regulations (TR) serve as basis for the:

1. Competency assessment and certification;
2. Registration and delivery of training programs; and
3. Development of curriculum and assessment instruments.

Each TR has four sections:

Section 1 Definition of Qualification - refers to the group of competencies that describes the different functions of the qualification.

Section 2 Competency Standards - gives the specifications of competencies required for effective work performance.

Section 3 Training Standards - contains information and requirements in designing training program for certain Qualification. It includes curriculum design, training delivery; trainee entry requirements; tools and requirements; tools and equipment; training facilities and trainer's qualification.

Section 4 National Assessment and Certification Arrangement - describes the policies governing assessment and certification procedure.

TABLE OF CONTENTS

METALS AND ENGINEERING SECTOR

MACHINING NC II

TRAINING REGULATIONS FOR MACHINING NC II

SECTION 1 MACHINING NC II QUALIFICATION

The Machining NC II Qualification consists of competencies that a person must achieve to set up and operate a variety of machine tools to perform precision machining operations.

Specifically, these Training Regulations in Machining covers turning, milling, precision grinding and bench work.

The Units of Competency comprising this qualification include the following:

Code No.	BASIC COMPETENCIES
500311105	Participate in workplace communication
500311106	Work in a team environment
500311107	Practice career professionalism
500311108	Practice occupational health and safety procedures

Code No.	COMMON COMPETENCIES
MEE722202	Interpret working drawings and sketches
MEE722203	Select and cut workshop materials
MEE722204	Perform shop computations (Basic)
MEE722205	Measure workpiece (Basic)
MEE722207	Perform shop computations (Intermediate)
MEE722208	Measure workpiece using angular measuring instruments
MEE722211	Perform preventive and corrective maintenance

Code No.	CORE COMPETENCIES
MEE722301	Perform bench work (Basic)
MEE722305	Perform bench work (Complex)
MEE722302	Turn workpiece (Basic)
MEE722306	Turn workpiece (Intermediate)
MEE722303	Mill workpiece (Basic)
MEE722307	Mill workpiece (Intermediate)
MEE722304	Grind workpiece (Basic)
MEE722308	Grind workpiece (Complex)

A person who has achieved this qualification is competent to be:

- **Machinist**
- **Lathe operator**
- **Milling machine operator**
- **Precision grinding machine operator**
- **Bench worker/fitter**

SECTION 2 COMPETENCY STANDARDS

This section gives the details of the contents of the basic, common and core units of competency required in MACHINING NC II.

BASIC COMPETENCIES

UNIT OF COMPETENCY : **PARTICIPATE IN WORKPLACE COMMUNICATION**

UNIT CODE : **500311105**

UNIT DESCRIPTOR : This unit covers the knowledge, skills and attitudes required to gather, interpret and convey information in response to workplace requirements.

ELEMENT	PERFORMANCE CRITERIA ***Italicized terms*** are elaborated in the Range of Variables
1. Obtain and convey workplace information	1.1 Specific and relevant information is accessed from ***appropriate sources*** 1.2 Effective questioning , active listening and speaking skills are used to gather and convey information 1.3 Appropriate ***medium*** is used to transfer information and ideas 1.4 Appropriate non- verbal communication is used 1.5 Appropriate lines of communication with supervisors and colleagues are identified and followed 1.6 Defined workplace procedures for the location and ***storage*** of information are used 1.7 Personal interaction is carried out clearly and concisely
2. Participate in workplace meetings and discussions	2.1 Team meetings are attended on time 2.2 Own opinions are clearly expressed and those of others are listened to without interruption 2.3 Meeting inputs are consistent with the meeting purpose and established ***protocols*** 2.4 ***Workplace interactions*** are conducted in a courteous manner 2.5 Questions about simple routine workplace procedures and maters concerning working conditions of employment are asked and responded to 2.6 Meetings outcomes are interpreted and implemented
3. Complete relevant work related documents	3.1 Range of ***forms*** relating to conditions of employment are completed accurately and legibly 3.2 Workplace data is recorded on standard workplace forms and documents 3.3 Basic mathematical processes are used for routine calculations 3.4 Errors in recording information on forms/ documents are identified and properly acted upon 3.5 Reporting requirements to supervisor are completed according to organizational guidelines

RANGE OF VARIABLES

VARIABLE	RANGE
1. Appropriate sources	1.1. Team members 1.2. Suppliers 1.3. Trade personnel 1.4. Local government 1.5. Industry bodies
2. Medium	2.1. Memorandum 2.2. Circular 2.3. Notice 2.4. Information discussion 2.5. Follow-up or verbal instructions 2.6. Face to face communication
3. Storage	3.1. Manual filing system 3.2. Computer-based filing system
4. Forms	4.1. Personnel forms, telephone message forms, safety reports
5. Workplace interactions	5.1. Face to face 5.2. Telephone 5.3. Electronic and two way radio 5.4. Written including electronic, memos, instruction and forms, non-verbal including gestures, signals, signs and diagrams
6. Protocols	6.1. Observing meeting 6.2. Compliance with meeting decisions 6.3. Obeying meeting instructions

EVIDENCE GUIDE

1. Critical aspects of competency	Assessment requires evidence that the candidate: 1.1. Prepared written communication following standard format of the organization 1.2. Accessed information using communication equipment 1.3. Made use of relevant terms as an aid to transfer information effectively 1.4. Conveyed information effectively adopting the formal or informal communication
2. Underpinning knowledge and attitudes	2.1. Effective communication 2.2. Different modes of communication 2.3. Written communication 2.4. Organizational policies 2.5. Communication procedures and systems 2.6. Technology relevant to the enterprise and the individual's work responsibilities
3. Underpinning skills	3.1. Follow simple spoken language 3.2. Perform routine workplace duties following simple written notices 3.3. Participate in workplace meetings and discussions 3.4. Complete work related documents 3.5. Estimate, calculate and record routine workplace measures 3.6. Basic mathematical processes of addition, subtraction, division and multiplication 3.7. Ability to relate to people of social range in the workplace 3.8. Gather and provide information in response to workplace Requirements
4. Resource implications	4.1. Fax machine 4.2. Telephone 4.3. Writing materials 4.4. Internet
5. Method of assessment	5.1. Direct Observation 5.2. Oral interview and written test
6. Context of assessment	Competency may be assessed individually in the actual workplace or through accredited institution

UNIT OF COMPETENCY : **WORK IN TEAM ENVIRONMENT**

UNIT CODE : **500311106**

UNIT DESCRIPTOR : This unit covers the skills, knowledge and attitudes to identify role and responsibility as a member of a team.

ELEMENT	PERFORMANCE CRITERIA ***Italicized terms*** are elaborated in the Range of Variables
1. Describe team role and scope	1.1. The ***role and objective of the team*** is identified from available ***sources of information*** 1.2. Team parameters, reporting relationships and responsibilities are identified from team discussions and appropriate external sources
2. Identify own role and responsibility within team	2.1. Individual role and responsibilities within the team environment are identified 2.2. Roles and responsibility of other team members are identified and recognized 2.3. Reporting relationships within team and external to team are identified
3. Work as a team member	3.1. Effective and appropriate forms of communications used and interactions undertaken with team members who contribute to known team activities and objectives 3.2. Effective and appropriate contributions made to complement team activities and objectives, based on individual skills and competencies and ***workplace context*** 3.3. Observed protocols in reporting using standard operating procedures 3.4. Contribute to the development of team work plans based on an understanding of team's role and objectives and individual competencies of the members.

RANGE OF VARIABLES

VARIABLE	RANGE
1. Role and objective of team	1.1. Work activities in a team environment with enterprise or specific sector 1.2. Limited discretion, initiative and judgement maybe demonstrated on the job, either individually or in a team environment
2. Sources of information	2.1. Standard operating and/or other workplace procedures 2.2. Job procedures 2.3. Machine/equipment manufacturer's specifications and instructions 2.4. Organizational or external personnel 2.5. Client/supplier instructions 2.6. Quality standards 2.7. OHS and environmental standards
3. Workplace context	3.1. Work procedures and practices 3.2. Conditions of work environments 3.3. Legislation and industrial agreements 3.4. Standard work practice including the storage, safe handling and disposal of chemicals 3.5. Safety, environmental, housekeeping and quality guidelines

EVIDENCE GUIDE

1. Critical aspects of competency	Assessment requires evidence that the candidate: 1.1. Operated in a team to complete workplace activity 1.2. Worked effectively with others 1.3. Conveyed information in written or oral form 1.4. Selected and used appropriate workplace language 1.5. Followed designated work plan for the job 1.6. Reported outcomes
2. Underpinning knowledge and attitude	2.1. Communication process 2.2. Team structure 2.3. Team roles 2.4. Group planning and decision making
3. Underpinning skills	3.1. Communicate appropriately, consistent with the culture of the workplace
4. Resource implications	The following resources MUST be provided: 4.1. Access to relevant workplace or appropriately simulated environment where assessment can take place 4.2. Materials relevant to the proposed activity or tasks
5. Method of assessment	Competency may be assessed through: 5.1. Observation of the individual member in relation to the work activities of the group 5.2. Observation of simulation and or role play involving the participation of individual member to the attainment of organizational goal 5.3. Case studies and scenarios as a basis for discussion of issues and strategies in teamwork
6. Context of assessment	6.1. Competency may be assessed in workplace or in a simulated workplace setting 6.2. Assessment shall be observed while task are being undertaken whether individually or in group

UNIT OF COMPETENCY : **PRACTICE CAREER PROFESSIONALISM**

UNIT CODE : **500311107**

UNIT DESCRIPTOR : This unit covers the knowledge, skills and attitudes in promoting career growth and advancement.

ELEMENT	PERFORMANCE CRITERIA ***Italicized terms*** are elaborated in the Range of Variables
1. Integrate personal objectives with organizational goals	1.1 Personal growth and work plans are pursued towards improving the qualifications set for the profession 1.2 Intra- and interpersonal relationships are maintained in the course of managing oneself based on performance ***evaluation*** 1.3 Commitment to the organization and its goal is demonstrated in the performance of duties
2. Set and meet work priorities	2.1 Competing demands are prioritized to achieve personal, team and organizational goals and objectives. 2.2 ***Resources*** are utilized efficiently and effectively to manage work priorities and commitments 2.3 Practices along economic use and maintenance of equipment and facilities are followed as per established procedures
3. Maintain professional growth and development	3.1 ***Trainings and career opportunities*** are identified and availed of based on job requirements 3.2 ***Recognitions*** are sought/received and demonstrated as proof of career advancement 3.3 ***Licenses and/or certifications*** relevant to job and career are obtained and renewed

RANGE OF VARIABLES

VARIABLE	RANGE
1. Evaluation	1.1 Performance Appraisal 1.2 Psychological Profile 1.3 Aptitude Tests
2. Resources	2.1 Human 2.2 Financial 2.3 Technology 2.3.1 Hardware 2.3.2 Software
3. Trainings and career opportunities	3.1 Participation in training programs 3.1.1 Technical 3.1.2 Supervisory 3.1.3 Managerial 3.1.4 Continuing Education 3.2 Serving as Resource Persons in conferences and workshops
4. Recognitions	4.1 Recommendations 4.2 Citations 4.3 Certificate of Appreciations 4.4 Commendations 4.5 Awards 4.6 Tangible and Intangible Rewards
5. Licenses and/or certifications	5.1 National Certificates 5.2 Certificate of Competency 5.3 Support Level Licenses 5.4 Professional Licenses

EVIDENCE GUIDE

1. Critical aspects of competency	Assessment requires evidence that the candidate: 1.1 Attained job targets within key result areas (KRAs) 1.2 Maintained intra - and interpersonal relationship in the course of managing oneself based on performance evaluation 1.3 Completed trainings and career opportunities which are based on the requirements of the industries 1.4 Acquired and maintained licenses and/or certifications according to the requirement of the qualification
2. Underpinning knowledge	2.1 Work values and ethics (Code of Conduct, Code of Ethics, etc.) 2.2 Company policies 2.3 Company operations, procedures and standards 2.4 Fundamental rights at work including gender sensitivity 2.5 Personal hygiene practices
3. Underpinning skills	3.1 Appropriate practice of personal hygiene 3.2 Intra and Interpersonal skills 3.3 Communication skills
4. Resource implications	The following resources **MUST** be provided: 4.1 Workplace or assessment location 4.2 Case studies/scenarios
5. Method of assessment	Competency may be assessed through: 5.1 Portfolio Assessment 5.2 Interview 5.3 Simulation/Role-plays 5.4 Observation 5.5 Third Party Reports 5.6 Exams and Tests
6. Context of assessment	Competency may be assessed in the work place or in a simulated work place setting

UNIT OF COMPETENCY : **PRACTICE OCCUPATIONAL HEALTH AND SAFETY PROCEDURES**

UNIT CODE : **500311108**

UNIT DESCRIPTOR : This unit covers the outcomes required to comply with regulatory and organizational requirements for occupational health and safety.

ELEMENT	PERFORMANCE CRITERIA ***Italicized terms*** are elaborated in the Range of Variables
1. Identify hazards and risks	1.1 ***Safety regulations*** and workplace safety and hazard control practices and procedures are clarified and explained based on organization procedures 1.2 ***Hazards/risks*** in the workplace and their corresponding indicators are identified to minimize or eliminate risk to co-workers, workplace and environment in accordance with organization procedures 1.3 ***Contingency measures*** during workplace accidents, fire and other emergencies are recognized and established in accordance with organization procedures
2. Evaluate hazards and risks	2.1 Terms of maximum tolerable limits which when exceeded will result in harm or damage are identified based on threshold limit values (TLV) 2.2 Effects of the hazards are determined 2.3 OHS issues and/or concerns and identified safety hazards are reported to designated personnel in accordance with workplace requirements and relevant workplace OHS legislation
3. Control hazards and risks	3.1 Occupational Health and Safety (OHS) procedures for controlling hazards/risks in workplace are consistently followed 3.2 Procedures for dealing with workplace accidents, fire and emergencies are followed in accordance with organization OHS policies 3.3 ***Personal protective equipment (PPE)*** is correctly used in accordance with organization OHS procedures and practices 3.4 Appropriate assistance is provided in the event of a workplace emergency in accordance with established organization protocol
4. Maintain OHS awareness	4.1 ***Emergency-related drills and trainings*** are participated in as per established organization guidelines and procedures 4.2 ***OHS personal records*** are completed and updated in accordance with workplace requirements

RANGE OF VARIABLES

VARIABLE	RANGE
1. Safety regulations	May include but are not limited to: 1.1 Clean Air Act 1.2 Building code 1.3 National Electrical and Fire Safety Codes 1.4 Waste management statutes and rules 1.5 Philippine Occupational Safety and Health Standards 1.6 DOLE regulations on safety legal requirements 1.7 ECC regulations
2. Hazards/Risks	May include but are not limited to: 2.1 Physical hazards – impact, illumination, pressure, noise, vibration, temperature, radiation 2.2 Biological hazards- bacteria, viruses, plants, parasites, mites, molds, fungi, insects 2.3 Chemical hazards – dusts, fibers, mists, fumes, smoke, gasses, vapors 2.4 Ergonomics • Psychological factors – over exertion/ excessive force, awkward/static positions, fatigue, direct pressure, varying metabolic cycles • Physiological factors – monotony, personal relationship, work out cycle
3. Contingency measures	May include but are not limited to: 3.1 Evacuation 3.2 Isolation 3.3 Decontamination 3.4 (Calling designed) emergency personnel
4. PPE	May include but are not limited to: 4.1 Mask 4.2 Gloves 4.3 Goggles 4.4 Hair Net/cap/bonnet 4.5 Face mask/shield 4.6 Ear muffs 4.7 Apron/Gown/coverall/jump suit 4.8 Anti-static suits
5. Emergency-related drills and training	5.1 Fire drill 5.2 Earthquake drill 5.3 Basic life support/CPR 5.4 First aid 5.5 Spillage control 5.6 Decontamination of chemical and toxic 5.7 Disaster preparedness/management
6. OHS personal records	6.1 Medical/Health records 6.2 Incident reports 6.3 Accident reports 6.4 OHS-related training completed

EVIDENCE GUIDE

1. Critical aspects of competency	Assessment requires evidence that the candidate: 1.1 Explained clearly established workplace safety and hazard control practices and procedures 1.2 Identified hazards/risks in the workplace and its corresponding indicators in accordance with company procedures 1.3 Recognized contingency measures during workplace accidents, fire and other emergencies 1.4 Identified terms of maximum tolerable limits based on threshold limit value- TLV. 1.5 Followed Occupational Health and Safety (OHS) procedures for controlling hazards/risks in workplace 1.6 Used Personal Protective Equipment (PPE) in accordance with company OHS procedures and practices 1.7 Completed and updated OHS personal records in accordance with workplace requirements
2. Underpinning knowledge and attitude	2.1 OHS procedures and practices and regulations 2.2 PPE types and uses 2.3 Personal hygiene practices 2.4 Hazards/risks identification and control 2.5 Threshold Limit Value -TLV 2.6 OHS indicators 2.7 Organization safety and health protocol 2.8 Safety consciousness 2.9 Health consciousness
3. Underpinning skills	3.1 Practice of personal hygiene 3.2 Hazards/risks identification and control skills 3.3 Interpersonal skills 3.4 Communication skills
4. Resource implications	The following resources **MUST** be provided: 4.1 Workplace or assessment location 4.2 OHS personal records 4.3 PPE 4.4 Health records
5. Method of assessment	Competency may be assessed through: 5.1 Portfolio Assessment 5.2 Interview 5.3 Case Study/Situation
6. Context of assessment	Competency may be assessed in the work place or in a simulated work place setting

COMMON COMPETENCIES

UNIT OF COMPETENCY : **INTERPRET WORKING DRAWINGS AND SKETCHES**

UNIT CODE : **MEE722202**

UNIT DESCRIPTOR : This unit covers the competencies required to read and interpret drawings and sketches.

ELEMENT	PERFORMANCE CRITERIA ***Italicized terms*** are elaborated in the Range of Variables
1. Interpret technical drawing	1.1 Components, assemblies or objects recognized as required. 1.2 Dimensions identified as appropriate. 1.3 Instructions identified and followed as required. 1.4 Material requirements identified as required. 1.5 Symbols recognized as appropriate in the *drawing*. 1.6 ***Tolerance***, limits and fits identified in the drawing.
2. Prepare freehand sketch of parts	2.1 Sketch drawn correctly and appropriately. 2.2 Sketch depicted objects or part appropriately. 2.3 Dimensions indicated in sketch are clear and correct. 2.4 Instructions included in sketch are clear and correct. 2.5 Base line or datum points indicated as required.
3. Interpret details from freehand sketch	3.1 Components, assemblies or objects recognized as required. 3.2 Dimensions identified as appropriate. 3.3 Instructions identified and followed as required. 3.4 Material requirements identified as required. 3.5 Symbols recognized as appropriate in the drawing.

RANGE OF VARIABLES

VARIABLE	RANGE
1. Drawing	1.1 Drawing technique include 1.1.1 Perspective 1.1.2 Exploded view 1.1.3 Hidden view technique 1.2 Projections 1.2.1 First angle projections 1.2.2 Third angle projections
2. Tolerance	2.1 General tolerance 2.2 Angular tolerance 2.3 Geometric tolerance

EVIDENCE GUIDE

1. Critical aspects of evidence	Assessment requires evidence that the candidate: 1.1 Interpreted technical drawing 1.2 Prepared sketches 1.3 Interpreted sketches.
2. Underpinning knowledge	2.1 Alphabet of lines 2.2 Projections 2.3 Drawing symbols 2.4 Dimensioning techniques 2.5 Tolerance, limits and fits 2.6 Engineering materials 2.7 Drawing tools and supplies
3. Underpinning skills	3.1 Handling tools and drawing instruments 3.2 Using measuring instruments
4. Resource implications	The following resources **MUST** be provided 4.1 Drafting room/facilities and drafting instruments and supplies appropriate to the activity 4.2 Measuring tools 4.3 Drawings, sketches or blueprint 4.4 Specimen parts/components
5. Method of assessment	The following assessment methods are suggested: 5.1 direct observation 5.2 written or oral short answer questions 5.3 demonstration 5.4 project/work sample 5.5 portfolio
6. Context of assessment	Competency may be assessed in the workplace or in simulated workplace environment.

UNIT OF COMPETENCY : **SELECT/ CUT WORKSHOP MATERIALS**

UNIT CODE : **MEE722203**

UNIT DESCRIPTOR : This unit covers the skills and knowledge required to select and cut workshop materials

ELEMENT	PERFORMANCE CRITERIA ***Italicized terms*** are elaborated in the Range of Variables
1. Determine requirement	1.1 ***Plans/ drawings*** are interpreted to produce component to specification 1.2 Sequence of operation is determined to produce component to specification
2. Select and measure materials	2.1 ***Materials*** are selected according to the requirement of the operation 2.2 Materials are measured to required level of accuracy using measuring tools 2.3 ***Measuring tools*** are used according to manufacturers specification
3. Cut materials	3.1 Materials are cut according to plans/drawing instruction 3.2 ***Cutting tools/equipment*** are used based on manufacturers specification, appropriate techniques or the ***safety procedure***

RANGE OF VARIABLES

VARIABLE	RANGE
1. Plan/drawings	1.1 Dimensions 1.2 Tolerance
2. Materials	2.1 Ferrous 2.2 Non-ferrous
3. Measuring tools	3.1 Steel rule 3.2 Pull-push rule
4. Cutting tools/equipment	4.1 Hacksaw 4.2 Power hacksaw
5. Safety procedure	Safety involves the handling of 5.1 Equipment 5.2 Tools 5.3 Materials

EVIDENCE GUIDE

1. Critical aspects of evidence	Assessment requires evidence that the candidate 1.1 Interpreted plans/drawings 1.2 Selected natural according to the requirement 1.3 Performed cutting operation 1.4 Cutting tools/equipment used safely
2. Underpinning knowledge and attitude	2.1 Shop safety practices 2.1.1 Safe working habits 2.1.2 Safe handling of tools, equipment and materials 2.2 Blueprint reading 2.2.1 Standard drawing scales, symbols and abbreviations 2.2.2 Assembly and details of drawing 2.2.3 Dimensions 2.3 Measurement 2.3.1 Linear measuring tools 2.4 Materials and related science 2.4.1 Classification and mechanical properties of engineering materials
3. Underpinning skills	3.1 Selecting materials 3.2 Using measuring tools 3.3 Operating power hacksaw
4. Resource implications	The following resources **MUST** be provided 4.1 Tools, equipment and facilities appropriate processes of an activity 4.2 Materials relevant to the proposal activity 4.3 Drawings/plans
5. Method of assessment	The following assessment activity are suggested 5.1 Direct observation 5.2 Oral short answer question 5.3 Practical exercises
6. Context of assessment	Competency may be assessed in the workplace or in simulated work environment

UNIT OF COMPETENCY : **PERFORM SHOP COMPUTATIONS (BASIC)**

UNIT CODE : **MEE722204**

UNIT DESCRIPTOR : This unit covers the competencies required to perform basic calculations using the four fundamental operation.

ELEMENT	PERFORMANCE CRITERIA ***Italicized terms*** are elaborated in the Range of Variables
1. Perform four fundamental operations.	1.1 Simple calculations performed using ***four fundamental operations.*** 1.2 Simple calculations performed involving fractions and mixed numbers using four fundamental operations
2. Perform basic calculations involving fractions and decimals	2.1 Simple calculations are performed involving fractions and decimals using the four fundamental operations. 2.2 Decimal are converted into fraction (and vice versa) accurately.
3. Perform basic calculations involving percentages.	3.1 Simple calculations are performed to obtain percentages from information expressed in either fractional or decimal format.
4. Perform basic calculation involving ration and proportion	4.1 Simple calculations are performed involving ratios and proportion using whole numbers, fractions and decimal fractions.
5. Perform calculations on algebraic expressions	5.1 Simple calculations are performed on algebraic expressions using the four fundamental operations. 5.2 Simple transposition of formulae is carried out to isolate the variable required, involving the four fundamental operations.

RANGE OF VARIABLES

VARIABLE	RANGE
1. Four fundamental operations	1.1 Addition 1.2 Subtraction 1.3 Multiplication 1.4 Division
2. Algebraic expressions	Calculation using formula for determining 2.1 tap drill size 2.2 feed 2.3 speed

EVIDENCE GUIDE

1. Critical aspects of evidence	Assessment requires evidence that the candidate performed calculations: 1.1 using four fundamental operations 1.2 involving fractions and mixed numbers 1.3 involving fractions and decimals 1.4 involving percentages 1.5 involving ratio and proportion 1.6 on algebraic expressions 1.7 of simple formulae
2. Underpinning knowledge and attitude	2.1 English and metric system of measurements
3. Underpinning skills	3.1 Performing calculations using pen and paper or on a calculator.
4. Resource implications	The following resources **MUST** be provided 4.1 Tools, equipment and facilities appropriate to processes or activity 4.2 Materials relevant to the proposed activity
5. Method of assessment	The following assessment methods are suggested: 5.1 written or oral short answer questions 5.2 practical exercises
6. Context of assessment	Competency may be assessed in the workplace or in simulated workplace environment.

UNIT OF COMPETENCY : **MEASURE WORKPIECE (BASIC)**

UNIT CODE : **MEE722205**

UNIT DESCRIPTOR : This unit covers the competencies required to measure workpieces using measuring instruments such as steel rules, vernier calipers, micrometers, etc.…

ELEMENT	PERFORMANCE CRITERIA ***Italicized terms*** are elaborated in the Range of Variables
1. Select and use measuring tools	1.1 ***Measuring tools*** are selected and used according to the level of accuracy required. 1.2 ***Measurements*** taken are accurate to the finest graduation of the selected measuring instrument. 1.3 Measuring technique used is correct and appropriate to the device used.
2. Clean and store measuring tools	2.1 Care and storage of devices undertaken to manufacturer's specifications or standard operating procedures.

RANGE OF VARIABLES

VARIABLE	RANGE
1. Measuring tools	Measuring tools include 1.1 Steel tape 1.2 Steel rule 1.3 Straight edge 1.4 Combination square 1.5 Steel square 1.6 Divider or trammel 1.7 Caliper 1.8 Protractor 1.9 Vernier caliper 1.10 Micrometer
2. Measurements	2.1 length 2.2 diameter 2.3 depth 2.4 flatness 2.5 straightness 2.6 squareness

EVIDENCE GUIDE

1. Critical aspects of evidence	Assessment requires evidence that the candidate: 1.1 Selected and used measuring instruments 1.2 Cleaned and stored measuring instruments
2. Underpinning knowledge	2.1 Types, purposes and accuracy of measuring instruments 2.2 Capability of measuring instruments 2.3 Part dimensions and tolerances 2.4 Techniques for measuring dimensions 2.5 Care and storage procedure of measuring tools
3. Underpinning skills	Safe handling of measuring tools and materials
4. Resource implications	The following resources **MUST** be provided 4.1 Tools, equipment and facilities appropriate to the activity 4.2 Specimen component or part to the proposed activity
5. Method of assessment	The following assessment methods are suggested: 5.1 direct observation 5.2 demonstration 5.3 written or oral short answer questions 5.4 portfolio
6. Context of assessment	Competency may be assessed in the workplace or in simulated workplace environment.

UNIT OF COMPETENCY : **PERFORM SHOP COMPUTATIONS (INTERMEDIATE)**

UNIT CODE : **MEE722207**

UNIT DESCRIPTOR : This unit covers the competencies required to perform calculation involving triangles and tapers.

ELEMENT	PERFORMANCE CRITERIA ***Italicized terms*** are elaborated in the Range of Variables
1. Perform calculations involving triangles	1.1 Problems involving right triangles are performed using the ***trigonometric functions***. 1.2 Problems involving non-right triangles are performed using sine and cosine rules.
2. Calculate taper	2.1 Taper of work calculated correctly using appropriate formula.

RANGE OF VARIABLES

VARIABLE	RANGE
1. trigonometric functions	1.1 Sine 1.2 Cosine 1.3 Tangent 1.4 Cotangent 1.5 Secant 1.6 Cosecant

EVIDENCE GUIDE

1. Critical aspects of evidence	Assessment requires evidence that the candidate performed calculations: 1.1 Involving right triangles 1.2 Involving non-right triangles 1.3 involving tapers
2. Underpinning knowledge and attitude	2.1 English and metric system of measurements 2.2 Geometrical shapes
3. Underpinning skills	Performing calculations using pen and paper or on a calculator
4. Resource implications	The following resources **MUST** be provided 4.1 Tools, equipment and facilities appropriate to processes or activity 4.2 Materials relevant to the proposed activity
5. Method of assessment	The following assessment methods are suggested: 5.1 written or oral short answer questions 5.2 practical exercises
6. Context of assessment	Competency may be assessed in the workplace or in simulated workplace environment.

UNIT OF COMPETENCY : **MEASURE WORKPIECE USING ANGULAR MEASURING INSTRUMENTS**

UNIT CODE : **MEE722208**

UNIT DESCRIPTOR : This unit covers the competencies required to measure workpieces using angular measuring instruments.

ELEMENT	PERFORMANCE CRITERIA ***Italicized terms*** are elaborated in the Range of Variables
1. Select and use angular measuring tools	1.1 ***Angular measuring tools*** are selected and used according to the level of accuracy required. 1.2 ***Measurements*** taken are accurate to the finest graduation of the selected measuring instrument. 1.3 Measuring technique used is correct and appropriate to the device used.
2. Maintain angular measuring tools	2.1 Measuring tools are adjusted and maintained to the required accuracy utilizing manufacturer's or worksite procedures.
3. Clean and store measuring tools	3.1 Care and storage of devices undertaken to manufacturer's specifications or standard operating procedures.

RANGE OF VARIABLES

VARIABLE	RANGE
1. Angular measuring tools	Measuring tools include 1.1 Bevel protractor 1.2 Gage blocks 1.3 Sine bar
2. Measurements	2.1 angle 2.2 taper

EVIDENCE GUIDE

1. Critical aspects of evidence	Assessment requires evidence that the candidate: 1.1 Selected and used angular measuring instruments 1.2 Maintained/adjusted instruments 1.3 Cleaned and stored measuring instruments
2. Underpinning knowledge	2.1 Types, purposes and accuracy of angular measuring instruments 2.2 Capability of measuring tools 2.3 Techniques for measuring angles and tapers 2.4 Care and storage procedure of measuring tools
3. Underpinning skills	3.1 Safe handling of measuring tools and materials 3.2 Reading vernier scale 3.3 Reading micrometer
4. Resource implications	The following resources **MUST** be provided 4.1 Tools, equipment and facilities appropriate to the activity 4.2 Specimen component or part to the proposed activity
5. Method of assessment	The following assessment methods are suggested: 5.1 direct observation 5.2 demonstration 5.3 written or oral short answer questions 5.4 portfolio
6. Context of assessment	Competency may be assessed in the workplace or in simulated workplace environment.

UNIT OF COMPETENCY : **PERFORM PREVENTIVE AND CORRECTIVE MAINTENANCE**

UNIT CODE : **MEE722211**

UNIT DESCRIPTOR : This unit covers the knowledge and skills required in performing preventive and corrective maintenance such as inspection and repair of hand tools, cleaning and lubrication of machine parts and changing drive pulley and belts.

ELEMENT	PERFORMANCE CRITERIA ***Italicized terms*** are elaborated in the Range of Variables
1. Perform inspection of machine	1.1 Machine ***inspected*** according to worksite procedures. 1.2 Status/Report recorded on pro-forma or reported orally according to worksite procedure.
2. Perform cleaning and lubricating of machine	2.1 ***Machines*** lubricated as per manufacturer's recommendation using appropriate ***tools and materials*** 2.2 Fluids and lubricants replaced and/or topped up according to prescribed schedule.
3. Perform minor machine repair and adjustments	3.1 Minor machine repairs performed according to manufacturer's instruction or worksite procedures. 3.2 Machine moving parts adjusted to manufacturer's specifications.
4. Maintain hand tools	4.1 Tool cutting ground to recommended specifications 4.2 Hand tools lubricated and stored according to prescribed procedure

RANGE OF VARIABLES

VARIABLES	RANGE
1. Inspected	Inspected machine parts include: 1.1 V-belt 1.2 Bearing 1.3 Gears 1.4 Clutch 1.5 Drive pulley
2. Machines	Machine included but not limited to: 2.1 Lathe machine 2.2 Milling machine 2.3 Grinding machine
3. Tools and materials	Tools and materials used include: 3.1 Lubricants 3.2 Oil can 3.3 Grease gun 3.4 Oil 3.5 Coolant or compound

EVIDENCE GUIDE

1. Critical aspects of evidence	Assessment requires evidence that that the candidate 1.1 performed inspection of machine 1.2 performed cleaning and lubricating of machine 1.3 performed minor machine repairs and adjustments
2. Underpinning knowledge	2.1 Proper cleaning and oiling 2.2 Kinds of oil 2.3 Parts and function of machine tools 2.4 Cutting oil, coolant or compound 2.5 Pulleys and belts 2.6 Location of main switches of the machine 2.7 Handling and storage of tools 2.8 Checklist of safe working conditions 2.9 Procedures in cleaning and disposal of waste materials
3. Underpinning skills	3.1 Inspecting and repairing hand tools 3.2 Inspecting and changing drive pulleys and belts 3.3 Replacing and adjusting machine parts 3.4 Distinguishing old and new coolant 3.5 Distinguishing odor of polluted coolant 3.6 Selecting coolant, cutting oil or compounds 3.7 Changing coolant 3.8 Inspecting work area for safe working environment 3.9 Cleaning work area 3.10 Disposing metal scraps, chips and waste materials.
4. Resource Implications	The following resources **MUST** be provided 4.1 Tools, equipment and facilities appropriate to processes or activity 4.2 Materials relevant to the proposed activity
5. Method of assessment	The following assessment methods are suggested: 5.1 direct observation of activities 5.2 oral or written questioning
6. Context of assessment	Competency may be assessed in the workplace or in simulated workplace environment.

CORE COMPETENCIES

UNIT OF COMPETENCY : **Perform Bench Work (Basic)**

UNIT CODE : **MEE722301**

UNIT DESCRIPTOR : This unit covers the competencies required to determine job requirements, perform basic bench work operations (i.e. layout; cutting with hacksaw and chisel; filing; drilling; tapping etc…) and check the components for conformance to specifications.

ELEMENT	PERFORMANCE CRITERIA ***Italicized terms*** are elaborated in the Range of Variables
1. Layout and mark dimensions/ features on workpiece	1.1 ***Materials*** are selected according to the requirements specified in the drawing. 1.2 Dimensions/features are laid out and marked in accordance with drawing specifications using ***bench work tools and equipment.*** 1.3 Layouting and marking are performed applying knowledge on safety procedures and using personal protective devices.
2. Cut, chip and file flat, rectangular or round blocks	2.1 Workpieces are clamped in ***workholding devices*** to avoid damage and accidents. 2.2 Workpieces are cut, chipped or filed to within tolerance specified in the drawing. 2.3 Broken or dull hacksaw blades are replaced according to requirements 2.4 ***Bench work operations*** are performed applying knowledge on safety procedures and using personal protective devices.
3. Drill, ream and lap holes	3.1 Hole is drilled, reamed, spot-faced and lapped to drawing specification. 3.2 Drilling, reaming or lapping holes are performed according to recommended sequence. 3.3 Operations are performed applying knowledge on safety procedures and using personal protective devices.
4. Cut threads using tap and stock and die	4.1 Thread is cut to fit gage or mating screw, within tolerance given in the blueprint 4.2 Thread is cut in accordance with the recommended tapping sequence 4.3 Thread cutting operations are performed applying knowledge on safety procedures and using personal protective devices.
5. Off-hand grind cutting tools	5.1 Cut edges are honed and free of burrs. 5.2 Cutter is sharpened to conform with specifications. 5.3 Cutters are ground using appropriate cooling agents. 5.4 Cutting tool grinding is performed applying knowledge on safety procedures and using personal protective devices.

RANGE OF VARIABLES

VARIABLE	RANGE
1. Materials	Materials used in bench work operations include 1.1 Ferrous 1.2 Non Ferrous
2. Bench work tools and Equipment	Equipment and tools may include 2.1 Drill Press 2.2 Pedestal Grinder 2.3 Surface plate 2.4 Layout and marking tools 2.5 Cutting tools (hacksaw, chisel, files) 2.6 Drills, reamers, laps 2.7 Thread cutting tools (taps and stock and die) 2.8 Inspection and measuring tools (templates, vernier caliper, micrometer, straight edge, gages, etc…)
3. Workholding Devices	Workholding devices include the use of 3.1 Clamps 3.2 Vises
4. Bench work operations	Bench work operations 4.1 Layout and marking 4.2 Cutting 4.3 Chipping 4.4 Filing 4.5 Drilling, boring, counterboring, spot-facing 4.6 Lapping 4.7 Reaming 4.8 Thread cutting 4.9 Off-hand grinding

EVIDENCE GUIDE

1. Critical aspects of evidence	Assessment requires evidence that the candidate: 1.1 Laid-out and marked dimensions/features on the workpiece 1.2 Cut, chipped and filed workpiece. 1.3 Drilled, reamed and lapped holes. 1.4 Cut threads 1.5 Performed off-hand grinding
2. Underpinning knowledge and attitude	2.1 Shop safety practices 2.1.1 Safe working habits 2.1.2 Identification of hazardous areas 2.1.3 Protective clothing and devices 2.1.4 Safe handling of tools, equipment and materials 2.1.5 Housekeeping 2.1.6 First-aid 2.1.7 Fire extinguishers 2.2 Drawing/Plans 2.2.1 Standard drawing symbols 2.2.2 Orthographic and isometric drawings

	2.3 Shop mathematics 2.3.1 Basic arithmetic operations 2.3.2 Fractions and decimals 2.3.3 Percentages and ratios 2.3.4 Conversion of units (English to metric) 2.3.5 Trigonometric functions 2.3.6 Computation of feed, cutting speed and machine rpm 2.4 Measurements 2.4.1 Linear measuring tools (rules, vernier, micrometer, height gage) 2.4.2 Geometrical tolerances 2.5 Materials and related science 2.5.1 Classification and mechanical properties of engineering materials 2.6 Bench work 2.6.1 Theory, use and care of hand tools for: 2.6.2 Layout and marking tools 2.6.3 Sawing, chipping, filing, lapping 2.6.4 Drilling, reaming, tapping 2.6.5 External threading 2.6.6 Off-hand grinding
3. Underpinning skills	3.1 Using bench work tools and equipment 3.2 Using measuring instruments 3.3 Operating drill press and grinders
4. Resource implications	The following resources **MUST** be provided: 4.1 Tools, equipment and facilities appropriate to processes or activity 4.2 Materials relevant to the proposed activity 4.3 Drawings, sketches or blueprint
5. Method of assessment	Competency must be assessed through: 5.1 direct observation of bench work activities 5.2 written or oral short answer questions 5.3 practical exercises 5.4 project work 5.5 identify colleagues/clients who can be approached for the collection of competency evidence, where appropriate
6. Context of assessment	Competency may be assessed in the workplace or in simulated workplace environment.

UNIT OF COMPETENCY : **Perform Bench Work (Complex)**

UNIT CODE : **MEE722305**

UNIT DESCRIPTOR : This unit covers the competencies required to select and use hand and power tools to perform complex bench work operation.

ELEMENT	PERFORMANCE CRITERIA ***Italicized terms*** are elaborated in the Range of Variables
1. Chip workpiece	1.1 ***Chisels*** are selected according to requirements of the operation. 1.2 Workpieces are ***chipped*** to drawing specifications
2. File workpieces	2.1 ***File*** selected is appropriate to requirement of the operation. 2.2 Workpieces are ***filed*** to drawing specifications. 2.3 Files are cleaned and stored according worksite procedures.
3. Remove damaged and broken threaded fasteners.	3.1 ***Extractors*** are selected according to the requirements of the operation. 3.2 Damaged threaded fastener is removed according to worksite procedures.
4. Repair damaged threads	4.1 Taps and or dies are selected according to the requirements of the operation. 4.2 ***Thread*** is repaired according to worksite procedures. 4.3 Thread is repaired to conforms with drawing specifications.
5. Scrape and hone holes	5.1 ***Scrapers*** are selected according to requirements of the operation. 5.2 Honing flushing agent is selected and applied according the requirements of the operation. 5.3 Workpieces are scraped and honed according to drawing specifications.

RANGE OF VARIABLES

VARIABLE	RANGE
1. Chisels	Chisels include 1.1 Flat cold chisel 1.2 Cape chisel 1.3 Diamond-point chisel 1.4 Round nose chisel
2. Chipped	2.1 grooves 2.2 slots 2.3 keyways
3. File	File types based on 3.1 teeth cut (single cut, double cut, rasp and curved tooth) 3.2 cut (bastard, second cut) 3.3 cross section (square, round, triangular, half-round) 3.4 shape (flat, hand, pillar, mill)
4 Filed	Filing operations 4.1 Contoured outline 4.2 Contoured holes
5. Extractors	5.1 Screw extractor 5.2 Stud extractors
6. Thread	6.1 Internal threads 6.2 External threads
7. Scrapers	Scraper for 7.1 Flat surface (flat scraper, hook scraper) 7.2 Curve surface (half-round bent scraper, three-cornered scraper)

EVIDENCE GUIDE

1. Critical aspects of evidence	Assessment requires evidence that the candidate: 1.1 chipped grooves, slots and keyways on workpiece 1.2 filed contoured outline and hole. 1.3 removed damaged and broken threaded fasteners 1.4 repaired threads 1.5 scraped and honed holes
2. Underpinning knowledge and attitude	2.1 Shop safety practices 2.1.1 Safe working habits 2.1.2 Identification of hazardous areas 2.1.3 Protective clothing and devices 2.1.4 Safe handling of tools, equipment and materials 2.1.5 Housekeeping 2.1.6 First-aid 2.2 Drawing/Plans 2.2.1 Standard drawing symbols 2.2.2 Orthographic and isometric drawings 2.3 Shop mathematics 2.3.1 Basic arithmetic operations 2.3.2 Fractions and decimals 2.3.4 Percentages and ratios 2.3.5 Conversion of units (English to metric) 2.3.6 Trigonometric functions

	2.4 Measurements 2.4.1 Measuring tools (rules, vernier, micrometer, height gage, profile gage) 2.5 Materials and related science 2.5.1 Classification and mechanical properties of engineering materials 2.6 Bench work Theory, use and care of hand tools for: 2.6.1 layout and marking tools 2.6.2 chipping, filing, scraping and honing 2.6.3 cutting threads 2.6.4 extracting fasteners
3. Underpinning skills	3.1 Using bench work tools and equipment 3.2 Using measuring tools 3.3 Operating drill press and grinder
4. Resource implications	The following resources **MUST** be provided 4.1 Tools, equipment and facilities appropriate to processes or activity 4.2 Materials relevant to the proposed activity 4.3 Drawings, sketches or blueprint
5. Method of assessment	Competency must be assessed through: 5.1 direct observation of bench work activities 5.2 written or oral short answer questions 5.3 practical exercises 5.4 project work 5.5 identify colleagues/clients who can be approached for the collection of competency evidence, where appropriate
6. Context of assessment	Competency may be assessed in the workplace or in simulated workplace environment.

UNIT OF COMPETENCY : **Turn Workpiece (Basic)**

UNIT CODE : **MEE722302**

UNIT DESCRIPTOR : This unit covers the skills required to setup and turn workpiece to drawing specifications. It details the requirements for performing lathe operations such as facing and straight turning; cutting grooves, drilling and boring, knurling; cutting single start external vee- and ACME threads; and cutting tapers using compound slide and formed tools.

ELEMENT	PERFORMANCE CRITERIA ***Italicized terms*** are elaborated in the Range of Variables
1. Determine job requirements	1.1 Drawings are interpreted to produce component to specifications. 1.2 Sequence of operation is determined to produce component to specifications. 1.3 ***Cutting tools*** are selected according to the requirements of the operation.
2. Setup workpiece	2.1 ***Workpiece*** is mounted and centered on chuck to required level of accuracy using tools and equipment in accordance with worksite procedures. 2.2 Workpiece is setup to required level of accuracy using ***instruments/equipment*** according to work site procedures. 2.3 Setup operations are performed applying knowledge on safety procedures and using personal protective devices.
3. Perform turning operations	3.1 Speeds and feeds are calculated using appropriate mathematical techniques and reference material. 3.2 ***Lathe accessories*** used are appropriate to the requirements of the operation. 3.3 ***Lathe operations*** are performed to produce component to specifications in the drawing. 3.4 Operations are performed applying knowledge on safety procedures and using personal protective devices.
4. Check/Measure workpiece	4.1 Workpiece is checked/measured for conformance to specification using appropriate techniques, ***measuring tools*** and equipment.

RANGE OF VARIABLES

VARIABLE	RANGE
1. Drawings	Reading and interpretation 1.1 Views and projections 1.2 Drawing symbols 1.3 Dimensions and features 1.4 Tolerances
2. Cutting Tools	Cutting tools used in lathe operations include: 2.1 Tool bits 2.1.1 High speed steel 2.1.2 Inserts 2.2 Drills 2.3 Reamers
3. Workpiece	Workpiece materials used in turning operations 3.1 Ferrous metals 3.2 Non-ferrous metals
4. Setup Instruments/ equipment	4.1 Surface gage 4.2 Dial indicator on magnetic stand
5. Lathe Accessories	5.1 3- and 4-jaw chucks 5.2 Lathe centers 5.3 Drill chucks 5.4 Knurling tools 5.5 Boring bar
6. Lathe Operations	Basic lathe operations 6.1 facing 6.2 straight turning 6.3 cutting recess, shoulders, grooves and chamfers 6.4 drilling, boring, counterboring, countersinking, reaming 6.5 knurling 6.6 single-start external vee and ACME thread cutting 6.7 parting-off 6.8 cutting external taper using compound slide or formed tool
7. Measuring Tools	7.1 Steel rule 7.2 Vernier caliper 7.3 Micrometer caliper 7.4 Gages (thread, drill, surface finish, radius, screw pitch, taper)

EVIDENCE GUIDE

1. Critical aspects of evidence	Assessment requires evidence that the candidate: 1.1 determined job requirements 1.2 setup the workpiece . 1.3 performed turning operations 1.4 checked/measured the workpiece
2. Underpinning knowledge and attitude	2.1 Shop safety practices 2.1.1 Safe working habits 2.1.2 Identification of hazardous areas 2.1.3 Protective clothing and devices 2.1.4 Safe handling of tools, equipment and materials 2.1.5 Housekeeping 2.1.6 First-aid 2.1.7 Fire extinguishers

	2.2 Drawing interpretation 2.2.1 Standard drawing scales, symbols and abbreviations 2.2.2 Orthographic and isometric drawings 2.2.3 1st and 3rd angle projections 2.2.4 Assembly and detail drawings 2.2.5 Interpreting tolerances, limits and fits 2.3 Shop mathematics 2.3.1 Basic arithmetic operations 2.3.2 Fractions and decimals 2.3.3 Percentages and ratios 2.3.4 Conversion of units (English to metric) 2.3.5 Applying trigonometric functions 2.4 Measurements 2.4.1 Linear measuring tools (rules, vernier, micrometer) 2.4.2 Angle measuring tools 2.4.3 Geometrical tolerances 2.4.4 Dial indicator 2.4.5 Slip gages 2.4.6 Precision levels 2.5 Materials and related science 2.5.1 Classification and mechanical properties of engineering materials 2.6 Lathe machine operations 2.6.1 Lathe types and specifications 2.6.2 Lathe parts and functions 2.6.3 Setting cutting speed, rpm, feed rate 2.6.4 Workholding and tool holding devices 2.6.5 Turning tools and tool geometry 2.6.6 Tooling, set up and parameters in turning operations 2.6.7 Lathe accessories, fixtures and attachments
3. Underpinning skills	3.1 Selecting and grinding cutting tools 3.2 Using measuring instruments 3.3 Verifying workpiece specifications 3.4 Computation of feed, cutting speed and machine rpm
4. Resource implications	The following resources **MUST** be provided 4.1 Tools, equipment and facilities appropriate to processes or activities 4.2 Materials relevant to the proposed activity 4.3 Drawings, sketches or blueprint
5. Method of assessment	Competency must be assessed through: 5.1 direct observation of lathe setting activities 5.2 written or oral short answer questions 5.3 practical exercises 5.4 identify colleagues/clients who can be approached for the collection of competency evidence, where appropriate
6. Context of assessment	Competency may be assessed in the workplace or in simulated workplace environment.

UNIT OF COMPETENCY : **Turn Workpiece (Intermediate)**

UNIT CODE : **MEE722306**

UNIT DESCRIPTOR : This unit covers the skills required to setup and turn workpiece to drawing specifications. It details the requirements for performing lathe operations such as cutting tapers by offsetting tailstock or using taper attachment; machining components using collet chuck and follower rest; and cutting internal vee and internal and external ACME threads.

ELEMENT	PERFORMANCE CRITERIA ***Italicized terms*** are elaborated in the Range of Variables
1. Determine job requirements	1.1 Drawings are interpreted to produce component to specifications. 1.2 Sequence of operation is determined to produce component to specifications. 1.3 ***Cutting tools*** are selected according to the requirements of the operation.
2. Setup workpiece	2.1 ***Workpiece*** is mounted and centered on chuck to required level of accuracy using tools and equipment in accordance with worksite procedures. 2.2 Workpiece is setup using instruments/equipment according to recommended procedure. 2.3 Setup operations are performed applying knowledge on safety procedures and using personal protective devices.
3. Perform turning operations	3.1 Speeds and feeds are calculated using appropriate mathematical techniques and reference material. 3.2 ***Lathe accessories*** used are appropriate to the requirements of the operation. 3.2 ***Lathe operations*** are performed to produce component to specifications in the drawing. 3.4 Operations are performed applying knowledge on safety procedures and using personal protective devices.
4. Check/Measure workpiece	4.1 Workpiece is checked/measured for conformance to specification using appropriate techniques**, *measuring tools* and equipment**.

RANGE OF VARIABLES

VARIABLE	RANGE
1. Cutting Tools	Cutting tools used in lathe operations include: 1.1 High speed steel 1.2 Inserts 1.3 drills
2. Workpiece	Workpiece materials used in turning operations 2.1 Ferrous 2.2 non-ferrous
3. Lathe Accessories	3.1 3- and 4-jaw chucks 3.2 face plates and weights 3.3 lathe centers 3.4 drill chucks 3.5 lathe dogs 3.6 boring bar 3.7 follower rest
4. Lathe Operations	Machining operations 4.1 facing 4.2 straight turning 4.3 drilling, boring 4.4 parting-off 4.5 face and turn external shapes (radii, cones) 4.6 external square thread cutting 4.7 multi-start external thread cutting 4.8 cutting taper using taper turning attachment or offset tailstock method 4.9 turning diameters between centers
5. Safety Procedures	Shop safety involves the handling of 5.1 Equipment 5.2 Tools 5.3 Materials
6. Measuring Tools	6.1 Steel rule 6.2 Vernier caliper 6.3 Micrometer caliper 6.4 Gages (thread, drill, depth, surface finish, radius, screw pitch, slip or block, taper)

EVIDENCE GUIDE

1. Critical aspects of evidence	Assessment requires evidence that the candidate: 1.1 determined job requirements 1.2 setup the workpiece . 1.3 performed turning operations 1.4 checked/measured the workpiece
2. Underpinning knowledge and attitude	2.1 Shop safety practices 2.1.1 Safe working habits 2.1.2 Identification of hazardous areas 2.1.3 Protective clothing and devices 2.1.4 Safe handling of tools, equipment and materials 2.1.5 Housekeeping 2.1.6 First-aid 2.1.7 Fire extinguishers

	2.2 Drawing interpretation 2.2.1 Standard drawing scales, symbols and abbreviations 2.2.2 Orthographic and isometric drawings 2.2.3 1st and 3rd angle projections 2.2.4 Assembly and detail drawings 2.2.5 Interpreting tolerances, limits and fits 2.3 Shop mathematics 2.3.1 Basic arithmetic operations 2.3.2 Fractions and decimals 2.3.3 Percentages and ratios 2.3.4 Conversion of units (English to metric) 2.3.5 Applying trigonometric functions 2.4 Measurements 2.4.1 Linear measuring tools (rules, vernier, micrometer) 2.4.2 Angle measuring tools 2.4.3 Geometrical tolerances 2.4.4 Dial indicator 2.4.5 Slip gages 2.4.6 Precision levels 2.5 Materials and related science 2.5.1 Classification and mechanical properties of engineering materials 2.6 Lathe machine operations 2.6.1 Lathe types and specifications 2.6.2 Lathe parts and functions 2.6.3 Setting cutting speed, rpm, feed rate 2.6.4 Workholding and tool holding devices 2.6.5 Turning tools and tool geometry 2.6.6 Tooling, set up and parameters in turning operations 2.6.7 Lathe accessories, fixtures and attachments
3. Underpinning skills	3.1 Selecting and grinding cutting tools 3.2 Using measuring instruments 3.3 Verifying workpiece specifications 3.4 Computation of feed, cutting speed and machine rpm
4. Resource implications	The following resources **MUST** be provided 4.1 Tools, equipment and facilities appropriate to processes or activities 4.2 Materials relevant to the proposed activity 4.3 Drawings, sketches or blueprint
5. Method of assessment	Competency must be assessed through: 5.1 direct observation of lathe setting activities 5.2 written or oral short answer questions 5.3 practical exercises 5.4 identify colleagues/clients who can be approached for the collection of competency evidence, where appropriate
6. Context of assessment	Competency may be assessed in the workplace or in simulated workplace environment.

UNIT OF COMPETENCY : **Mill Workpiece (Basic)**

UNIT CODE : **MEE722303**

UNIT DESCRIPTOR : This unit covers the skills required to setup and mill workpiece to drawing specifications . It details the requirements for performing milling operations such as drilling, boring, reaming and spot facing holes; milling blocks, shoulder, parallel and angled faces; milling slots, keys, serrations; and milling castings and circular slots and external radius.

ELEMENT	PERFORMANCE CRITERIA ***Italicized terms*** are elaborated in the Range of Variables
1. Determine job requirements	1.1 Drawings are interpreted to produce component to specifications. 1.2 Sequence of operation is determined to produce component to specifications***.*** 1.3 ***Cutting tools*** are selected according to the requirements of the operation.
2. Setup workpiece	2.1 ***Workpiece*** is setup to required level of accuracy using instruments/equipment according to work site procedures. 2.2 Setup operations are performed applying knowledge on safety procedures and using personal protective devices.
3. Perform milling operations	3.1 Speeds and feeds are set to requirements of the job. 3.2 ***Milling machine accessories*** used are appropriate to the requirements of the operation. 3.3 ***Milling operations*** are performed to produce component to specifications in the drawing. 3.4 Milling operations are performed applying knowledge on ***safety procedures*** and using ***personal protective devices***.
4. Check/Measure workpiece	4.1 Workpiece is checked/measured for conformance to specification using appropriate techniques, ***measuring tools*** and equipment.

RANGE OF VARIABLES

VARIABLE	RANGE
1. Cutting Tools	Cutting tools used in milling operations include: 1.1 Drills 1.2 Reamers 1.3 Slab mills 1.4 End mills 1.5 Shell mills 1.6 Side and face cutters 1.7 Formed cutter 1.8 Slitter 1.9 T-slot cutter
2. Workpiece	Workpiece materials used in milling operations 2.1 Ferrous 2.2 Non-ferrous
3. Milling machine accessories	3.1 Workholding devices 3.1.1 clamps 3.1.2 vises 3.1.3 angle plates 3.2 Rotary tables
4. Milling Operations	Basic milling operations 4.1 drilling 4.2 boring 4.3 spot facing 4.4 milling slot and keyways 4.5 milling serrations 4.6 milling vees 4.7 parting-off 4.8 milling circular slots
5. Safety Procedures	Shop safety involves the handling of 5.1 Equipment 5.2 Tools 5.3 Materials
6. Measuring Tools	6.1 Steel rule 6.2 Vernier caliper 6.3 Micrometer caliper 6.4 Gages (bore, surface finish, radius, depth)

EVIDENCE GUIDE

1. Critical aspects of evidence	Assessment requires evidence that the candidate: 1.1 determined job requirements 1.2 set up the workpiece . 1.3 performed turning operations 1.4 checked/measured the workpiece
2. Underpinning knowledge	2.1 Shop safety practices 2.1.1 Safe working habits 2.1.2 Identification of hazardous areas 2.1.3 Protective clothing and devices 2.1.4 Safe handling of tools, equipment and materials 2.1.5 Housekeeping 2.1.6 First-aid 2.1.7 Fire extinguishers

	2.2 Drawing interpretation 2.2.1 Alphabet of lines 2.2.2 Drawing symbols 2.2.3 Projections and views 2.2.4 Fits and tolerances 2.2.5 Surface texture 2.2.6 Sketches and mechanical drawing 2.3 Shop mathematics 2.3.1 Basic arithmetic operations 2.3.2 Fractions and decimals 2.3.3 Percentages and ratios 2.3.4 Conversion of units (English to metric) 2.3.5 Applying trigonometric functions 2.4 Measurements 2.4.1 Linear measuring tools (rules, vernier, micrometer) 2.4.2 Dial indicator 2.4.3 Precision square 2.4.4 Bevel protractor 2.4.5 Vernier height gage 2.5 Materials and related science 2.5.1 Classification and mechanical properties of engineering materials 2.5.2 Lubricants and coolants 2.6 Milling operations 2.6.1 Milling types and specifications 2.6.2 Milling machine parts and functions 2.6.3 Milling cutters and holders 2.6.4 Setting cutting speed, rpm, feed rate 2.6.5 Workholding devices 2.6.6 Milling machine accessories, fixtures and attachments
3. Underpinning skills	3.1 Selecting and setting cutting tools 3.2 Using measuring instruments 3.3 Verifying workpiece specifications 3.4 Computation of feed, cutting speed and machine rpm
4. Resource implications	The following resources **MUST** be provided 4.1 Tools, equipment and facilities appropriate to processes or activities 4.2 Materials relevant to the proposed activity 4.3 Drawings, sketches or blueprint
5. Method of assessment	Competency must be assessed through: 5.1 direct observation of milling activities 5.2 written or oral short answer questions 5.3 practical exercises 5.4 identify colleagues/clients who can be approached for the collection of competency evidence, where appropriate
6. Context of assessment	Competency may be assessed in the workplace or in simulated workplace environment.

UNIT OF COMPETENCY : **Mill Workpiece (Intermediate)**

UNIT CODE : **MEE722307**

UNIT DESCRIPTOR : This unit covers the skills required to setup and mill workpiece to drawing specifications. It details the requirements for performing milling operations such as indexing, milling splines, equally-spaced grooves, 45° serrations in cylindrical workpiece, spur gear and rack, ratchets, converging faces, large radial slots, internal radii and plain bevel gear.

ELEMENT	PERFORMANCE CRITERIA ***Italicized*** terms are elaborated in the Range of Variables
1. Determine job requirements	1.1 Drawings are interpreted to produce component to specifications. 1.2 Sequence of operation is determined to produce component to specifications. 1.3 ***Cutting tools*** are selected according to the requirements of the operation.
2. Setup workpiece	2.1 ***Workpiece*** is setup to required level of accuracy using instruments/equipment according to work site procedures. 2.2 Setup operations are performed applying knowledge on safety procedures and using personal protective devices.
3. Perform milling operations	3.1 Speeds and feeds are set appropriate to the job. 3.2 ***Milling machine accessories*** used are appropriate to the requirements of the operation. 3.2 ***Milling operations*** are performed to produce component to specifications in the drawing. 3.4 Milling operations are performed applying knowledge on safety procedures and using personal protective devices.
4. Check/Measure workpiece	4.1 Workpiece is checked/measured for conformance to specification using appropriate techniques, ***measuring tools*** and equipment.

RANGE OF VARIABLES

VARIABLE	RANGE
1. Cutting Tools	Cutting tools used in milling operations include: 1.1 Side and face cutters 1.2 Gear cutter and other formed cutter 1.3 Slitter 1.4 Slot cutter
2. Workpiece	Workpiece materials used in milling operations 2.1 Ferrous 2.2 Non-ferrous
3. Milling machine accessories	3.1 Workholding devices 3.1.1 clamps 3.1.2 vises 3.1.3 angle plates 3.2 Rotary tables 3.3 Indexing head 3.4 Footstock
4. Milling Operations	Milling operations 4.1 indexing 4.2 straddle-milling 4.3 milling using fly cutter 4.4 milling splines 4.5 milling equally-spaced grooves 4.6 milling 45° serrarions on cylindrical workpiece 4.7 milling spur gear and rack 4.8 milling bevel gear 4.9 milling ratchet 4.10 milling converging faces 4.11 milling large radial slots 4.12 milling internal radii
5. Measuring Tools	5.1 Steel rule 5.2 Vernier caliper 5.3 Micrometer caliper 5.4 Gages (bore, surface finish, radius, depth) 5.5 Gear tooth caliper

EVIDENCE GUIDE

1. Critical aspects of evidence	Assessment requires evidence that the candidate: 1.1 determined job requirements 1.2 set up the workpiece . 1.3 performed milling operations 1.4 checked/measured the workpiece
2. Underpinning knowledge	2.1 Shop safety practices 2.1.1 Safe working habits 2.1.2 Identification of hazardous areas 2.1.3 Protective clothing and devices 2.1.4 Safe handling of tools, equipment and materials 2.1.5 Housekeeping 2.1.6 First-aid 2.1.7 Fire extinguishers

	2.2 Drawing interpretation 2.2.1 Alphabet of lines 2.2.2 Drawing symbols 2.2.3 Projections and views 2.2.4 Fits and tolerances 2.2.5 Surface texture 2.2.6 Sketches and mechanical drawing 2.3 Shop mathematics 2.3.1 Basic arithmetic operations 2.3.2 Fractions and decimals 2.3.3 Percentages and ratios 2.3.4 Conversion of units (English to metric) 2.3.5 Applying trigonometric functions 2.4 Measurements 2.4.1 Linear measuring tools (rules, vernier, micrometer) 2.4.2 Dial indicator 2.4.3 Precision square 2.4.4 Bevel protractor 2.4.5 Vernier height gage 2.4.6 Gear tooth caliper 2.5 Materials and related science 2.5.1 Classification and mechanical properties of engineering materials 2.5.2 Lubricants and coolants 2.6 Milling operations 2.6.1 Milling types and specifications 2.6.2 Milling machine parts and functions 2.6.3 Milling cutters and holders 2.6.4 Setting cutting speed, rpm, feed rate 2.6.5 Workholding devices 2.6.6 Milling machine accessories, fixtures and attachments 2.7 Indexing
3. Underpinning skills	3.1 Selecting and setting cutting tools 3.2 Using measuring instruments 3.3 Verifying workpiece specifications 3.4 Computation of feed, cutting speed and machine rpm
4. Resource implications	The following resources **MUST** be provided 4.1 Tools, equipment and facilities appropriate to processes or activities 4.2 Materials relevant to the proposed activity 4.3 Drawings, sketches or blueprint
5. Method of assessment	Competency must be assessed through: 5.1 direct observation of milling activities 5.2 written or oral short answer questions 5.3 practical exercises 5.4 identify colleagues/clients who can be approached for the collection of competency evidence, where appropriate
6. Context of assessment	Competency may be assessed in the workplace or in simulated workplace environment.

UNIT OF COMPETENCY : **Grind Workpiece (Basic)**

UNIT CODE : **MEE722304**

UNIT DESCRIPTOR : This unit covers the skills required to setup and grind workpiece to drawing specifications. It details the requirements for grinding parallel surfaces, square surfaces, angles, radii and cutting off parts.

ELEMENT	PERFORMANCE CRITERIA ***Italicized terms*** are elaborated in the Range of Variables
1. Determine job requirements	1.1 Drawings are interpreted to produce component to specifications. 1.2 Sequence of operation is determined to produce component to specifications. 1.3 Workholding devices are selected according to the requirements of the operation.
2. Select wheels and accessories	2.1 Grinding wheels are selected, inspected, mounted, dressed and trued according to worksite procedures to produce component to specifications. 2.2 Accessories selected are appropriate to the requirements of the operation. 2.3 Machine guards, coolant and dust extraction devices are checked according to worksite procedure.
3. Perform grinding operations	3.1 ***Grinding machine*** is setup and adjusted in accordance with worksite procedures. 3.2 Workpiece is held or clamped to avoid damage. 3.3 Grinding operations are performed safely, utilizing guards, safety procedures and personal protective clothing and devices. 3.4 ***Grinding operations*** are performed to produce component to specifications in the drawing.
4. Check/Measure component	4.1 Workpiece is checked/measured for conformance to specification using appropriate techniques, measuring tools and equipment.

RANGE OF VARIABLES

VARIABLE	RANGE
1. Grinding wheels	Wheels are selected according to: 1.1 types 1.2 grades 1.3 sizes
2. Accessories	2.1 magnetic chuck 2.2 vices 2.3 clamps 2.4 angle plates 2.5 adapter plates 2.6 parallels 2.7 wheel dresser
3. Grinding machine	3.1 Horizontal spindle surface grinder 3.2 Vertical spindle surface grinder
4. Grinding operations	Grinding 4.1 parallel faces 4.2 square surfaces 4.3 angles 4.4 to a square shoulder 4.5 radii 4.6 to cut off parts

EVIDENCE GUIDE

1. Critical aspects of evidence	Assessment requires evidence that the candidate: 1.1 determined job requirements 1.2 selected wheels and accessories . 1.3 performed grinding operations 1.4 checked/measured the workpiece
2. Underpinning knowledge	2.1 Shop safety practices 2.1.1 Safe working habits 2.1.2 Identification of hazardous areas 2.1.3 Protective clothing and devices 2.1.4 Safe handling of tools, equipment and materials 2.1.5 Housekeeping 2.1.6 First-aid 2.1.7 Fire extinguishers 2.2 Drawing interpretation 2.2.1 Alphabet of lines 2.2.2 Drawing symbols 2.2.3 Projections and views 2.2.4 Fits and tolerances 2.2.5 Surface texture 2.2.6 Sketches and mechanical drawing 2.3 Shop mathematics 2.3.1 Basic arithmetic operations 2.3.2 Fractions and decimals 2.3.3 Percentages and ratios 2.3.4 Conversion of units (English to metric) 2.3.5 Applying trigonometric functions

	2.4 Measurements 2.4.1 Linear measuring tools (rules, vernier, micrometer) 2.4.2 Dial indicator 2.4.3 Precision square 2.4.4 Bevel protractor 2.4.5 Vernier height gage 2.4.6 Gage blocks 2.4.7 Sine bar 2.4.8 Radius gage 2.4.9 Precision square 2.5 Materials and related science 2.5.1 Classification and mechanical properties of engineering materials 2.5.2 Lubricants and coolants 2.6 Grinding operations 2.6.1 Grinding machine types and specifications 2.6.2 Grinding machine parts and functions 2.6.3 Grinding wheels 2.6.4 Workholding devices 2.6.5 Grinding machine accessories, fixtures and attachments
3. Underpinning skills	3.1 Using measuring instruments 3.2 Verifying workpiece specifications
4. Resource implications	The following resources **MUST** be provided 4.1 Tools, equipment and facilities appropriate to processes or activities 4.2 Materials relevant to the proposed activity 4.3 Drawings, sketches or blueprint
5. Method of assessment	Competency must be assessed through: 5.1 direct observation of milling activities 5.2 written or oral short answer questions 5.3 practical exercises 5.4 identify colleagues/clients who can be approached for the collection of competency evidence, where appropriate
6. Context of assessment	Competency may be assessed in the workplace or in simulated workplace environment.

UNIT OF COMPETENCY : **Grind Workpiece (Complex Operation)**

UNIT CODE : **MEE722308**

UNIT DESCRIPTOR : This unit covers the skills required to setup and grind workpiece to drawing specifications. It details the requirements for grinding tapers, internal radii and recess, to remove warp, and polishing components.

ELEMENT	PERFORMANCE CRITERIA ***Italicized terms*** are elaborated in the Range of Variables
1. Determine job requirements	1.1 Drawings are interpreted to produce component to specifications. 1.2 Sequence of operation is determined to produce component to specifications. 1.3 Workholding devices are selected according to the requirements of the operation.
2. Select wheels and accessories	2.1 Grinding wheels are selected, balanced and dressed to the required form and size as required. 2.2 Accessories selected are appropriate to the requirements of the operation. 2.3 Machine guards, coolant and dust extraction devices are checked according to worksite procedure.
3. Perform grinding operations	3.1 ***Grinding machine*** is setup and adjusted in accordance with worksite procedures. 3.2 Workpiece is set up and held or clamped to required level of accuracy as per specifications. 3.2 Grinding operations are performed safely, utilizing guards, safety procedures and personal protective clothing and devices. 3.4 Grinding operations are performed to produce component to specifications in the drawing.
4. Check/Measure component	4.1 Workpiece is checked/measured for conformance to specification using appropriate techniques, measuring tools and equipment.

RANGE OF VARIABLES

VARIABLE	RANGE
1. Grinding wheels	Wheels are selected according to: 1.1 types 1.2 grades 1.3 sizes
2. Accessories	2.1 magnetic chuck 2.2 vices 2.3 clamps 2.4 angle plates 2.5 adapter plates 2.6 parallels 2.7 wheel dresser 2.8 mandrels 2.9 balancing stand with weights 2.10 de-burring tools 2.11 templates 2.12 headstock/footstock 2.13 centers
3. Grinding machine	3.1 Horizontal spindle surface grinder 3.2 Vertical spindle surface grinder 3.3 Plain cylindrical grinder 3.4 Universal cylindrical grinder 3.5 Center-less grinder 3.6 Universal tool and cutter grinder
4. Grinding operations	Grinding 4.1 external and internal tapers 4.2 internal radii 4.3 internal recess 4.4 to remove warp

EVIDENCE GUIDE

1. Critical aspects of evidence	Assessment requires evidence that the candidate: 1.1 determined job requirements 1.2 selected wheels and accessories . 1.3 performed grinding operations 1.4 checked/measured the workpiece
2. Underpinning knowledge	2.1 Shop safety practices 2.1.1 Safe working habits 2.1.2 Identification of hazardous areas 2.1.3 Protective clothing and devices 2.1.4 Safe handling of tools, equipment and materials 2.1.5 Housekeeping 2.1.6 First-aid 2.1.7 Fire extinguishers 2.2 Drawing interpretation 2.2.1 Alphabet of lines 2.2.2 Drawing symbols 2.2.3 Projections and views 2.2.4 Fits and tolerances 2.2.5 Surface texture 2.2.6 Sketches and mechanical drawing

	2.3 Shop mathematics 2.3.1 Basic arithmetic operations 2.3.2 Fractions and decimals 2.2.3 Percentages and ratios 2.3.4 Conversion of units (English to metric) 2.3.5 Trigonometric functions 2.4 Measurements 2.4.1 Linear measuring tools (rules, vernier, micrometer) 2.4.2 Dial indicator 2.4.3 Precision square 2.4.4 Bevel protractor 2.4.5 Vernier height gage 2.4.6 Gage blocks 2.4.7 Sine bar 2.4.8 Radius gage 2.4.9 Precision square 2.4.10 Bore gage 2.4.11 Optical comparator 2.4.12 Gage block 2.5 Materials and related science 2.5.1 Classification and mechanical properties of engineering materials 2.5.2 Lubricants and coolants 2.6 Grinding operations 2.6.1 Grinding machine types and specifications 2.6.2 Grinding machine parts and functions 2.6.3 Grinding wheels 2.6.4 Workholding devices 2.6.5 Grinding machine accessories, fixtures and attachments
3. Underpinning skills	3.1 Using measuring instruments 3.2 Verifying workpiece specifications
4. Resource implications	The following resources **MUST** be provided 4.1 Tools, equipment and facilities appropriate to processes or activities 4.2 Materials relevant to the proposed activity 4.3 Drawings, sketches or blueprint
5. Method of assessment	Competency must be assessed through: 5.1 direct observation of milling activities 5.2 written or oral short answer questions 5.3 practical exercises 5.4 identify colleagues/clients who can be approached for the collection of competency evidence, where appropriate
6. Context of assessment	Competency may be assessed in the workplace or in simulated workplace environment.

SECTION 3 TRAINING STANDARDS

These guidelines are set to provide the Technical and Vocational Education and Training (TVET) providers with information and other important requirements to consider when designing training programs for MACHINING NC II.

3.1 CURRICULUM DESIGN

Course Title: MACHINING **NC Level:** NC II

Training Duration: **18** Hours (Basic)
12 Hours (Common)
307 Hours (Core)

Course Description:

This qualification is designed to develop knowledge, desirable attitudes and skills of Machinist. It covers the competencies required to select and use hand and power tools to perform complex bench operations, skills to set up and turn workplace to drawing specifications. Such as cutting tapers by offsetting tailstock or using taper attachment; machining components using collets chuck and follower rest; and cutting internal Vee and internal and external ACME threads. It also covers the skills required to set up and mill workpiece to drawing specifications such as indexing, milling splines, equally spaced grooves, 45 degrees, serrations in cylindrical workpiece, spur gear and rack, ratchets, converging faces, large radial slots, internal radii and plain bevel gear. It also covers the skills required to set up and grind workpiece to drawing specifications such as grinding tapers internal and external, internal radii and recess, remove warp and polish components.

To obtain this, all units of competency prescribed for this qualification must be achieved.

BASIC COMPETENCIES

Unit of Competency	Learning Outcomes	Methodology	Assessment Approach
1. Participate in workplace communication	1.1 Obtain and convey workplace information. 1.2 Complete relevant work related documents. 1.3 Participate in workplace meeting and discussion.	• Group discussion • Interaction	• Demonstration • Observation • Interviews/ questioning
2. Work in a team environment	2.1 Describe and identify team role and responsibility in a team. 2.2 Describe work as a team member.	• Discussion • Interaction	• Demonstration • Observation • Interviews/ questioning
3. Practice career professionalism	3.1 Integrate personal objectives with organizational goals. 3.2 Set and meet work priorities. 3.3 Maintain professional growth and development.	• Discussion • Interaction	• Demonstration • Observation • Interviews/ questioning
4. Practice occupational health and safety	4.1 Evaluate hazard and risks 4.2 Control hazards and risks 4.3 Maintain occupational health and safety awareness	• Discussion • Plant tour • Symposium	• Observation • Interview

COMMON COMPETENCIES

Unit of Competency	Learning Outcomes	Methodology	Assessment Approach
1. Interpret working drawings and sketches	1.1 Interpret technical drawing 1.2 Prepare freehand sketch of parts 1.3 Interpret details from freehand sketch	• Lecture • Group Discussion/ interaction	• Observation • Interview • Interview/ Questioning
2. Select and cut workshop materials	2.1 Determine requirements 2.2 Select and measure materials 2.3 Cut materials	• Lecture • Demonstration • Practical exercise	• Demonstration • Observation • Performance test • Interview/ Questioning
3. Perform shop computations (Basic)	3.1 Perform four fundamental operations 3.2 Perform basic calculations involving fractions and decimals 3.3 Perform basic calculations involving percentages 3.4 Perform basic calculation involving ratio and proportion 3.5 Perform calculations on algebraic expressions	• Lecture • Demonstration • Practical exercise	• Demonstration • Observation • Performance test • Interview/ Questioning
4. Measure workpiece (Basic)	4.1 Select and use measuring instruments 4.2 Clean and store measuring instruments	• Lecture • Demonstration • Practical exercise	• Demonstration • Observation • Performance test • Interview/ Questioning
5. Perform shop computations (Intermediate)	5.1 Perform calculations involving triangles 5.2 Calculate taper	• Lecture • Demonstration • Practical exercise	• Demonstration • Observation • Performance test • Interview/ Questioning
6. Measure workpiece using angular measuring instruments	6.1 Select and use angular measuring tools. 6.2 Maintain angular measuring tools 6.3 Clean and store measuring tools	• Lecture • Demonstration • Practical exercise	• Demonstration • Observation • Performance test • Interview/ Questioning
7. Perform preventive and corrective maintenance	7.1 Perform inspection of machine 7.2 Perform cleaning and lubricating of machine 7.3 Perform minor machine repair and adjustments 7.4 Maintain hand tools	• Lecture • Demonstration • Group discussion • Practical exercise	• Demonstration • Observation • Performance test • Interview/ Questioning

CORE COMPETENCIES

Unit of Competency	Learning Outcomes	Methodology	Assessment Approach
1. Perform Bench work	1.1 Explain the principle of honing. 1.2 Procedure in honing 1.3 Perform honing 1.4 Explain the principle of scraping 1.5 Procedure in scraping 1.6 Perform scraping. 1.7 Identify damage screws 1.8 Procedure in removing damage screws. 1.9 Perform removing of damaged screws	• Demonstration • Discussion	• Direct Observation • Demonstration • Written or oral
2. Turn Work piece	2.1 Explain the procedure of : • Facing • Straight turning • Drilling • Boring • Parting-Off • Cutting external square thread • Cutting multi-start external thread • Cutting taper using taper attachment • Turning between centers 2.2 Set up work piece 2.3 Perform turning operations 2.4 Check / measure work piece as per drawing specification.	• Demonstration • Discussion	• Written /Oral • Direct Observation
3. Mill Workpiece	3.1 Explain the procedure of: • Indexing • Straddle milling • Milling using fly cutter • Milling splines • Milling equally spaced grooves • Milling 45 degrees serrations on cylindrical workpiece • Milling spur gear and rack • Milling bevel gear • Milling ratchet • Milling converging faces • Milling large radial slots • Milling internal radii 3.2 Set up workpiece 3.3 Perform milling operations 3.4 Check / Measure workpiece	• Demonstration • Discussion	• Direct Observation • Written / Oral

4. Grind workpiece	4.1 Explain the procedure of Grinding: • External and internal taper • Internal radii • Internal recess • To remove warp 4.2 Select Wheels and accessories 4.3.Perform grinding operations 4.4 Check / Measure workpiece	• Demonstration • Discussion	• Direct observation • Written / Oral examination

3.2 TRAINING DELIVERY

The delivery of training should adhere to the design of the curriculum. Delivery should be guided by the 10 basic principles of competency-based TVET.

- The training is based on curriculum developed from the competency standards;
- Learning is modular in its structure;
- Training delivery is individualized and self-paced;
- Training is based on work that must be performed;
- Training materials are directly related to the competency standards and the curriculum modules;
- Assessment is based in the collection of evidence of the performance of work to the industry required standard;
- Training is based both on and off-the-job components;
- Allows for recognition of prior learning (RPL) or current competencies;
- Training allows for multiple entry and exit; and
- Approved training programs are Nationally Accredited

The competency-based TVET system recognizes various types of delivery modes, both on and off-the-job as long as the learning is driven by the competency standards specified by the industry. The following training modalities may be adopted when designing training programs:

- The dualized mode of training delivery is preferred and recommended. Thus programs would contain both in-school and in-industry training or fieldwork components. Details can be referred to the Dual Training System (DTS) Implementing Rules and Regulations.
- Modular/self-paced learning is a competency-based training modality wherein the trainee is allowed to progress at his own pace. The trainer just facilitates the training delivery.
- Peer teaching/mentoring is a training modality wherein fast learners are given the opportunity to assist the slow learners.
- Supervised industry training or on-the-job training is an approach in training designed to enhance the knowledge and skills of the trainee through actual experience in the workplace to acquire specific competencies prescribed in the training regulations.
- Distance learning is a formal education process in which majority of the instruction occurs when the students and instructor are not in the same place. Distance learning may employ correspondence study, audio, video or computer technologies.

3.3 TRAINEE ENTRY REQUIREMENTS

This section specifies the qualifications of trainees and their educational attainment. Other requirements like health and physical requirements are also stated. Passing entry written entrance examinations may also be indicated if necessary.

- With good moral character;
- Able to communicate both orally and in writing; and
- Physically and mentally fit

3.4 LIST OF TOOLS, EQUIPMENT AND MATERIALS MACHINING NC II

Recommended list of tools, equipment and materials for the training of 25 trainees for Machining NC II

TOOLS					
Measuring Tools:		**Bench Tools**		**Safety Devices:**	
QTY.	**Description**	**QTY.**	**Description**	**QTY.**	**Description**
6 pcs.	• Steel Rule 12 “	1 Set	• Honing tool	1 box	• First –Aid kit
10 pcs.	• Vernier caliper 150mm	1 set 1 set	• Extractor • Scraper (flat & curve)	25 pcs.	• Safety Goggle
5 pcs.	• Vernier caliper 200mm	1 Set	• Drill 1mm to 12 mm	10 pcs.	• Safety Shield
2 pcs.	• Vernier caliper 300mm	1 Set	• Center punch	4 cyl.	• Fire extinguisher
5 pcs.	• Micrometer 0-25	1 Set	• Prick punch		
3 pcs.	• Micrometer 25-50	6 pcs.	• Scriber		
2 pcs.	• Micrometer 50-75	1 Set	• Tap 4mm to 12 mm dia.		
3 Sets	• Dial Indicator Plunger type	1 set	• Die 4 mm to 12 mm dia.		
2 pcs	• Precision Square 10 “	2 pcs	• Cold chisels 6 “		
1 Set	• Vernier height gage	2 pcs. 2 pcs.	• Cape chisel 6” • Diamond point Chisel 6“		
1 Set 1 set 2 Sets	• Gear Tooth caliper • Radius Gage • Center gage	2 pcs.	• Round nose Chisel 6“		
2 Sets	• Bevel Protractors	6 pcs.	▪ Ball peen Hammer 12 oz		
1 Set 2 Sets	• Gage Blocks • Thread Gage	2 sets	▪ Allen Wrench 1 mm to 10 mm		
1 Set	• Sine Bar	2 sets	▪ Open end wrench 4mm to 20 mm		

EQUIPMENT					
QTY.	**Description**	**QTY.**	**Description**	**QTY.**	**Description**
2 units	• Two Head Bench Grinder	2 units	• Milling Machine Universal complete w/ accessories per machine: -Clamping bolts -Milling Vises - Angle plates - Rotary table - Indexing Head with: 3-jaw chuck, gears, footstock and center	1 unit	• Plain cylindrical grinder complete w/ accessories
2 units	• Bench Drill w/ Drill Vise			1 unit	• Universal Cylindrical grinder complete w/ accessories
3 units	• Lathe Machine 10'" swing Complete with: (1 unit each machine)				
	• 3-jaw chucks • 4-jaw chucks • Face Plates • 1 set lathe dogs • Revolving Centers • Drill Chucks • Dead Centers • 1 Set Boring Bars • Follower rest • Steady Rest • Tool Holders: Facing, Straight, RH,LH • Parting-Off • Surface Gage	2 pcs.	▪ Side milling cutter 2 ½ dia	1 unit	• Universal Tool and Cutter Grinder Complete w/ accessories
		2 pcs.	▪ 45 degrees milling cutter 2 ½ dia.	**Additional Accessories**	
		1 set	▪ Gear Cutter 1.5 M	- Clamps w/ bolts	
		1 Set	▪ Gear Cutter 2.0 M	- Angle plates	
		2 pcs.	▪ Slitter cutters	- Parallels	
		2 pcs.	▪ Slot Cutters	- Wheel balancing	
		1 unit	▪ Power Saw complete with accessories	- Diamond Wheel dresser	
		1 unit	• Band Saw complete with accessories		

MATERIALS				
QTY.	**Description**	**QTY.**	**Description**	**Training Materials :**
50 pcs. 50 pcs.	• High speed steel tool bit (Momax) 3/8 x 3/8 x 2" 1/4 x 1/4 x 2"	10 pcs.	• Center drill # 3 and # 2	• Reference books
		4 pcs.	▪ Grinding wheel for bench grinder	• Manuals
2 pcs.	• CRS 12mm dia	2 Sets	▪ Drill 3mm to 12 mm	• Catalogs
2 pcs.	• CRS 19mm dia	5 pcs.	▪ Carbide insert	• Brochures
1 pc.	• CRS 50 mm dia.	6 doz.	▪ Hack saw blade	• Modules / LEs
2 pcs.	• CRS 25mm dia.	1 doz.	▪ Power hack saw blade	• CDs/Video tapes
		2 pcs	• Oil Stone	

3.5 TRAINING FACILITIES
MACHINING NC II

The machining workshop must be of concrete structure for 25 students/trainees. The space requirements for the teaching/learning and circulation areas are as follows:

SPACE REQUIREMENT	SIZE IN METERS	AREA IN SQ. METERS	TOTAL AREA IN SQ. METERS
• Building (permanent)	10 M X 30 M		300 Sq. M
▪ Trainee working space	2 M X 2 M	4 Sq.M / trainee	100 Sq. M
▪ Lecture Room	8 M X 10 M	80 Sq. M.	80 Sq. M
▪ Learning Resource Center	4 M X 8 M	32 Sq. M	32 Sq. M
▪ Facilities/ Equipment/ Circulation Area			88 Sq. M

3.6 TRAINER'S QUALIFICATIONS FOR MACHINING NC II

TRAINER QUALIFICATION (TQ II)

- Must be a holder of Machining NC III Qualification or its equivalent
- Must have undergone training on Training Methodology II (TM II) or equivalent in training experience
- Must be computer literate
- Must be physically and mentally fit
- *Must have at least 2 years job/industry experience
- Must be a civil service eligible (for government position or appropriate professional license issued by the Professional Regulatory Commission)

*** Optional. Only when required by the hiring institution.**

Reference: TESDA Board Resolution No. 2004 03

3.7 INSTITUTIONAL ASSESSMENT

Institutional assessment is undertaken by trainees to determine their achievement of units of competency. A certificate of achievement is issued for each unit of competency.

SECTION 4 NATIONAL ASSESSMENT AND CERTIFICATION ARRANGEMENTS

4.1 To attain the National Qualification of Machining NC II, the candidate must demonstrate competence in all the units listed in Section 1. Successful candidates shall be awarded a National Certificate signed by the TESDA Director General.

4.2 The qualification of Machining NC II may be attained through:

4.2.1 Accumulation of Certificates of Competency (COCs) in all the following areas:

4.2.1.1 Perform bench work (Basic)

4.2.1.2 Perform bench work (Complex)

4.2.1.3 Turn workpiece (Basic)

4.2.1.4 Turn workpiece (Intermediate)

4.2.1.5 Mill workpiece (Basic)

4.2.1.6 Mill workpiece (Intermediate)

4.2.1.7 Grind workpiece (Basic)

4.2.1.8 Grind workpiece(Complex)

Successful candidates shall be awarded Certificates of Competency (COCs) bearing the signature of the TESDA Regional Director and Chair of the recognized local industry body.

4.2.2 Demonstration of competence through project-type assessment covering all the required units of qualification.

4.3 Assessment shall focus on the core units of competency. The basic and common units shall be integrated or assessed concurrently with the core units.

4.4 The following are qualified to apply for assessment and certification:

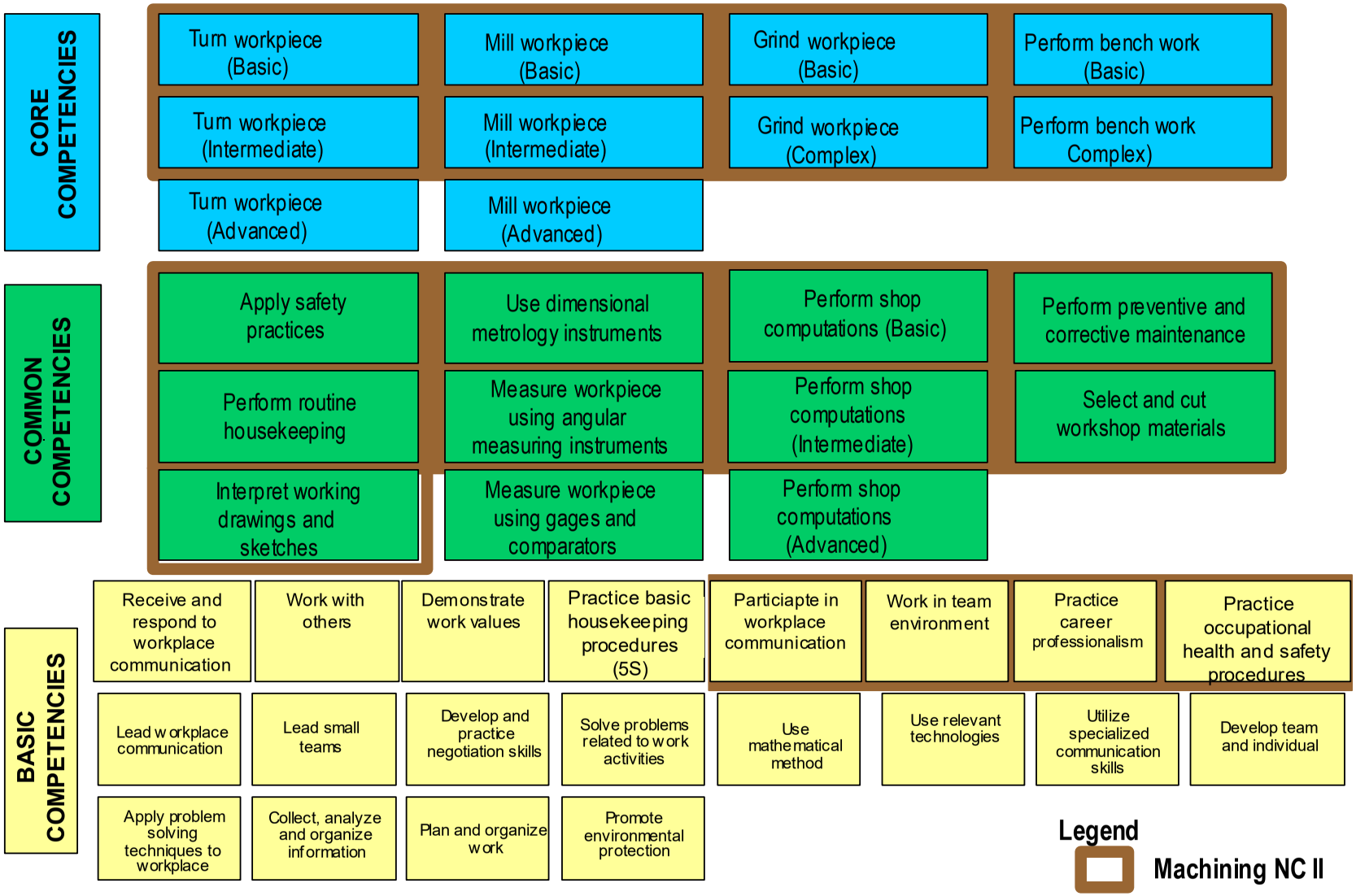
4.4.1 Graduates of formal, non-formal and informal including enterprise-based training programs.

4.4.2 Experienced workers (wage employed or self employed)

4.5 The guidelines on assessment and certification are discussed in detail in the *"Procedures Manual on Assessment and Certification" and "Guidelines on the Implementation of the Philippine TVET Qualification and Certification System* **(PTQCS)".**

Supermarket of Competencies - Metals and Engineering Sector

MACHINING



Definition of Terms

1.	**bench work**	the operations incident to the process of laying out, fitting, assembling, etc… when the work is placed on the bench or in a bench vise
2.	**boring**	is the operation of enlarging a hole by means of an adjustable cutting tool with only one cutting edge
3.	**chipping**	is the operation of removing/cutting metal using hammer and chisel
4.	**counterboring**	is the operation of enlarging the end of a hole cylindrically
5.	**drilling**	is the operation of producing a circular hole by removing solid metal
6.	**facing**	the lathe operation of finishing the ends of the work, to make the piece the right length. Also known as squaring
7.	**grinding**	refers to the removal of material from a workpiece with grinding wheel
8.	**laying out**	term used to include the marking or scribing of center points, circles, arcs, or straight lines upon metal surfaces, either curved or flat, for the guidance of the worker
9.	**milling**	refers to removal of metal by feeding a workpiece through the periphery of rotating circular cutter
10.	**reaming**	is an operation of sizing and finishing a hole by means of a cutting tool having several cutting edges. reaming serves to make the hole smoother, straighter, and more accurate
11.	**spot-facing**	is the operation of smoothening and squaring the surface around a hole
12.	**tapping**	is the operation of forming internal threads by means of a tool called tap
13.	**turning**	refers to shaping a workpiece by gripping it in a workholding device and rotating it under power against a suitable cutting tool

ACKNOWLEDGEMENTS

The Technical Education and Skills Development Authority (TESDA) wishes to extend thanks and appreciation to the many representatives of business, industry, academe and government agencies who donated their time and expertise to the development and validation of these Training Regulations.

THE TESDA ADVISORY PANEL

MR. BENJAMIN MARIA AYCARDO†
TAP Chairman
UniMagma Phil., Inc.

MR. RAUL M. CONSUNJI
RMC Consultancy Services, Inc.

MR. CARLOS MEDINA, JR.
Co-Chairman
Don Bosco Technical College

MR. EDUARDO R. LACBAY†
Member
Metal Industry Research and Development Center

MR. JIMMY LIBO-ON RUZGAL
Member
FFW/MFI

THE TECHNICAL EXPERTS PANEL

MR. TIMOTEO INTALAN
Directric Industries, Inc.

The **PARTICIPANTS** in the Validation of these Training Regulations

Region I

MR. RAUL P. TAMINAYA
TESDA REGION I
San Fernando, La Union

CAR

MR. ROCKY F. DELA ROSA
Trinidad Valley Institute of Technology
La Trinidad,Benguet

MR. ROBERT V. NUESTRO
MOOG Controls Corporation Inc., Phils
Baguio City

MR. NESTOR A. LOMIBAO
MOOG Controls Corporation Inc., Phils
Baguio City

MR. EDWARD FRENZEL D. YAPYAPAN
TESDA-CAR, Baguio

Region VI

MR. RUEL D. BALDERAS
RJ Foundry Machine Shop Corp
Bacolod City, Negros Occ.

MR. JOSE G. JUNSAY, JR.
JJR Shop
Silay City

MR. EDGARDO R. GARCES
Ben's Machine Shop
Bacolod City, Negros Occ.

MR. PABLO H. CORTEZ, JR.
RTC Talisay
Talisay City, Negros Occ.

MR. LARRY A. BAYONETA
RJ Foundry Machine Shop Corp
Bacolod City, Negros Occ.

MR. JOSE MA. O JUSTINIANI, JR.
JO Justiniani Motors
Victorias City, Negros Occ.

MR. CHRISTOPHER I. COSTALES
Bacolod Advance Eng'g Employee Multi-Purpose Cooperative
Bacolod City, Negros Occ.

CARAGA

MR. BENJAMIN L. RUBI
WINRO Eng'g Works
Butuan City, Agusan del Norte

MR. HENRY M. ARREZA
Junel Machine Shop
Butuan City, Agusan del Norte

MR. LEONARDO A. CORTINA
Surigao State College of Technology
Surigao City, Surigao del Norte

MR. EDGARDO M. MENDOZA
Northern Mindanao School of Fisheris
Buenavista, Agusan del Norte

MR. ARTEMIO E. MARTIZANO, JR.
Agusan del Sur School of Arts & Trades
Prosperidad, Agusan del Sur

MR. RENEE C. TAN
Surigao State College of Technology
Surigao City, Surigao del Norte

MR. LIBERATO B. BANIOLA
Provincial Equipment Pool Office
Prosperidad, Agusan del Sur

The Members of the TESDA Board

The TESDA Executive Committee

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- ❑ Automotive Body Painting/Finishing NC II
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- ❑ Computer Hardware Servicing NC II
- ❑ Deck Seafaring NC II
- ❑ Dressmaking NC II
- ❑ Driving NC II
- ❑ Engine Seafaring NC II
- ❑ Food and Beverage Services NC II
- ❑ Footwear Making NC II
- ❑ Heavy Equipment Operation NC II
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- ❑ Housekeeping NC II
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