



COMPETENCY BASED CURRICULUM

MECHANICAL FITTING BQF Certificate-2

Technical Trainers Training and Resource Center
Department of Workforce Planning and Skills Development
Ministry of Education and Skills Development

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FOREWORD

Bhutan has seen a gradual increase in the requirement of skilled workers in recent years due to growth of industries. However, supply of skilled workforce that are responsive to the needs of the industry has not been able to keep in pace with the industry demand. Since the skilled workers are crucial ingredient for socio- economic development of the country, it is important to have adequate number of trained and certified workers. With growing industrial sector, the “Mechanical Technician” are not only the most significant occupation but also have high demand in the labour market. In an effort to meet the skilled human resources requirement in the area of power sector, it is imperative to deliver training based on Competency Based Training system in Mechanical Fitter to ensure quality and adequate number of work force in this sector.

To this end, the Department of Workforce Planning and Skills Development (DWPSD) is pleased to present the first edition of Competency Based Curriculum for Mechanical Fitter BQF Certificate-II course developed based on National Competency Standards (NCS) and using standard curriculum development guidelines. Since it is an outcome of a more participatory process of curriculum development, it is expected to provide training delivery with reformed approaches having its content being directly related to labour market needs, focusing on imparting of skills and assessment based on industry work standards. We believe that the Competency Based Curriculum will help in bridging the skill gap between industry’s needs and training institutes thereby enhance the employability of the technical graduates.

The Department acknowledges the valuable contributions made by institutes, officials, and experts from relevant industries who were involved in the design and development of this curriculum. As it is a dynamic document which may require revision based on the needs of the changing labour market, the Department look forward to receiving valuable feedbacks from the institutes and the industries to further improve and refine the curriculum. The Department hope that this document will help advance Competency Based Learning in most of the TVET Institutions.

Director
Department of Workforce Planning and Skills Development

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COMPETENCY PROFILE
Occupation: Mechanical Fitter
Level: BQF Certificate-II

Competency Area	Sub- Competency Area	Competencies/Tasks 			
A: Carryout production of mechanical parts	A1: Produce mechanical parts manually	A1.01 Perform hacksaw cutting	A1.02 Perform filing	A1.03 Perform internal threading	A1.04 Perform external threading
		A1.05 Perform chiselling	A1.06 Perform hand reaming	A1.07 Perform emery paper work	A1.08 Perform hand chamfering
	A2: Perform operation of power tools	A2.01 Perform high speed cutting	A2.02 Perform hand drilling	A2.03 Perform hand grinding	A2.04 Perform surface grinding
		A2.05 Perform power saw cutting			
	A3: Perform drilling machine operation	A3.01 Perform machine drilling	A3.02 Perform countersinking	A3.03 Perform counter boring	
	A4: Perform pedestal grinding machine operation	A4.01 Perform wheel dressing	A4.02 Perform single point cutting tool grinding	A4.03 Perform multipoint cutting tool grinding	
	A5: Perform lathe machine operation	A5.01 Setup job piece in 3jaw chuck	A5.02 Setup job piece in 4 jaw chuck	A5.03 Perform facing	A5.04 Perform center drilling

		A5.05 Perform straight turning	A5.06 Perform step turning	A5.07 Perform chamfering	A5.08 Perform grooving
		A5.09 Perform taper turning	A5.10 Perform knurling	A5.11 Perform lathe drilling	A5.12 Perform boring
		A5.13 Perform reaming	A5.14 Perform internal threading	A5.15 Perform external threading	A5.16 Perform eccentric turning
		A5.17 Perform form turning	A5.18 Perform parting off		
	A6: Perform milling machine operation	A6.01 Perform facing	A6.02 Perform side milling	A6.03 Perform gear cutting	A6.04 Perform keyway cutting
		A6.05 Perform slot cutting	A6.06 Perform hexagon milling	A6.07 Perform circular interpolation	A6.08 Perform dovetail cutting
	A7: Perform shaper machine operation	A7.01 Make internal keyway	A7.02 Make external keyway	A7.03 Perform angular surface cutting	
B: Carryout maintenance of machine tools	B1: Perform preventive maintenance	B1.01 Check lubricant	B1.02 Check Revolution Per Minute (RPM)	B1.03 Check vibration	B1.04 Check coolant
		B1.05 Check lathe machine geometry	B1.06 Check milling machine geometry	B1.07 Check tightness of fasteners	B1.08 Check mechanical drive
	B2: Perform predictive maintenance	B2.01 Change machine oil	B2.02 Change coolant	B2.03 Perform greasing	B2.04 Change filter
	B3:	B3.01 Diagnose machine fault	B3.02 Change V-belt	B3.03 Change pulley	B3.04 Change gears

	Perform breakdown maintenance	B3.05 Replace impeller of coolant pump	B3.06 Change shaft	B3.07 Change oil seal	B3.08 Change bearing
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COURSE INFORMATION

COURSE TITLE	Mechanical Fitting
LEVEL	BQF Certificate II
COURSE OBJECTIVE	Upon completion of Mechanical Fitting BQF Certificate II, the trainee will be able to: • Operate machine tools • Carryout production of mechanical parts • Carryout maintenance of machine tools
COURSE DESCRIPTION	This course is designed to provide learners with the knowledge, skills and attitude required of an individual to become competent as Mechanical Fitter in accordance with industry standards. Upon completion of this course, the graduates will be able to work in Manufacturing Industries where they can perform duties like operating machine tool, carrying out production of mechanical parts and maintenance of machine tools. To obtain the qualification of Mechanical Fitting BQF Certificate II, all learning outcomes prescribed for this qualification must be achieved.
INSTITUTE TRAINING DURATION ON-THE-JOB TRAINING(OJT) DURATION	Core Module: 1080 Hours + 562 Hours Generic subjects
TOTAL DURATION	420 Hours
TRAINING PROPORTION	2062 Hours
ENTRY REQUIREMENT	1:12 (Practical) 1:20 (Theory)
TRAINER QUALIFICATION	Class Ten Passed
	• Must have undergone Training of Trainers-Technical Instruction and Pedagogy • Must have a minimum qualification of Mechanical Fitting NC III or equivalent with three years of relevant working experience • Should have good moral character • Must¹ have at least 5 years' experience in relevant job/industry

¹ Applicable only if institutes hire instructor or guest lecturer from industry

COURSE OUTLINE

Sl. No	Subject /Module	Duration (Hours)	Content Competencies (Mapped)
1.	Core modules	1080	CC
2.	OJT	420(3 months)	CC
3.	Engineering Drawing	68	SS
4.	Applied Dzongkha	42	SS
5.	ICT	68	SS
6.	Applied Mathematics	60	SS
7.	Technical English	82	SS
8.	Entrepreneurship	70	SS
9.	Occupational Health and Safety (OHS)	68	ES
10.	Sustainable Consumption and Production (SCP)	36	ES
11.	Ethics, Integrity and Professionalism	68	PD
	Total Course Duration	2062	

Note: (*) This curriculum contains core modules which cover main competencies of Mechanical Fitting BQF Certificate-II and OJT component. There are separate curricula for subjects/modules for delivery of soft skills, professional development & values and environmental concern & safety. In order to achieve the qualification of Mechanical Fitting BQF Certificate-II, the subjects and modules listed must be accomplished as per the credit hours provided.

Content Competencies:

CC-Core Competencies

SS-Soft Skills

PD-Professional Development and Values

ES-Environmental concern and Safety

COURSE STRUCTURE FOR CORE COMPETENCIES

Training Modality	Module Title	Learning outcomes	Nominal Duration
1. Institute Training	1.1 Carrying out production of mechanical parts	1.1.1 Produce mechanical parts manually 1.1.2 Perform operation of power tools 1.1.3 Perform drilling machine operation 1.1.4 Perform pedestal grinding machine operation 1.1.5 Perform lathe machine operation 1.1.6 Perform milling machine operation 1.1.7 Perform sharper machine operation	792 Hours
	1.2 Carrying out maintenance of machine tools	1.2.1 Perform preventive maintenance work 1.2.2 Perform periodic maintenance 1.2.3 Perform planned maintenance	256 Hours
2. On the Job Training	2.1 Carrying out production of mechanical parts	2.1.1 Perform drilling machine operation 2.1.2 Perform pedestal grinding machine operation 2.1.3 Perform lathe machine operation 2.1.4 Perform milling machine operation 2.1.5 Perform sharper machine operation 2.1.6 Produce mechanical parts 2.1.7 Perform sharper machine operation	140 Hours
	2.2 Carrying out maintenance of machine tools	2.2.1 Perform preventive maintenance work 2.2.2 Perform periodic maintenance 2.2.3 Perform planned maintenance	280 Hours

ASSESSMENT

Formative assessment for every module and learning outcome will be conducted through assignments, project works, continuous assessment, demonstration of practical skills/observations, oral questioning and written test.

Summative assessment after completion of each national certificate level will be conducted by TVET Quality Council, Bhutan Qualifications and professional certification authority, MoESD as per the National Competency Standards and Guidelines for National Assessment and Certification System, provided the course is accredited with TVET Quality Council, Bhutan Qualifications and professional certification authority, MoESD.

CERTIFICATION

On successful completion of every module, the institute will award a certificate of achievement to the trainees. The TVET Quality Council, Bhutan Qualifications and professional certification authority, MoESD will award a National Certificate to the trainees upon the successful completion of NC level assessment.

**COURSE
DELIVERY**

1. Modular
2. Demonstration
3. Lecture
4. Discussion
5. Industrial visit/training
6. Project Work

RESOURCES

Materials

- V-belt, markin cloth, motor, marker pen, chalk, pulley, oil, gears, grease, kerosene, circlip, nuts & bolt, washer, emery paper, oil stone, diesel, impeller, coolant, shaft, oil seal, insulation paper, bearing, liquid gasket, anti-rust spray, cotton jute, reflective tape, copper shim, hacksaw blade, aluminium plain bar, grinding wheel, cutting wheel, high speed cutter wheel, high speed steel (HSS), power saw blade, water, soluble oil, Mild Steel, Stainless Steel, Carbon Steel & Aluminium job piece and nylon brush

Tools

- Container, ladle, hacksaw, bench vice, scribe, file, file card, tap set, tap wrench, chisel, anvil, reamer, spanner set, Allen key set, drill bit, centre punch, chuck key, socket set, drill chuck, countersink tool, drift, counter bore tool, wheel dresser, mallet, hammer, grooving tool, knurling tool, boring tool, internal threading tool, external threading tool, left hand turning tool, driving plate, lathe dog, center drill, live center, form tool, face mill cutter, adapter, screw driver set, side mill cutter, gear cutter, end milling cutter, slot cutter, surface plate, angle plate, die, die holder, parting tool, drill sleeve, collet chuck, mandrel, torque wrench, torch, grease gun, pulley puller, circlip pliers, V-block and pipe wrench

Instrument

- Measuring cylinder, refract meter, Vernier calliper, try square, steel ruler, outside and inside caliper, bevel protractor, divider, go no go gauge, Vernier height gauge, pitch gauge, measuring tape, roughness tester, surface/dial gauge, micro-meter, bore gauge, thread ring gauge, radius gauge, spirit level, plug gauge, granite square block (Triangular), tachometer, vibration meter, viscometer, trummeter, straight edge and laser alignment instrument

Equipment

- Drilling machine, hand drilling machine, high speed cutter, power saw, angle grinder, pedestal grinding machine, lathe machine, milling machine, bending machine, arbor press machine, coolant pump, shaper machine, hydraulic press machine, shearing machine and machine gearbox

PPE

- Nose mask, safety gloves, safety goggles, safety boots, ear muff/plug, leather apron, grinding shield, leg guard, hand sleeve, working dress and safety helmet

Learning Materials

- Reference books
- Handouts
- Audio visuals
- Competency Based Learning Materials (CBLM)

Infrastructure and Training facilities

- **Theory classroom size:** Minimum of 1 square meter per person
- **Practical workshop size:** Minimum of 2.25 square meter per student. Variables must be considered depending upon type of skill being taught and the number of students being participated at one time

MODULE INFORMATION:
MECHANICAL FITTING BQF C-II

MODULE 1
ON
CARRYING OUT PRODUCTION OF MECHANICAL PARTS

MODULE INFORMATION

Occupation	Mechanical Fitter
Competency Area	Carryout production of mechanical parts
Module Title	Carrying out production of mechanical parts
Module Code	7233-L2-M1
Module Description	This module is structured to provide learners with the knowledge, skills and right attitude required to produce mechanical parts manually, perform operation of power tools, perform drilling machine operation, perform pedestal grinding machine operation, perform lathe machine operation, perform milling machine operation and perform shaper machine operation
Nominal Duration	815 Hours
Certificate Level	BQF Certificate Level-II
Pre-requisite	Class X passed
Learning Outcome	1. Produce mechanical parts manually 2. Perform operation of power tools 3. Perform drilling machine operation 4. Perform pedestal grinding machine operation 5. Perform lathe machine operation 6. Perform milling machine operation 7. Perform shaper machine operation

Module Title	Carrying out production of mechanical parts		
Module Code	7233-L2-M1		
Learning Outcome 1	Produce mechanical parts manually		
Duration	Theory:21 hours	Practical:52 hours	Total:73 hours
Assessment Criteria	• Job piece is cut using hacksaw as per job requirement following standard procedures • Job piece is filed as per job requirement following standard procedures • Job piece is threaded manually using set of taps as per job requirement following standard procedures • External threading is performed manually using die as per job requirement following standard procedures • Job piece is cut/chipped using chisel as per job requirement following standard procedures • Hand reaming is performed manually as per job requirement following standard procedures • Emery polishing is performed manually as per job requirement following standard procedures • Hand chamfering is performed manually as per job requirement following standard procedures		
Content	A1.00 Introductory knowledge • Overview of mechanical fitting • Scopes and market trends of fitter A1.01 Performing hacksaw cutting Knowledge • Estimation and costing • Importance of marking and measuring instruments • Types of marking media • Types of hacksaw frame • Parts of hacksaw • Specification of hacksaw blade • Cutting position • Purpose of applying coolant • Material composition of job piece • Definition of bench vice • Parts of bench vice • Types of vice • Classification of blade Skills • Interpreting drawing • Using marking tool • Using try-square • Using steel ruler		

	• Using Vernier caliper • Using hacksaw <i>Attitude, safety and environmental concern</i> • Being time conscious • Having work ethics and integrity • Being efficient in using materials • Proper handling and storage of tools and materials • Having patience • Ensuring to follow OHS rules and regulations • Ensuring proper disposal of waste • Ensuring to be cautious while handling hacksaw • Ensuring to apply required pressure while cutting A1.02 Performing filing <i>Knowledge</i> • Definition of file • Classification of file • Parts of file • Types of file and their purpose <i>Skills</i> • Interpreting drawing • Using marking tool • Using try-square • Using steel ruler • Using Vernier caliper • Using Vernier height gauge • Using file • Using feeler gauge <i>Attitude, safety and environmental concern</i> • Being time conscious • Having work ethics and integrity • Being efficient in using materials • Proper handling and storage of tools and materials • Having patience • Ensuring to follow OHS rules and regulations • Ensuring proper disposal of waste • Ensuring to be cautious while handling file • Ensuring to apply required pressure while filing A1.03 Performing internal threading <i>Knowledge</i> • Introduction to thread
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	• Nomenclature of thread • Forms of thread • Application of internal threading • Definition of tapping • Types of tap • Tap Drill Size (TDS) calculation Skills • Interpreting drawing • Using tap • Using try-square • Using steel ruler • Using pitch gauge • Using Vernier caliper Attitude, safety and environmental concern • Being time conscious • Having work ethics and integrity • Being efficient in using materials • Proper handling and storage of tools and materials • Having patience • Ensuring to follow OHS rules and regulations • Ensuring proper disposal of waste • Ensuring to be cautious while handling tap • Ensuring to apply required pressure while tapping • Ensuring correct positioning of tap with respect to job piece while threading A1.04 Performing external threading Knowledge • Introduction to die • Types of die • Application of external threading Skills • Interpreting drawing • Using steel ruler • Using Vernier caliper • Using pitch gauge Attitude, safety and environment concern • Being time conscious • Having work ethics and integrity • Being efficient in using materials • Proper handling and storage of tools and materials • Having patience • Ensuring to follow OHS rules and regulations
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	- Ensuring proper disposal of waste A1.05 Performing chiselling Knowledge - Introduction to chisel - Types of chisel and their purpose - Parts of chisel - Properties of chisel - Purpose of anvil - Parts of anvil Skills - Interpreting drawing - Using marking tool - Using try-square - Using chisel - Using hammer Attitude, safety and environment concern - Being time conscious - Having work ethics and integrity - Being efficient in using materials - Proper handling and storage of tools and materials - Ensuring to follow OHS rules and regulations - Ensuring proper disposal of waste - Ensuring to be cautious while chiselling A1.06 Performing hand reaming Knowledge - Definition of reaming - Purpose of reaming - Types of reamer - Nomenclature of reamer Skills - Interpreting drawing - Using Vernier caliper - Using reamer Attitude, safety and environment concern - Being time conscious - Having work ethics and integrity - Being efficient in using materials - Proper handling and storage of tools and materials - Having patience - Ensuring to follow OHS rules and regulations
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	- Ensuring proper disposal of waste A1.07 Performing emery paper work Knowledge - Purpose of emery paper - Grades of emery paper Skills - Observation skills - Using emery paper Attitude, safety and environment concern - Being time conscious - Having work ethics and integrity - Being efficient in using materials - Proper handling and storage of tools and materials - Having patience - Ensuring to follow OHS rules and regulations - Ensuring proper disposal of waste A1.08 Performing hand chamfering Knowledge - Definition of chamfering - Purpose of chamfering Skills - Using chamfering tools - Observation skills Attitude, safety and environment concern - Being time conscious - Having work ethics and integrity - Being efficient in using materials - Proper handling and storage of tools and materials - Having patience - Ensuring to follow OHS rules and regulations - Ensuring proper disposal of waste
Learning Conditions	Learning Materials - CBLM - Hand-outs - Audio Visuals - Reference books - Manuals Learning facilities and infrastructure - Classroom with adequate facilities - Information Technology (IT) lab

	• Library • Workshop Materials • Hacksaw blade, job piece, chalk, emery paper and Markin cloth Tools • Hacksaw, bench vice, marking tool, file, file card, tap set, tap wrench, die, die holder, screwdriver set, chisel, anvil, chamfering tool and reamer Instruments • Refractometer, Vernier caliper, Vernier height gauge, try square, steel ruler, straight edge, bevel protractor, divider, go no go gauge, plug gauge, feeler gauge and pitch gauge PPE • Nose mask, safety gloves, safety goggles, safety boots, ear plug, apron and working dress
Underpinning skills	• Team work • Communication • Negotiation • Creativity • Problem solving • Time management
Instructional Methodologies	• Lecture • Interactive discussion • Demonstration • Industrial visit/training • Guided practice • Group practice • Individual practice
Method of Assessment	• Practical observation • Oral/viva-voce • Written test • Assignment • Project work

Module Title	Carrying out production of mechanical parts		
Module Code	7233-L2-M1		
Learning Outcome 2	Perform operation of power tools		
Duration	Theory: 7 hours	Practical:19 hours	Total:26 hours
Assessment Criteria	- Job piece is cut using high speed cutter as per job requirement following standard procedures - Job piece is drilled using hand drilling machine as per job requirement following standard procedures - Job piece is grinded using angle grinder as per job requirement following standard procedures - Job piece is cut using power saw as per job requirement following standard procedures - Surface grinding is performed as per job requirement following standard procedures		
Content	A2.01 Performing high speed cutting Knowledge - Introduction to high-speed cutter - Parts of high-speed cutter - Specification of high-speed cutter and cutting wheel Skills - Interpreting drawing - Using marking tools - Using high speed cutter Attitude, safety and environmental concern - Being time conscious - Having work ethics and integrity - Being efficient in using materials - Proper handling and storage of tools and materials - Having patience - Ensuring to follow OHS rules and regulation - Ensuring correct use of PPE - Ensuring proper disposal of waste - Ensuring to be cautious while handling high speed cutter A2.02 Performing hand drilling Knowledge - Definition of drilling - Types of drill bit - Parts of drill bit and its functions - Specification of hand drill Skills - Interpreting drawing - Using centre punch - Using Vernier caliper		

	• Using chuck key • Operating hand drilling machine <i>Attitude, safety and environmental concern</i> • Being time conscious • Having work ethics and integrity • Being efficient in using materials • Proper handling and storage of tools and materials • Having patience • Ensuring to follow OHS rules and regulations • Ensuring proper disposal of waste • Ensuring to apply required pressure while drilling A2.03 Performing hand grinding <i>Knowledge</i> • Definition of grinding • Types of grinding wheel and its specification <i>Skills</i> • Interpreting drawing • Using marking tool • Using try-square • Using steel ruler • Using Vernier caliper • Using surface roughness gauge/surface plate • Operating angle grinder <i>Attitude, safety and environmental concern</i> • Being time conscious • Having work ethics and integrity • Being efficient in using materials • Proper handling and storage of tools and materials • Having patience • Ensuring to follow OHS rules and regulations • Ensuring proper disposal of waste • Ensuring to be cautious while handling angle grinder • Ensuring to apply required pressure while hand grinding A2.04 Performing surface grinding <i>Knowledge</i> • Definition of surface grinding • Working principle of surface grinder • Definition of surface texture • Signs and symbols of surface roughness • Types of surface texture measuring instrument and its purpose
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	<i>Skills</i> • Interpreting drawing • Using marking tool • Using try-square • Using steel ruler • Using Vernier caliper • Using surface roughness gauge/surface plate • Operating surface grinder • Using micrometer/screw gauge <i>Attitude, safety and environmental concern</i> • Being time conscious • Having work ethics and integrity • Being efficient in using materials • Proper handling and storage of tools and materials • Having patience • Ensuring to follow OHS rules and regulations • Ensuring proper disposal of waste • Ensuring to be cautious while operating power saw • Ensuring appropriate use of PPE A2.05 Performing power saw cutting <i>Knowledge</i> • Introduction to power saw • Parts of power saw • Working principle of power saw <i>Skills</i> • Interpreting drawing • Using steel ruler/measuring tape • Using vernier calliper • Fixing power saw blade <i>Attitude, safety and environmental concern</i> • Being time conscious • Having work ethics and integrity • Being efficient in using materials • Proper handling and storage of tools and materials • Having patience • Ensuring to follow OHS rules and regulations • Ensuring proper disposal of waste • Ensuring to be cautious while operating power saw • Ensuring to apply coolant while cutting the job • Ensuring appropriate use of PPE
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Learning Conditions	Learning Materials • CBLM • Hand-outs • Audio Visuals • Reference books • Manuals Learning Facilities and infrastructure • Classroom with adequate facilities • Information Technology (IT) lab • Library • Workshop Materials • Cutting wheel, job piece, grinding wheel, coolant, brush and power saw blade Tools • Spanner set, Allen key set, marking tool, drill bit, centre punch, chuck key, hammer, try square, surface plate and bench vice Instruments • Steel ruler, measuring tape, bevel protractor, Vernier caliper, straight edge and roughness gauge Equipment • High speed cutter, power saw, hand drilling machine, angle grinder and surface grinder PPE • Safety gloves, safety boots, safety helmet, ear muff/plug, apron, grinding shield, working dress, nose mask, safety goggles, leg guard and hand sleeve
Underpinning Skills	• Team work • Communication • Negotiation • Creativity • Problem solving • Time management
Instructional Methodologies	• Lecture • Interactive discussion • Demonstration • Industrial visit/training • Guided practice • Group practice • Individual practice

Method of Assessment	• Practical observation • Oral/viva-voce • Written test • Assignment • Project work
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Module Title	Carrying out production of mechanical parts		
Module Code	7233-L2-M1		
Learning Outcome 3	Perform drilling machine operation		
Duration	Theory:8 hours	Practical:18 hours	Total:26 hours
Assessment Criteria	- Machine drilling is performed as per job requirement following standard procedures - Countersinking is performed as per job requirement following standard procedures - Counter boring is performed as per the job requirement following standard procedures		
Content	A3.01 Performing machine drilling Knowledge - Introduction to drilling machine - Types of drilling machine - Working principle of drilling machine - Parts of drilling machine - Accessories of drilling machine - Differences between drill sleeve and socket - Purpose of drill drift - Selection of rpm as per size of drill bit - Calculation of feed rate, drilling time and cutting speed Skills - Interpreting drawing - Operating drilling machine - Using drift - Using Vernier caliper - Using chuck key - Numeracy skills Attitude, safety and environmental concern - Being time conscious - Having work ethics and integrity - Being efficient in using materials - Proper handling and storage of tools and materials - Having patience - Ensuring to follow OHS rules and regulation - Ensuring correct use of PPE - Ensuring proper disposal of waste A3.02 Performing countersinking Knowledge - Definition of countersinking - Purpose of countersinking - Angle of countersinking - Types of countersink tools		

	<i>Skills</i> • Interpreting drawing • Operating drilling machine • Using Vernier caliper • Using drill chuck key <i>Attitude, safety and environmental concern</i> • Being time conscious • Having work ethics and integrity • Being efficient in using materials • Proper handling and storage of tools and materials • Having patience • Ensuring to follow OHS rules and regulation • Ensuring correct use of PPE • Ensuring proper disposal of waste A3.03 Performing counter boring <i>Knowledge</i> • Definition of counter boring • Purpose of counter boring • Comparison between counter boring and countersinking <i>Skills</i> • Interpreting drawing • Operating drilling machine • Using Vernier caliper • Using drill chuck key <i>Attitude, safety and environmental concern</i> • Being time conscious • Having work ethics and integrity • Being efficient in using materials • Proper handling and storage of tools and materials • Having patience • Ensuring to follow OHS rules and regulation • Ensuring correct use of PPE • Ensuring proper disposal of waste
Learning Conditions	Learning Materials • CBLM • Hand-outs • Audio Visuals • Reference books • Manuals Learning Facilities and infrastructure • Classroom with adequate facilities

	• Information Technology (IT) lab • Library • Workshop Materials • Brush, job piece, marking clothes and coolant Tools • Drill chuck key, drill chuck, drill socket, hammer, marking tool, countersink tool, drill sleeve, socket set, drill bit, centre punch, drift, anvil and counterbore tool Instruments • Vernier caliper and steel ruler Equipment • Drilling machine PPE • Safety gloves, safety boots, safety helmet, ear muff/plug, apron, working dress and safety goggles
Underpinning skills	• Team work • Communication • Negotiation • Creativity • Problem solving • Time management
Instructional Methodologies	• Lecture • Interactive discussion • Demonstration • Industrial visit/training • Guided practice • Group practice • Individual practice
Method of Assessment	• Practical observation • Oral/viva-voce • Written test • Assignment • Project work

Module Title	Carrying out production of mechanical parts		
Module Code	7233-L2-M1		
Learning Outcome 4	Perform pedestal grinding machine operation		
Duration	Theory:6 hours	Practical:30 hours	Total:36 hours
Assessment Criteria	- Wheel dressing is performed as per job requirement following standard procedures - Single point cutting tool is grinded as per job requirement following standard procedures - Multipoint cutting tool is grinded as per job requirement following standard procedures		
Content	A4.01 Performing wheel dressing Knowledge - Introduction to pedestal grinding machine - Definition of wheel dresser - Purpose of wheel dressing - Types of wheel dresser Skills - Operating pedestal grinding machine - Using wheel dresser - Observation skills Attitude, safety and environmental concern - Being time conscious - Having work ethics and integrity - Being efficient in using materials - Proper handling and storage of tools and materials - Having patience - Ensuring to follow OHS rules and regulations - Ensuring correct use of PPE - Ensuring proper disposal of waste A4.02 Performing single point cutting tool grinding Knowledge - Introduction to cutting tool - Types of cutting tool - Properties of cutting tool - Nomenclature of single point cutting tool Skills - Interpreting drawing - Operating pedestal grinding machine - Using bevel protractor - Using pitch gauge - Using radius gauge - Using vernier calliper		

	<i>Attitude, safety and environmental concern</i> • Being time conscious • Having work ethics and integrity • Being efficient in using materials • Proper handling and storage of tools and materials • Having patience • Ensuring to follow OHS rules and regulation • Ensuring correct use of PPE • Ensuring proper disposal of waste A4.03 Performing multipoint cutting tool grinding <i>Knowledge</i> • Definition of multipoint cutting tool • Types of multipoint cutting tool • Nomenclature of multipoint cutting tool • Differences between single point and multipoint cutting tool <i>Skills</i> • Interpreting drawing • Operating pedestal grinding machine • Using bevel protractor <i>Attitude, safety and environmental concern</i> • Being time conscious • Having work ethics and integrity • Being efficient in using materials • Proper handling and storage of tools and materials • Having patience • Ensuring to follow OHS rules and regulation • Ensuring correct use of PPE • Ensuring proper disposal of waste
Learning Conditions	Learning Materials • CBLM • Hand-outs • Audio Visuals • Reference books • Manuals Learning Facilities and infrastructure • Classroom with adequate facilities • Information Technology (IT) lab • Library • Workshop

	Materials - Grinding wheel, cutting tool bit, Mild Steel Square Bar, coolant and drill bit Tools - Wheel dresser, screwdriver set, Allen key set and spanner set Equipment - Pedestal grinding machine Instrument - Bevel protractor, vernier calliper, radius gauge and pitch gauge PPE - Safety gloves, safety boots, safety helmet, ear muff/plug, apron, grinding shield, working dress and safety goggles
Underpinning skills	- Team work - Communication - Negotiation - Creativity - Problem solving - Time management
Instructional Methodologies	- Lecture - Interactive discussion - Demonstration - Industrial visit/training - Guided practice - Group practice - Individual practice
Method of Assessment	- Practical observation - Oral/viva-voce - Written test - Assignment - Project work

Module Title	Carrying out production of mechanical parts		
Module Code	7233-L2-M1		
Learning Outcome 5	Perform lathe machine operation		
Duration	Theory:52 hours	Practical:282 hours	Total:334 hours
Assessment Criteria	• Job piece is set up in 3 jaw chuck as per the standard procedures • Job piece is set up in 4 jaw chuck as per the standard procedures • Facing of job piece is performed using lathe machine following standard procedures • Center drilling is performed on the job piece following standard procedures • Plain turning of job piece is performed following standard procedures • Step turning of job piece is performed following standard procedures • Job piece is chamfered as per the standard procedures • Grooving is performed using grooving tool following standard procedures • Taper turning is performed as per the standard procedures • Knurling is performed by using knurling tool following standard procedures • Drilling is performed using lathe machine following standard procedures • Boring is performed using lathe machine as per job requirement following standard procedures • Reaming is performed on job piece using lathe machine as per job requirement following standard procedures • Internal threading is performed using lathe machine as per the job requirement following standard procedures • External threading is performed on job piece using lathe machine as per standard procedures • Job piece is turned eccentrically using lathe machine as per the job requirement following standard procedures • Form turning is performed as per standard procedures • Parting off is performed on job piece as per standard procedures		
Content	A5.01 Setting up job piece in 3jaw chuck Knowledge • Introduction to lathe machine • Safety precaution associated with lathe machine • Types of lathe machine and its specification • Parts of lathe machine and its function • Working principle of lathe machine • Lathe attachment and accessories • Types of operations performed on lathe machine • Definition of jigs and fixtures • Advantage of jigs and fixtures • Purpose of using 3jaw chuck Skills • Interpreting drawing		

	• Using chuck key • Tool centering skills • Using surface gauge • Using dial gauge <i>Attitude, safety and environmental concern</i> • Being time conscious • Having work ethics and integrity • Being efficient in using materials • Proper handling and storage of tools and materials • Having patience • Ensuring to follow OHS rules and regulations • Ensuring proper disposal of waste A5.02 Setting up job piece in 4jaw chuck <i>Knowledge</i> • Purpose of using 4jaw chuck • Differences between 3jaw chuck and 4jaw chuck • Importance of surface gauge/dial gauge <i>Skills</i> • Interpreting drawing • Using chuck key • Using dial gauge • Using surface gauge • Tool centering skills <i>Attitude, safety and environmental concern</i> • Being time conscious • Having work ethics and integrity • Being efficient in using materials • Proper handling and storage of tools and materials • Having patience • Ensuring to follow OHS rules and regulations • Ensuring proper disposal of waste A5.03 Performing facing <i>Knowledge</i> • Definition of facing • Purpose of facing • Definition of feed, depth of cut and cutting speed • Importance of selecting appropriate RPM, depth of cut and feed rate • Calculation of feed rate, depth of cut, spindle speed and machining time <i>Skills</i> • Interpreting drawing
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	• Using surface gauge • Operating lathe machine • Setting up tool post angle • Numeracy skills • Tool grinding skills <i>Attitude, safety and environmental concern</i> • Being time conscious • Having work ethics and integrity • Being efficient in using materials • Proper handling and storage of tools and materials • Having patience • Ensuring to follow OHS rules and regulations • Ensuring proper disposal of waste • Ensuring to be cautious while operating lathe machine • Ensuring to provide required feed while facing A5.04 Performing center drilling <i>Knowledge</i> • Definition of center drilling • Purpose of center drilling <i>Skills</i> • Interpreting drawing • Using drill chuck • Using socket • Using sleeve • Operating lathe machine • Tool grinding skills <i>Attitude, safety and environmental concern</i> • Being time conscious • Having work ethics and integrity • Being efficient in using materials • Proper handling and storage of tools and materials • Having patience • Ensuring to follow OHS rules and regulations • Ensuring proper disposal of waste A5.05 Performing straight turning <i>Knowledge</i> • Definition of turning • Methods of turning • Calculation of feed rate, depth of cut, spindle speed and machining time
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	<i>Skills</i> • Interpreting drawing • Using Vernier caliper • Using screw gauge/outside micrometer • Numeracy skills • Setting up tool post angle • Tool grinding skills <i>Attitude, safety and environmental concern</i> • Being time conscious • Having work ethics and integrity • Being efficient in using materials • Proper handling and storage of tools and materials • Having patience • Ensuring to follow OHS rules and regulations • Ensuring proper disposal of waste A5.06 Performing step turning <i>Knowledge</i> • Definition of step turning • Purpose of step turning <i>Skills</i> • Interpreting drawing • Using Vernier caliper • Using screw gauge/outside micrometer • Operating lathe machine • Using chuck key • Numeracy skills • Tool grinding skills <i>Attitude, safety and environmental concern</i> • Proper handling of tools, equipment and materials • Being observant • Being patient • Working in team • Being time conscious • Ensuring appropriate use of PPE • Ensuring proper disposal of waste • Ensuring to follow OHS rules and regulations A5.07 Performing chamfering <i>Knowledge</i> • Definition of chamfering • Purpose of chamfering
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	• Methods of chamfering • Importance of maintaining chamfering angle <i>Skills</i> • Interpreting drawing • Using Vernier caliper • Using Vernier height gauge • Using chuck key • Using dial gauge • Using surface gauge • Using outside micrometer • Tool grinding skills • Using bevel protractor • Operating lathe machine <i>Attitude, safety and environmental concern</i> • Being time conscious • Having work ethics and integrity • Being efficient in using materials • Proper handling and storage of tools and materials • Having patience • Ensuring to follow OHS rules and regulations • Ensuring proper disposal of waste A5.08 Performing grooving <i>Knowledge</i> • Definition of grooving • Types of grooving • Purpose of grooving <i>Skills</i> • Interpreting drawing • Using Vernier caliper • Tool grinding skills • Operating lathe machine • Numeracy skills <i>Attitude, safety and environmental concern</i> • Being time conscious • Having work ethics and integrity • Being efficient in using materials • Proper handling and storage of tools and materials • Having patience • Ensuring to follow OHS rules and regulations • Ensuring proper disposal of waste
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	A5.09 Performing taper turning <i>Knowledge</i> • Definition of taper turning • Methods of taper turning • Calculation of taper angle • Purpose of taper turning <i>Skills</i> • Interpreting drawing • Using Vernier caliper • Using taper ring gauge • Using bevel protractor • Operating lathe machine • Numeracy skills • Tool grinding skills <i>Attitude, safety and environmental concern</i> • Being time conscious • Having work ethics and integrity • Being efficient in using materials • Proper handling and storage of tools and materials • Having patience • Ensuring to follow OHS rules and regulations • Ensuring proper disposal of waste A5.10 Performing knurling <i>Knowledge</i> • Definition of knurling • Purpose of knurling • Types of knurling pattern • Methods of knurling • Application of knurling • Calculation of feed rate, depth of cut, spindle speed and machining time <i>Skills</i> • Interpreting drawing • Using Vernier caliper • Using knurling tool • Operating lathe machine • Numeracy skills • Setting up tool post angle <i>Attitude, safety and environmental concern</i> • Being time conscious • Having work ethics and integrity • Being efficient in using materials
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	• Proper handling and storage of tools and materials • Having patience • Ensuring to follow OHS rules and regulations • Ensuring proper disposal of waste A5.11 Performing lathe drilling <i>Knowledge</i> • Purpose of drill chuck and drill sleeve • Calculation of cutting speed and rpm • Selection of rpm for drilling operation • Importance of center drilling prior to lathe drilling <i>Skills</i> • Interpreting drawing • Using Vernier caliper • Using dial gauge/surface gauge • Using drift • Using sleeve • Operating lathe machine • Numeracy skills <i>Attitude, safety and environmental concern</i> • Being time conscious • Having work ethics and integrity • Being efficient in using materials • Proper handling and storage of tools and materials • Having patience • Ensuring to follow OHS rules and regulation • Ensuring correct use of PPE • Ensuring proper disposal of waste A5.12 Performing boring <i>Knowledge</i> • Definition of boring • Purpose of boring • Types of boring tool <i>Skills</i> • Interpreting drawing • Operating lathe machine • Tool grinding skills • Using Vernier caliper • Using bore gauge • Using plug gauge • Using inside micrometer
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	<i>Attitude, safety and environmental concern</i> • Being time conscious • Having work ethics and integrity • Being efficient in using materials • Proper handling and storage of tools and materials • Having patience • Ensuring to follow OHS rules and regulations • Ensuring proper disposal of waste A5.13 Performing reaming <i>Knowledge</i> • Reamer allowance and rpm for reaming • Concept of fit, tolerance and allowances • Difference between reaming and boring <i>Skills</i> • Interpreting drawing • Operating lathe machine • Using Vernier caliper • Using chuck key • Using dial gauge/surface gauge • Using socket & sleeve • Using plug gauge • Using drift • Using bore gauge <i>Attitude, safety and environmental concern</i> • Being time conscious • Having work ethics and integrity • Being efficient in using materials • Proper handling and storage of tools and materials • Having patience • Ensuring to follow OHS rules and regulations • Ensuring proper disposal of waste A5.14 Performing internal threading <i>Knowledge</i> • Process of internal threading <i>Skills</i> • Interpreting drawing • Setting gear ratio • Operating lathe machine • Using Vernier caliper • Using chuck key
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	• Using pitch gauge • Using dial gauge/surface gauge • Using go no go thread gauge • Using drift • Tool grinding skills • Numeracy skills <i>Attitude, safety and environmental concern</i> • Being time conscious • Having work ethics and integrity • Being efficient in using materials • Proper handling and storage of tools and materials • Having patience • Ensuring to follow OHS rules and regulations • Ensuring proper disposal of waste A5.15 Performing external threading <i>Knowledge</i> • Process of external threading • Purpose of single thread and double thread • Differences between right-hand and left-hand thread <i>Skills</i> • Interpreting drawing • Operating lathe machine • Setting gear ratio • Using Vernier caliper • Using chuck key • Using dial gauge/surface gauge • Using go no go thread gauge • Using drift • Using pitch gauge • Tool grinding skills <i>Attitude, safety and environmental concern</i> • Being time conscious • Having work ethics and integrity • Being efficient in using materials • Proper handling and storage of tools and materials • Having patience • Ensuring to follow OHS rules and regulations • Ensuring proper disposal of waste
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	A5.16 Performing eccentric turning <i>Knowledge</i> • Definition of eccentric turning • Methods of eccentric turning • Application of eccentric turning • Difference between eccentric and concentric <i>Skills</i> • Interpreting drawing • Using V-Block • Using jigs & fixtures • Using Vernier caliper • Using Vernier height gauge • Using chuck key • Using dial gauge • Using surface gauge • Using outside Micrometer • Operating lathe machine <i>Attitude, safety and environmental concern</i> • Being time consciousness • Having work ethics and integrity • Being efficient in using materials • Proper handling and storage of tools and materials • Having patience • Ensuring to follow OHS rules and regulations • Ensuring proper disposal of waste A5.17 Performing form/profile turning <i>Knowledge</i> • Definition of form/profile turning • Types of form turning • Methods of form turning • Purpose of form turning <i>Skills</i> • Interpreting drawing • Using radius gauge • Tool grinding skills • Using Vernier caliper • Using Vernier height gauge • Using chuck key • Using dial gauge/surface gauge • Using outside micrometer • Using template
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	• Operating lathe machine <i>Attitude, safety and environmental concern</i> • Being time conscious • Having work ethics and integrity • Being efficient in using materials • Proper handling and storage of tools and materials • Having patience • Ensuring to follow OHS rules and regulations • Ensuring proper disposal of waste A5.18 Performing parting off <i>Knowledge</i> • Definition of parting off • Purpose of parting off • Differences between grooving and parting off <i>Skills</i> • Interpreting drawing • Using Vernier caliper • Using chuck key • Tool grinding skills • Operating lathe machine • Setting up tool post angle <i>Attitude, safety and environmental concern</i> • Being time conscious • Having work ethics and integrity • Being efficient in using materials • Proper handling and storage of tools and materials • Having patience • Ensuring to follow OHS rules and regulations • Ensuring proper disposal of waste
Learning Conditions	Learning Materials • CBLM • Hand-outs • Audio Visuals • Reference books • Manuals Learning Facilities and infrastructure • Classroom with adequate facilities • Information Technology (IT) lab • Library • Workshop

	Materials • Job piece, coolant, markin cloth, emery paper, marker and cutting oil Tools • Chuck key, Allen key set, file, socket set, mallet, hammer, grooving tool, knurling tool, spanner set, marking tool, drift, drill bit, boring tool, drill chuck key, reamer, internal threading tool, external threading tool, left hand turning tool, center drill bit, parting tool, single point cutting tool and form tool Instrument • Vernier caliper, Vernier height gauge, surface gauge, dial gauge, steel ruler, micrometer, bevel protractor, thread ring gauge, bore gauge, plug gauge, go no go thread gauge, templates, pitch gauge and radius gauge Equipment • Lathe machine, pedestal grinding machine and tool grinding machine PPE • Nose mask, safety gloves, safety goggles, ear plug, safety boots and working dress
Underpinning skills	• Team work • Communication • Negotiation • Creativity • Problem solving • Time management
Instructional Methodologies	• Lecture • Interactive discussion • Demonstration • Industrial visit/training • Guided practice • Group practice • Individual practice
Method of Assessment	• Practical observation • Oral/viva-voce • Written test • Assignment • Project work

Module Title	Carrying out production of mechanical parts		
Module Code	7233-L2-M1		
Learning Outcome 6	Perform milling machine operation		
Duration	Theory:35 hours	Practical:227 hours	Total:262 hours
Assessment Criteria	• Facing is performed on milling machine following standard procedures • Side milling is performed using milling machine following standard procedures • Gear cutting is performed using milling machine as per standard procedures • Key way is cut using milling machine as per standard procedures • Slot cutting is performed as per standard procedures • Hexagon milling is performed as per standard procedures • Circular interpolation is performed in milling machine as per standard procedures • Dove tail cutting is performed by using shaper machine following standard procedures		
Content	A6.01 Performing facing Knowledge • Introduction to milling machine • Types and specification of milling machine • Working principle of milling machine • Parts of milling machine and its function • Types of milling operation • Types of milling cutter • Attachment and accessories of milling machine • Differences between lathe and milling machine • Introduction to facing • Machining time calculation Skills • Interpreting drawing • Using dial gauge • Using Vernier caliper • Operating milling machine • Using micrometer • Using surface roughness gauge • Numeracy skills Attitude, safety and environmental concern • Being time conscious • Having work ethics and integrity • Being efficient in using materials • Proper handling and storage of tools and materials • Having patience • Ensuring to follow OHS rules and regulations • Ensuring proper disposal of waste		

	A6.02 Performing side milling <i>Knowledge</i> • Definition of side milling • Purpose of side milling • Types of side mill cutter <i>Skills</i> • Interpreting drawing • Using Vernier height gauge • Using Vernier caliper • Using collet chuck • Using surface roughness gauge • Using micrometer <i>Attitude, safety and environmental concern</i> • Being time conscious • Having work ethics and integrity • Being efficient in using materials • Proper handling and storage of tools and materials • Having patience • Ensuring to follow OHS rules and regulations • Ensuring proper disposal of waste A6.03 Performing gear cutting <i>Knowledge</i> • Definition of gear • Types of gear • Purpose of gear • Types of gear train • Types of gear cutter • Types of indexing head • Purpose of indexing head • Calculation of simple indexing <i>Skills</i> • Interpreting drawing • Using steel ruler • Using Vernier caliper • Using dial gauge • Using machine vice • Operating milling machine • Operating indexing head • Numeracy skills <i>Attitude, safety and environmental concern</i> • Being time conscious
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	• Having work ethics and integrity • Being efficient in using materials • Proper handling and storage of tools and materials • Having patience • Ensuring to follow OHS rules and regulations • Ensuring proper disposal of waste A6.04 Performing keyway cutting <i>Knowledge</i> • Introduction to key and keyway • Purpose of key and keyway • Types of key • Types of keyway cutter • Methods of keyway cutting <i>Skills</i> • Interpreting drawing • Operating milling machine • Using Vernier caliper • Using Vernier depth gauge <i>Attitude, safety and environmental concern</i> • Being time conscious • Having work ethics and integrity • Being efficient in using materials • Proper handling and storage of tools and materials • Having patience • Ensuring to follow OHS rules and regulations • Ensuring proper disposal of waste A6.05 Performing slot cutting <i>Knowledge</i> • Purpose of slot • Types of slot • Application of slot • Methods of slot cutting • Difference between slot, keyway and groove <i>Skills</i> • Interpreting drawing • Operating milling machine • Using Vernier caliper • Using Vernier depth gauge <i>Attitude, safety and environmental concern</i> • Being time conscious
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	• Having work ethics and integrity • Being efficient in using materials • Proper handling and storage of tools and materials • Having patience • Ensuring to follow OHS rules and regulations • Ensuring proper disposal of waste A6.06 Performing hexagon milling <i>Knowledge</i> • Importance of hexagon milling • Application of hexagon milling <i>Skills</i> • Interpreting drawing • Operating milling machine • Using Vernier caliper • Using indexing head <i>Attitude, safety and environmental concern</i> • Being time conscious • Having work ethics and integrity • Being efficient in using materials • Proper handling and storage of tools and materials • Having patience • Ensuring to follow OHS rules and regulations • Ensuring proper disposal of waste A6.07 Performing circular interpolation <i>Knowledge</i> • Definition of circular interpolation • Application of circular interpolation • Definition of rotary table • Types of rotary table • Purpose of rotary table <i>Skills</i> • Interpreting drawing • Operating milling machine • Using Vernier caliper • Using rotary table • Using micrometer • Using surface roughness gauge • Using bore gauge <i>Attitude, safety and environmental concern</i> • Being time conscious
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	• Having work ethics and integrity • Being efficient in using materials • Proper handling and storage of tools and materials • Having patience • Ensuring to follow OHS rules and regulations • Ensuring proper disposal of waste A6.08 Performing dovetail cutting <i>Knowledge</i> • Definition of dovetail • Purpose of dovetail • Methods of dovetail cutting • Application of dovetail <i>Skills</i> • Interpreting drawing • Using Vernier caliper • Using dial gauge • Using bevel protractor • Operating milling machine <i>Attitude, safety and environmental concern</i> • Being time conscious • Having work ethics and integrity • Being efficient in using materials • Proper handling and storage of tools and materials • Having patience • Ensuring to follow OHS rules and regulations • Ensuring proper disposal of waste
Learning Conditions	Learning Materials • CBLM • Hand-outs • Audio Visuals • Reference books • Manuals Learning Facilities and infrastructure • Classroom with adequate facilities • Information Technology (IT) lab • Library • Workshop

	Materials • Job piece, marker, coolant, markin cloth and brush Tools • Face mill cutter, socket set, Allen key set, adapter, screwdriver set, hammer, mallet, drill bit, center punch, side mill cutter, hook spanner, spanner set, gear cutter, dovetail cutter, adjustable wrench, end milling cutter and slot cutter Instrument • Vernier caliper, surface roughness gauge, inside micrometer, dial gauge, bore gauge, plug gauge, vernier depth gauge and spirit level Equipment • Milling Machine, tool grinding machine and pedestal grinding machine PPE • Nose mask, safety gloves, safety goggles, safety boots, ear plug, and working dress
Underpinning skills	• Team work • Communication • Negotiation • Creativity • Problem solving • Time management
Instructional Methodologies	• Lecture • Interactive discussion • Demonstration • Industrial visit/training • Guided practice • Group practice • Individual practice
Method of Assessment	• Practical observation • Oral/viva-voce • Written test • Assignment • Project work

Module Title	Carrying out production of mechanical parts		
Module Code	7233-L2-M1		
Learning Outcome 7	Perform shaper machine operation		
Duration	Theory:16 hours	Practical:42 hours	Total: 58 hours
Assessment Criteria	- Internal keyway is cut using shaper machine as per job requirement following standard procedures - External key is cut using shaper machine as per job requirement following standard procedures - Angular cutting is performed by using shaper machine as per job requirement following standard procedures		
Content	A7.01 Making internal keyway Knowledge - Introduction to shaper machine - Types of shaper machine - Parts of shaper machine and its function - Working mechanism of shaper machine - Calculation of shaper speed, shaper feed and depth of cut - Types of shaper tool - Differences between milling and shaper machine - Introduction to internal keyway Skills - Interpreting drawing - Using Vernier caliper - Operating shaper machine - Tool grinding skills Attitude, safety and environmental concern - Being time conscious - Having work ethics and integrity - Being efficient in using materials - Proper handling and storage of tools and materials - Having patience - Ensuring to follow OHS rules and regulations - Ensuring proper disposal of waste A7.02 Making external keyway Knowledge - Introduction to external keyway - Application of key & keyway Skills - Interpreting drawing - Using Vernier caliper - Using vernier depth gauge		

	• Using spirit level • Operating shaper machine • Tool grinding skills <i>Attitude, safety and environmental concern</i> • Being time conscious • Having work ethics and integrity • Being efficient in using materials • Proper handling and storage of tools and materials • Having patience • Ensuring to follow OHS rules and regulations • Ensuring proper disposal of waste A7.03 Performing angular surface cutting <i>Knowledge</i> • Introduction to angular surface cutting • Methods of angular surface cutting <i>Skills</i> • Interpreting drawing • Using Vernier caliper • Operating shaper machine • Using bevel protractor • Tool grinding skills <i>Attitude, safety and environmental concern</i> • Being time conscious • Having work ethics and integrity • Being efficient in using materials • Proper handling and storage of tools and materials • Having patience • Ensuring to follow OHS rules and regulations • Ensuring proper disposal of waste
Learning Conditions	Learning Materials • CBLM • Hand-outs • Audio Visuals • Reference books • Manuals Learning Facilities and infrastructure • Classroom with adequate facilities • Information Technology (IT) lab • Library • Workshop

	Materials • Job piece, coolant, marker, markin clothes and brush Tools • Cutting tool, socket set, hammer, adjustable wrench, Allen key set and screwdriver set Instrument • Vernier caliper, dial gauge, bevel protractor, steel ruler, surface roughness gauge, vernier depth gauge and micrometer Equipment • Shaper machine and tool grinding machine/pedestal grinding machine PPE • Nose mask, safety gloves, safety goggles, ear plug, safety boots, and working dress
Underpinning Skills	• Team work • Communication • Negotiation • Creativity • Problem solving • Time management
Instructional Methodologies	• Lecture • Interactive discussion • Demonstration • Industrial visit/training • Guided practice • Group practice • Individual practice
Method of Assessment	• Practical observation • Oral/viva-voce • Written test • Assignment • Project work

MODULE 2
ON
CARRYING OUT MAINTENANCE OF MACHINE TOOLS

MODULE INFORMATION

Occupation	Mechanical Fitter
Competency Area	Carryout maintenance of machine tools
Module Title	Carrying out maintenance of machine tools
Module Code	7233-L2-M2
Module Description	This module is structured to provide the learners with knowledge, skills and right attitude required to perform preventive maintenance work, periodic maintenance and planned maintenance
Nominal Duration	265 Hours
Qualification Level	BQF Certificate Level-II
Pre-requisite	Completed Module: 7233-L2-M1
Learning Outcome	1. Perform preventive maintenance 2. Perform predictive maintenance 3. Perform breakdown maintenance

Module Title	Carrying out maintenance of machine tools		
Module Code	7233-L2-M2		
LearningOutcome1	Perform preventive maintenance work		
Duration	Theory:21 hours	Practical:52 hours	Total:73 hours
Assessment Criteria	• Lubricant level is checked as per standard procedures • RPM is checked using laser tachometer as per standard procedures • Vibration is checked using vibration meter following standard procedures • Coolant is checked as per standard procedures • Lathe machine geometry is checked per the standard procedures • Tightness of fasteners is checked as per standard procedures • V-belt is checked as per the standard procedures • Drive system is checked as per the standard procedures		
Contents	B1.01 Checking lubricant Knowledge • Types of maintenance • Introduction to preventive maintenance • Definition of lubricant • Types of lubricant • Properties of lubricant • Function of lubricant • Application of lubricants • Methods of lubrication • Importance of maintaining gear oil level • Process of record keeping (sample for record keeping) Skills • Interpreting O&M manual • Interpreting indicator • Observation skills Attitude, safety and environmental concern • Being time conscious • Having work ethics and integrity • Being efficient in using materials • Proper handling and storage of tools and materials • Having patience • Ensuring to follow OHS rules and regulations • Ensuring proper disposal of waste B1.02 Checking Revolution Per Minute (RPM) Knowledge • Definition of revolution per minute (RPM) • Importance of checking RPM		

	• Types of RPM measuring instrument • Purpose of reflective tape Skills • Interpreting O&M manual • Using tachometer Attitude, safety and environmental concern • Being time conscious • Having work ethics and integrity • Being efficient in using materials • Proper handling and storage of tools and materials • Having patience • Ensuring to follow OHS rules and regulations • Ensuring proper disposal of waste B1.03 Checking vibration Knowledge • Definition of vibration and its unit • Causes and remedies of vibration • Effects of vibration Skills • Interpreting O&M manual • Using vibration meter • Using vibration analyser • Analytical skills Attitude, safety and environmental concern • Being time conscious • Having work ethics and integrity • Being efficient in using materials • Proper handling and storage of tools and materials • Having patience • Ensuring to follow OHS rules and regulations • Ensuring proper disposal of waste B1.04 Checking coolant Knowledge • Introduction to coolant • Purpose of checking coolant • Types of coolant • Properties of coolant • Causes and remedies of coolant leakage • Difference between air and water cool
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	<i>Skills</i> • Analytical skills • Operating coolant pump <i>Attitude, safety and environmental concern</i> • Being time conscious • Having work ethics and integrity • Being efficient in using materials • Proper handling and storage of tools and materials • Having patience • Ensuring to follow OHS rules and regulations • Ensuring proper disposal of waste B1.05 Checking lathe machine geometry <i>Knowledge</i> • Machine geometric parameters • Methods of checking machine geometry • Definition of alignment • Effects of misalignment • Types of levelling instrument • Introduction to mandrel • Function of mandrel <i>Skills</i> • Operating lathe machine • Using dial gauge • Using spirit level/water level • Using laser alignment tool <i>Attitude, safety and environmental concern</i> • Being time conscious • Having work ethics and integrity • Proper handling and storage of tools and materials • Having patience • Ensuring to follow OHS rules and regulations • Ensuring proper disposal of waste • Ensuring to oil the machine surface timely B1.06 Checking milling machine geometry <i>Knowledge</i> • Importance of safety guard <i>Skills</i> • Operating milling machine • Using dial gauge • Using spirit level/water level
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	• Using laser alignment tool <i>Attitude, safety and environmental concern</i> • Being time conscious • Having work ethics and integrity • Proper handling and storage of tools and materials • Having patience • Ensuring to follow OHS rules and regulations • Ensuring proper disposal of waste • Ensuring to oil the machine surface timely B1.07 Checking tightness of fasteners <i>Knowledge</i> • Definition of fastener • Types of fastener • Purpose of fastener • Definition of torque <i>Skills</i> • Interpreting O&M manual • Using spanners • Using Allen key • Using adjustable wrench • Using torque wrench <i>Attitude, safety and environmental concern</i> • Being time conscious • Having work ethics and integrity • Being efficient in using materials • Proper handling and storage of tools and materials • Having patience • Ensuring to follow OHS rules and regulations • Ensuring proper disposal of waste B1.07 Checking mechanical drive <i>Knowledge</i> • Introduction to mechanical drives • Types of mechanical drives • Purpose of mechanical drives • Introduction to coupling <i>Skills</i> • Interpreting O&M manual • Observation skills • Using trummeter
--	---

	<i>Attitude, safety and environmental concern</i> • Being time conscious • Having work ethics and integrity • Being efficient in using materials • Proper handling and storage of tools and materials • Having patience • Ensuring to follow OHS rules and regulations • Ensuring proper disposal of waste
Learning Conditions	Learning Materials • CBLM • Hand outs • Audio-visuals • Reference books • Manuals Learning Facilities and Infrastructure • Classroom with adequate facilities • Library • IT lab • Workshop Materials • Markin cloth, cotton jute and reflective tape Tools • Spanner set, mandrel, Allen key set, socket set, adjustable wrench, torque wrench, try square and torch Instrument • Spirit level, dial gauge, tachometer, vibration analyser, vibration meter and trummeter Equipment • Machine tools PPE • Nose mask, safety gloves, safety goggles, ear plug, safety boots, apron and working dress
Underpinning skills	• Team work • Communication • Negotiation • Creativity • Problem solving • Time management

Instructional Methodologies	• Lecture • Demonstration • Industrial visit/training • Interactive discussion • Guided practice • Group activities • Individual activities
Method of Assessment	• Practical observation • Written test • Oral assessment • Assignment • Project work

Module Title	Carrying out maintenance of machine tools		
Module Code	7233-L2-M2		
Learning Outcome 2	Perform predictive maintenance		
Duration	Theory:10 hours	Practical:48 hours	Total:58 hours
Assessment Criteria	- Machine oil is changed as per the standard procedures - Coolant is changed as per requirement following standard procedures - Greasing is performed as per the job requirement following standard procedures - Filter is changed as per the job requirement following standard procedures		
Contents	B2.01 Changing machine oil Knowledge - Purpose of changing machine oil - Definition of viscometer Skills - Interpreting O&M manual - Using viscometer - Using socket set - Using ratchet set Attitude, safety and environmental concern - Being time conscious - Having work ethics and integrity - Being efficient in using materials - Proper handling and storage of tools and materials - Having patience - Ensuring to follow OHS rules and regulations - Ensuring proper disposal of waste B2.02 Changing coolant Knowledge - Importance of changing coolant - Coolant mixing ratio Skills - Interpreting O&M manual - Using ratchet set - Numeracy skills Attitude, safety and environmental concern - Being time conscious - Having work ethics and integrity - Being efficient in using materials - Proper handling and storage of tools and materials - Having patience - Ensuring to follow OHS rules and regulations		

	- Ensuring proper disposal of waste B2.03 Performing greasing Knowledge - Definition of grease - Types of grease and its grades - Purpose of grease - Method of greasing Skills - Interpreting O&M manual - Using grease gun - Using grease pump - Using bearing packer Attitude, safety and environmental concern - Being time conscious - Having work ethics and integrity - Being efficient in using materials - Proper handling and storage of tools and materials - Having patience - Ensuring to follow OHS rules and regulations - Ensuring proper disposal of waste - Ensuring to clean the hose timely B2.04 Changing filter Knowledge - Types of filter and its uses - Purpose of changing filter Skills - Interpreting O&M manual - Using filter wrench Attitude, safety and environmental concern - Being time conscious - Having work ethics and integrity - Being efficient in using materials - Proper handling and storage of tools and materials - Having patience - Ensuring to follow OHS rules and regulations - Ensuring proper disposal of waste
Learning Conditions	Learning Materials - CBLM - Hand-outs - Audio-visuals

	• Reference books • Manuals Learning Facilities and Infrastructure • Classroom with adequate facilities • Library • IT lab • Workshop Materials • Machine oil, Markin cloth, grease, filter and coolant Tools • Spanner set, Allen key set, screwdriver set, oil container, socket set, grease gun, bearing packer, grease pump and filter wrench Instrument • Viscometer Equipment • Machine tools PPE • Nose mask, safety gloves, safety goggles, safety boots, apron and working dress
Underpinning skills	• Team work • Communication • Negotiation • Creativity • Problem solving • Time management
Instructional Methodologies	• Lecture • Demonstration • Industrial visit/training • Interactive discussion • Guided practice • Group activity • Individual activity
Method of Assessment	• Practical observation • Written test • Oral assessment • Assignment • Project work

Module Title	Carrying out maintenance of machine tools		
Module Code	7233-L2-M2		
Learning Outcome 3	Perform breakdown maintenance		
Duration	Theory:27 hours	Practical:107 hours	Total:134 hours
Assessment Criteria	- Machine fault is diagnosed following standard procedures - V-belt is changed following standard procedures - Pulley is changed as per O&M manual following standard procedures - Gear is changed as per O&M manual following standard procedures - Impeller of coolant pump is replaced as per job requirement following standard procedures - Shaft is repaired as per the standard procedures - Oil seal is changed as per requirement following standard procedures - Bearing is changed as per the standard procedures - Coupling is changed as per the standard procedure		
Contents	B3.01 Diagnosing machine fault <i>Knowledge</i> - Introduction to breakdown maintenance - Types of machine fault - Causes, symptoms and remedies of machine faults - Difference between preventive, predictive and breakdown maintenance <i>Skills</i> - Using pyrometer - Observation skills - Using spirit level - Using vibration meter - Using vibration analyzer <i>Attitude, safety and environmental concern</i> - Being time conscious - Having work ethics and integrity - Being efficient in using materials - Proper handling and storage of tools and materials - Having patience - Ensuring to follow OHS rules and regulations - Ensuring proper disposal of waste B3.02 Changing V-belt <i>Knowledge</i> - Nomenclature of belt drive - Function of belt - Specification of belt - Method of adjusting belt tension		

	• Importance of belt tension • Definition of slip and creep • Importance of belt alignment Skills • Using trummeter • Observation skills • Using laser alignment tool Attitude, safety and environmental concern • Being time conscious • Having work ethics and integrity • Being efficient in using materials • Proper handling and storage of tools and materials • Having patience • Ensuring to follow OHS rules and regulations • Ensuring proper disposal of waste B3.03 Changing pulley Knowledge • Introduction to pulley • Types of pulley • Introduction to pulley puller • Types of pulley puller Skills • Using pulley puller Attitude, safety and environmental concern • Being time conscious • Having work ethics and integrity • Being efficient in using materials • Proper handling and storage of tools and materials • Having patience • Ensuring to follow OHS rules and regulations • Ensuring proper disposal of waste B3.04 Changing gears Knowledge • Introduction to gear • Differences between gear drive and belt drive • Types of circlip and its purpose Skills • Using pulley puller • Using circlip plier • Using hydraulic press
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	<i>Attitude, safety and environmental concern</i> • Being time conscious • Having work ethics and integrity • Being efficient in using materials • Proper handling and storage of tools and materials • Having patience • Ensuring to follow OHS rules and regulations • Ensuring proper disposal of waste B3.05 Replacing impeller of coolant pump <i>Knowledge</i> • Definition of pump • Purpose of pump • Working principle of coolant pump • Principle parts of coolant pump and its function • Definition of impeller • Types of impeller <i>Skills</i> • Using pipe wrench • Using jaw puller <i>Attitude, safety and environmental concern</i> • Being time conscious • Having work ethics and integrity • Being efficient in using materials • Proper handling and storage of tools and materials • Having patience • Ensuring to follow OHS rules and regulations • Ensuring proper disposal of waste B3.06 Changing oil seal <i>Knowledge</i> • Definition of oil seal and its specification • Types of oil seal • Importance of oil seal • Parts of oil seal and its function <i>Skills</i> • Using Allen key • Using circlip plier • Using emery paper • Using file <i>Attitude, safety and environmental concern</i> • Being time conscious
--	---

	• Having work ethics and integrity • Being efficient in using materials • Proper handling and storage of tools and materials • Having patience • Ensuring to follow OHS rules and regulations • Ensuring proper disposal of waste • Ensuring to use oil/insulation paper to wrap the shaft before fitting oil seal B3.07 Changing bearing <i>Knowledge</i> • Definition of bearing • Types of bearing and its specification • Function of bearing • Parts of bearing • Applications of bearing <i>Skills</i> • Using pulley puller • Using induction heater • Using hydraulic press <i>Attitude, safety and environmental concern</i> • Being time conscious • Having work ethics and integrity • Being efficient in using materials • Proper handling and storage of tools and materials • Having patience • Ensuring to follow OHS rules and regulations • Ensuring proper disposal of waste B3.08 Changing shaft <i>Knowledge</i> • Introduction to machine shaft and transmission shaft • Function of machine shaft and transmission shaft • Methods of aligning shaft • Importance of shaft alignment • Symptoms, causes and remedies of shaft defect <i>Skills</i> • Operating lathe machine • Using Vernier caliper • Using Micrometer • Using dial gauge <i>Attitude, safety and environmental concern</i> • Being time conscious
--	--

	• Having work ethics and integrity • Being efficient in using materials • Proper handling and storage of tools and materials • Having patience • Ensuring to follow OHS rules and regulations • Ensuring proper disposal of waste
Learning Conditions	Learning Materials • CBLM • Hand-outs • Audio-visuals • Reference books • Manuals Learning Facilities and Infrastructure • Classroom with adequate facilities • Library • IT lab • Workshop Materials • V-belt, markin cloth, motor, marker, pulley, machine oil, kerosene, gears, grease, circlip, impeller, coolant, shaft, oil seal, oil/insulation paper, bearing and gasket Tools • Spanner set, socket set, Allen key set, screwdriver set, hammer, adjustable wrench, pulley puller, file, circlip plier, pipe wrench, oil seal installer, mallet, oil container and torque wrench Instrument • Trummeter, laser alignment instrument, Vernier caliper, micrometer and dial gauge Equipment • Machine tool, hydraulic press, induction heater and coolant pump PPE • Nose mask, safety gloves, safety goggles, ear plug, safety boots, and working dress
Underpinning skills	• Team work • Communication • Negotiation • Creativity • Problem solving • Time management

Instructional Methodologies	• Lecture • Demonstration • Industrial visit/training • Interactive discussion • Guided practice • Group activity • Individual activity
Method of Assessment	• Practical observation • Written test • Oral assessment • Assignment • Project work

What is Competency-Based Curriculum (CBC)?

- ✓ A competency-based curriculum is a framework or guide for the subsequent detailed development of competencies, associated methodologies, training and assessment resources.
- ✓ The CBC specifies the outcomes which are consistent with the requirements of the workplace as agreed through the industry or community consultations.
- ✓ CBC can be developed immediately when competency standards exist.
- ✓ When competency standards do not exist, curriculum developers need to clearly define the learning outcomes to be attained. The standard of performance required must be appropriate to industry and occupational needs through the industry/enterprise or specified client group consultations.

The CBC materials are available in both printed and electronic copies.

For more information please contact:

Technical Trainers Training and Resource Center (TTTRC), DWPSD

P.O. Box153; Gelephu

Telephone: General Office: 00975-77109569, Principal: 77353535,
official tttrc@tttrc.bt, Principal: karma.dorji@moesd.gov.bt

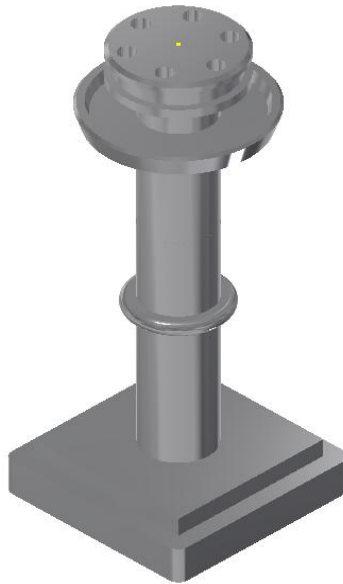
ANNEXES

Annex I: Assessment Sample

Candidate Resource:

Unit Title	Carrying out production of mechanical parts
Unit Code	7233-L2-M1
Total Marks	368
Pass mark	221
Time	8 hrs
Candidate's Name:	
CID NO:	

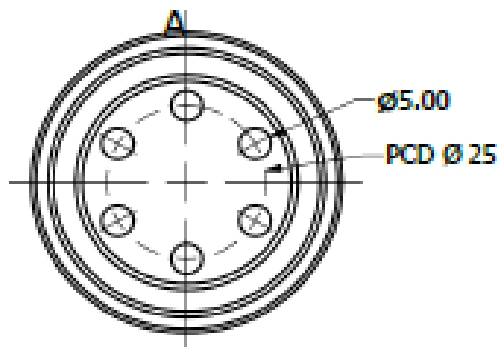
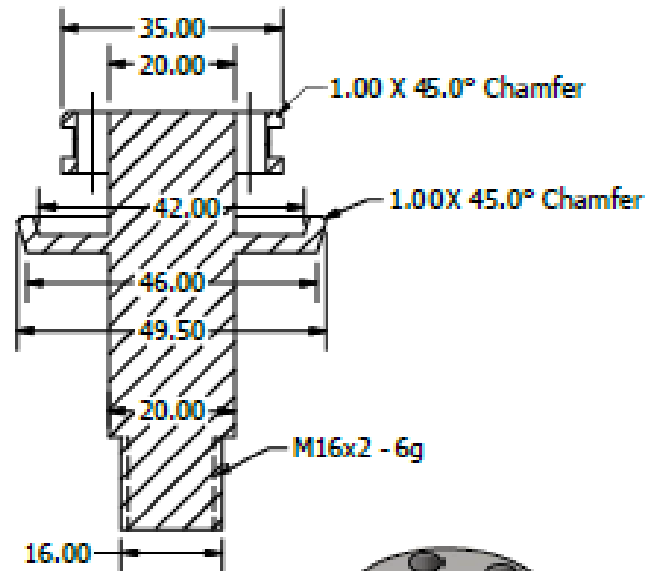
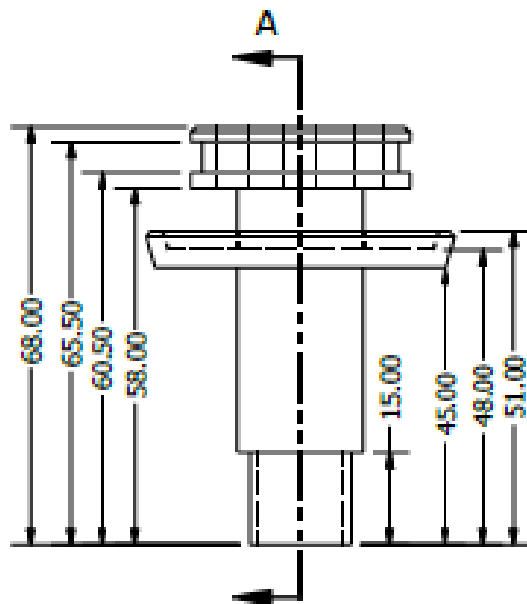
Assignment: Produce detachable Candle/Incense Stick Stand assembly from Mild Steel Bar of Ø55mm and 140 mm length and Mild Steel Plate of size 68mmx68mmx10mm thick & 48mmx48mmx5mm thick as per the dimensions indicated in the attached drawing.



Direction:

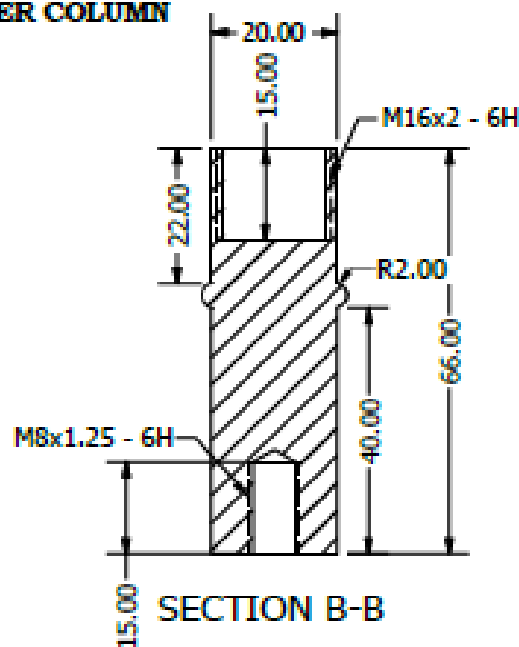
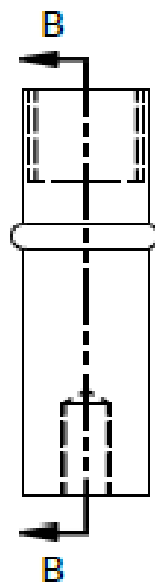
1. Respond to trainer(s)
2. Adhere to occupational health and safety at all times of performance
3. Perform activities in sequence, in case of confusion please contact your trainer(s)
4. Performance will be assessed on the following criteria:
 - a. Work preparation;
 - b. Selection of appropriate tools, materials, equipment and instruments;
 - c. Optimum utilization of resources;
 - d. Final product;
 - e. Completing the task within allocated time

UPPER COLUMN

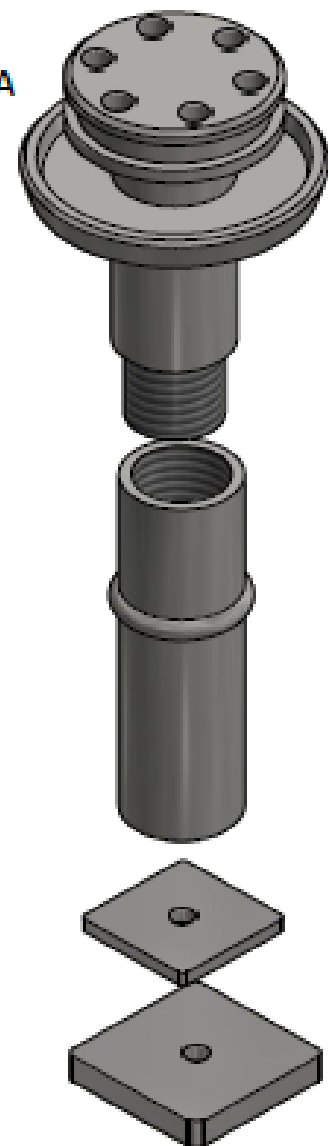


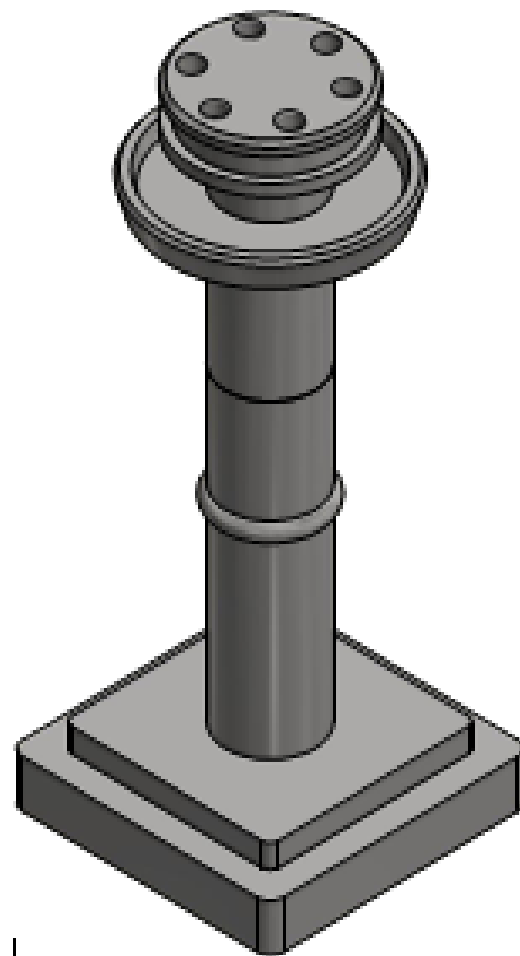
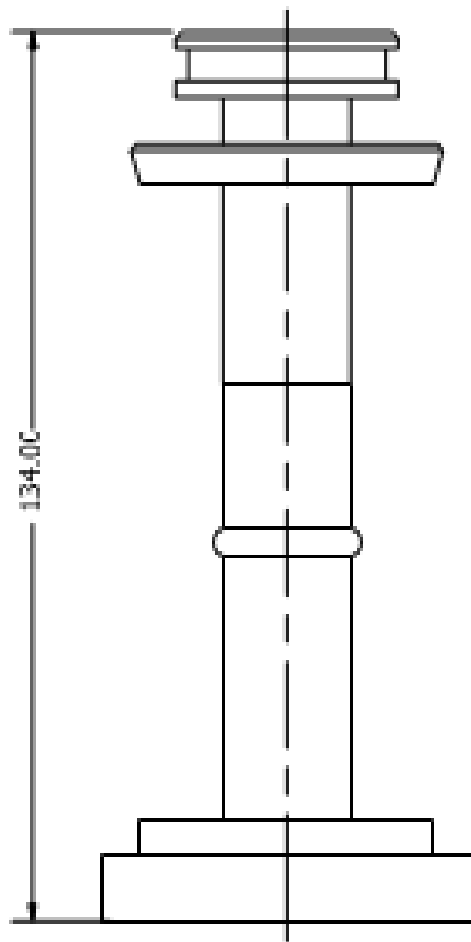
SECTION A-A

LOWER COLUMN

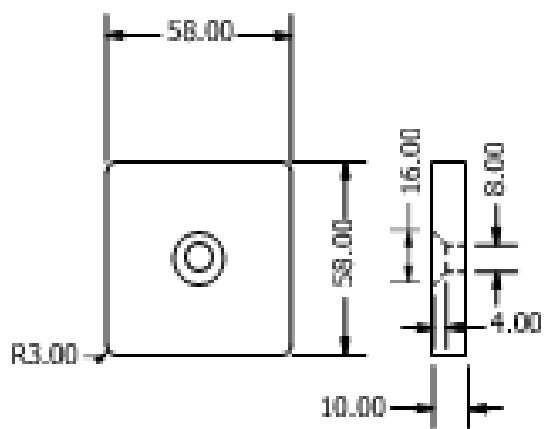


SECTION B-B

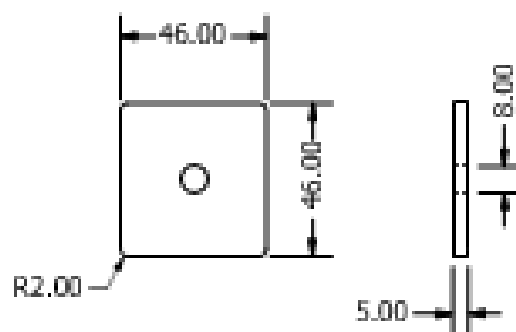




ASSEMBLY



LOWER PLATE



UPPER PLATE

Observation Checklist

Module Title:	Carrying out production of mechanical parts							
Module Code:	7233-L2-M1							
Duration:	5 Hours							
Assignment: Produce detachable Candle/Incense Stick Stand assembly from Mild Steel Bar of Ø55mm and 140 mm length and Mild Steel Plate of size 68mmx68mmx10mm thick & 48mmx48mmx5mm thick as per the dimensions indicated in the attached drawing.								
Candidate's Name:	CID NO:							
Start Time	End Time:							
A. During the demonstration of skills did the candidate do following:						Marks Allocated	Marks Obtained	Remarks
1. Follow safety procedures and use appropriate PPEs.						3		
2. Perform preventive maintenance of machine as per the standard checklist.						4		
3. Select and use appropriate cutting tools.						3		
4. Use the materials economically.						3		
5. Maintain clean work area.						3		
Marks (A)						16		
Marks Obtained(A)								
B. Is the job outcome correct in the following areas?								
Criteria	4	3	2	1	0	MF	Total	
1. Dimension Of Lower Base Plate						3		
2. Dimension Of Upper Base Plate						3		
3. Drill Hole Diameter (8mm)						3		
4. Fillet on edge of Lower Base Plate						2		
5. Fillet on edge of Upper Base Plate						2		
6. Overall surface finish						2		
7. Time						3		
The candidate should score a minimum of 60% from respective units.								
Marks (B)						72		
Marks Obtained (B)								
Total Marks E=(A+B)						88		
Total Marks Obtained F=(A+B)								
The Candidate's performance was:						Satisfactory:		
						Not Satisfactory:		
Assessor's Name:						Signature:		
Chief Assessor's Name:						Signature:		

A. Product Evaluation

Criteria / Marks	4	3	2	1	0
1. Lower Base Plate dimension (58mmx58mm)	Average Tolerance $\pm 0.4\text{mm}$	Average Tolerance $\pm 0.6\text{mm}$	Average Tolerance $\pm 0.8\text{mm}$	Average Tolerance $\pm 1\text{mm}$	Average Tolerance $\pm 1\text{mm}$ or more
2. Upper Base Plate dimension(44mmx44 mm)	Average Tolerance $\pm 0.4\text{mm}$	Average Tolerance $\pm 0.6\text{mm}$	Average Tolerance $\pm 0.8\text{mm}$	Average Tolerance $\pm 1\text{mm}$	Average Tolerance $\pm 1\text{mm}$ or more
3. Drill Hole diameter(8mm)	Tolerance $\pm 0.2\text{mm}$	Tolerance $\pm 0.3\text{mm}$	Tolerance $\pm 0.4\text{mm}$	Tolerance $\pm .5\text{mm}$	Tolerance $\pm .6\text{mm}$ or more
4. Fillet on edges of Lower base plate	Prepared all 4 edges as per dwg	Prepared 3 edges as per dwg	Prepared 2 edges as per dwg	Prepared only 1 edge	No fillet edges prepared
5. Fillet on edges of Upper base plate	Prepared all 4 edges as per dwg	Prepared 3 edges as per dwg	Prepared 2 edges as per dwg	Prepared only 1 edge	No fillet edges prepared
6. Overall Surface Finish	Even surface with no scratch marks.	Even surface with minimal scratch marks.	Even surface with major scratch marks.	Uneven surface with few /minor scratch marks.	Uneven surface with major scratch marks.
7. Time	Within 4 Hours	Within 4 Hours 10 Minutes	Within 4 Hours 20 Minutes	Within 4 Hours 30 Minutes	More than 4 Hours 30 Minutes

Annex II: Module Recognition

This is to verify that

Mr/Ms.....

has completed module on

.....

Covering following learning outcomes:

1.
....
2.
....
3.
....

Instructor:

Head of the Department:

.....

.....

Signature: **Signature:**

Date: / / (dd/mm/yyyy)
.....(dd/mm/yyyy)

Date: / /

Head of the Institute:
OC:

Trained Assessor (Institute)/Exam

.....

.....

Signature:

Signature:

Date: / ... / (dd/mm/yyyy)

Date: / /(dd/mm/yyyy)

Annex III: Lesson Plan
Lesson Plan

Course Title:		NC Level:
Module Code:		Duration:
Module Title:		
Learning Outcome:		
Skill/Task/Topic:		
Terminal Performance Objective:		
<i>(Note: Write narrative statement extracted from TPO of Task Sheet)</i>		
Enabling Objectives (Related knowledge):		
By the end of the lesson learners will be able to:		
i) ii) iii)		
What (Content/Activity)	Who (T/L)	How (Methods/ Media) Duration (Min.) Questions
Introduction: Main body Conclusion		
Projects/Problems:		

Instructional Resources Plan				
Skills/Task/Topic:				
No. of Trainees:				
Sl. No.:	Instructional materials/resources	Specifications	Qty.	Remarks
Prepared by :		Signature	Date:	
Revised by:		Signature	Date:	
Approved by:		Signature	Date:	

Annexure IV: Task sheet

TS-1/4: Practical Plan		
Course Title:		N C Level:
Module code:		Duration:
Module Title		
Learning outcome		
Skills/Task Title:		Task no:
Terminal Performance Objective: <i>Given:</i> <i>Cue:</i> <i>Who:</i> <i>What:</i> <i>Within:</i> <i>How well:</i> - - -		
Enabling Objectives (Related Skills): <i>By the end of a lesson, the learners will be able to:</i> i) ii) iii)		

iv)			
Activities	Who (T/L)	How (methods/ media)	Duration
Project/Assignment:			

TS-2/4: Tool and Equipment required:				
Sl no.	Particulars	Specifications	Qty	Remarks
Training Materials required:				

Safety Precaution i) ii) iii)		
Prepared by :	Signature	Date:
Revised By:	Signature	Date:
Approved by :	Signature	Date:

Annex V: Course Plan

Institutes letter head and Logo

(Trade)YEAR PLAN- _____ Semester _____ (Year)

Trade: NC Level:			Schedule																																Total Hours															
Modul Code	Module Title	Learning Outcome	Feb.				March				April				May				June				July				Aug.				Sept					Oct.				Nov.										
			1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4		1	2	3	4											
OJT																																																		
Assessment and Certification																																																		

Prepared by: _____

Verified & Approved by:

Date:

Monthly/Weekly Plan

Month:

Trade:

Trainer:

Week	Monday	Tuesday	Wednesday	Thursday	Friday	Saturday	Sunday
Week 01							
Week 02							
Week 03							
Week 04							
Week 05							

Developed by:

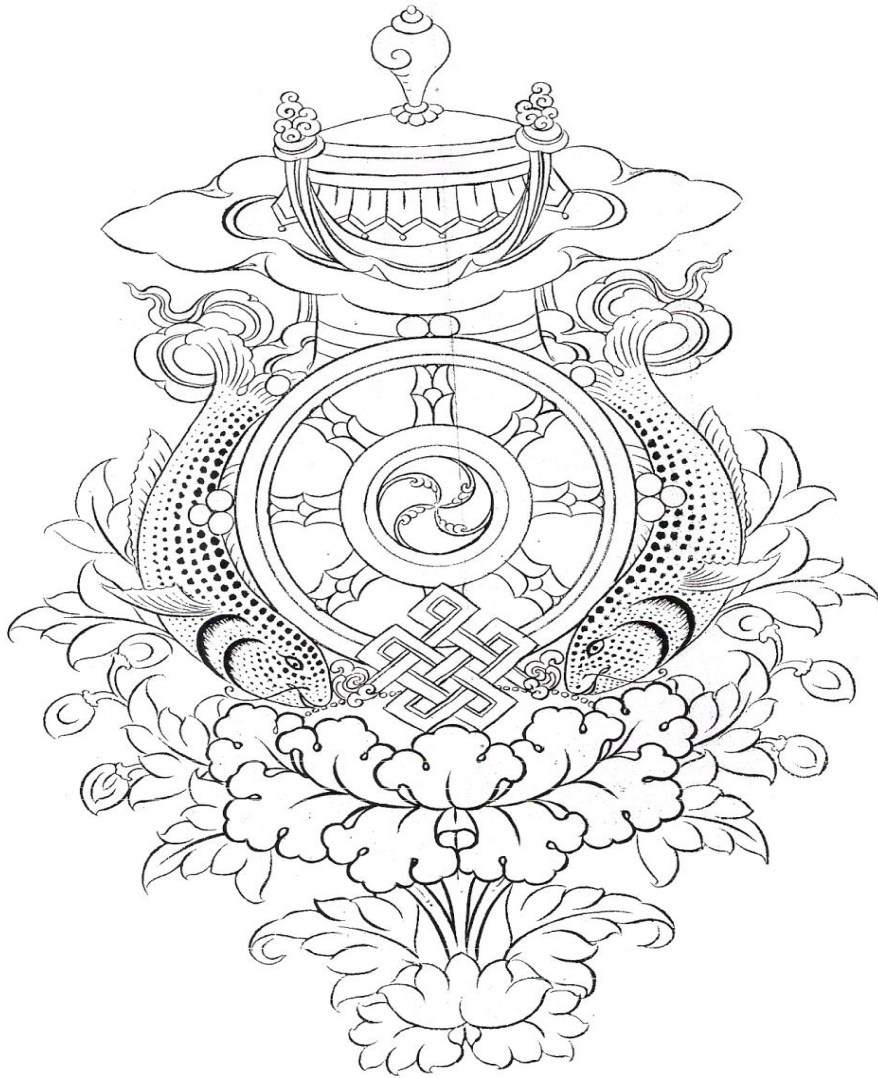
Approved by:

Date _____

Annexure VI: Time Distribution					
Module Title	Learning outcomes	Tasks	Theory	Practical	Total (hours)
			(hours)	(hours)	
A. Carrying out production of mechanical parts	A1: Produce mechanical parts manually	A1.00 Introductory Knowledge	2	0	2
		A1.02 Perform hacksaw cutting	4	6	10
		A1.03 Perform filing	2	18	20
		A1.04 Perform internal threading	3	6	9
		A1.05 Perform external threading	2	6	8
		A1.06 Perform chiseling	2	4	6
		A1.07 Perform hand reaming	2	4	6
		A1.08 Perform emery polishing	2	4	6
		A1.09 Perform hand chamfering	2	4	6
	Sub Total Duration		21	52	73
	A2: Perform operation of power tools	A2.01 Perform high speed cutting	1	3	4
		A2.02 Perform hand drilling	1	3	4
		A2.03 Perform hand grinding	2	4	6
		A2.04 Perform power saw cutting	2	4	6
		A2.05 Perform surface grindig	1	5	6
	Sub Total Duration		7	19	26
	A3: Perform drilling machine operation	A3.01 Perform machine drilling	4	6	10
		A3.02 Perform countersinking	2	6	8
		A3.03 Perform counterboring	2	6	8
	Sub Total Duration		8	18	26
	A4: Perform pedestal grinding machine operation	A4.01 Perform wheel dressing	2	4	6
		A4.02 Perform single point cutting tool grinding	2	16	18
		A4.03 Perform multipoint cutting tool grinding	2	10	12
	Sub Total Duration		6	30	36
	A5: Perform lathe machine operation	A5.01 Setup job piece in 3jaw chuck	4	6	10
		A5.02 Setup job piece in 4jaw chuck	2	16	18
		A5.02 Perform facing	4	8	12
		A5.03 Perform center drilling	2	6	8
		A5.04 Perform straight turning	2	6	8
		A5.06 Perform step turning	2	10	12
		A5.05 Perform chamfering	2	4	6
		A5.06 Perform grooving	2	10	12
		A5.07 Perform taper turning	4	32	36
		A5.08 Perform knurling	4	8	12
		A5.09 Perform lathe drilling	2	12	14
		A5.10 Perform boring	2	12	14
		A5.11 Perform reaming	2	12	14

B. Carrying out maintenance of machine tools		A5.12 Perform internal threading	4	26	30
		A5.13 Perform external threading	4	26	30
		A5.14 Perform eccentric turning	4	56	60
		A5.15 Perform form turning	4	26	30
		A5.18 Perform parting	2	6	8
	Sub Total Duration		52	282	334
	A6: Perform milling machine operation	A6.01 Perform facing	6	18	24
		A6.03 Perform side milling	4	18	22
		A6.04 Perform gear cutting	6	60	66
		A6.05 Perform keyway cutting	2	16	18
		A6.06 Perform slot cutting	2	16	18
		A6.07 Perform hexagon milling	6	60	66
		A7.09 Perform dovetail cutting	3	15	18
		A6.08 Perform circular interpolation	6	24	30
	Sub Total		35	227	262
	A7: Perform shaper machine operation	A7.01 Make internal keyway	12	18	30
		A7.02 Make external keyway	2	12	14
		A7.03 Perform angular surface cutting	2	12	14
	Sub Total		16	42	58
	Total Duration		145	670	815
	B1: Perform preventive maintenance work	B1.01 Check lubricant	4	2	6
		B1.02 Check revolution per minute	2	4	6
		B1.03 Check vibration	2	4	6
		B1.04 Check coolant	2	4	6
		B1.05 Check lathe machine geometry	3	15	18
		B1.06 Check milling machine geometry	3	15	18
		B1.07 Check tightness of fasteners	1	2	3
		B1.08 Check mechanical drive	4	6	10
	Sub Total Duration		21	52	73
	B2: Perform predictive maintenance	B2.01 Change machine oil	2	12	14
		B2.02 Change coolant	2	12	14
		B2.03 Perform greasing	4	18	22
		B2.04 Change filter	2	6	8
	Sub Total Duration		10	48	58
	B3: Perform breakdown maintenance	B3.01 Diagnose machine fault	4	12	16
		B3.02 Change V-belt	2	6	8
		B3.03 Change pulley	3	9	12
		B3.04 Change gears	4	26	30
		B3.05 Replace impeller of coolant pump	4	12	16
		B3.06 Change shaft	4	18	22
		B3.07 Change oil seal	3	12	15

	B3.08 Change bearing	3	12	15
	Sub Total Duration	27	107	134
	Total Duration	58	207	265
Grand Total Duration(hours)		203	877	1080



For more information please contact:

Technical Trainers Training and Resource Center (TTTRC), DWPSD

P.O. Box153; Gelephu

Telephone: General Office: 00975-77109569, Principal: 77353535,

official tttrc@tttrc.bt, Principal: karma.dorji@moesd.gov.bt