FEDERAL MINISTRY OF EDUCATION

National Technical Certificate (NTC) Curriculum in

INDUSTRIAL MECHANICS

February, 2025

NATIONAL BOARD FOR TECHNICAL EDUCATION
NBTE

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NATIONAL BOARD FOR TECHNICAL EDUCATION
Plot B, Bida Road, P.M.B. 2239, Kaduna, Nigeria

NATIONAL TECHNICAL CERTIFICATE

CURRICULUM AND MOUDULE SPECIFICATIONS IN

INDUSTRIAL MECHANICS

2025

General Information

AIM

To give training and impart the necessary skills leading to the production of craftsmen and women and other skilled personnel who will be enterprising and self-reliant.

ENTRY QUALIFICATIONS

CRAFT PROGRAM

Candidates must not be less than 14 years of age and should have successfully completed nine years of basic education or three years of junior secondary education or its equivalent. Special consideration may be given to sponsored candidates with lower academic qualifications who hold trade test certificates and are capable of benefiting from the program.

ADVANCED CRAFT PROGRAM

Candidates should possess the National Technical Certificate or its equivalent and should have had a minimum of two years of post-qualification cognate industrial experience. E2s

THE CURRICULUM

The Curriculum of each program is broadly divided into three components:

General Education, which accounts for 30% of the total hours required for the program.

Trade Theory, Trade Practice and Related Studies which account for 65%.

Supervised Industrial Training/Work Experience, which accounts for 5% of the total hours required for the program. This component of the course, which may be taken in industry or in the College Production Unit, is compulsory for the full-time students.

Included in the curriculum are the teacher's activities and learning resources required for the guidance of the teacher.

UNIT COURSE/MODULE

A course or module is defined as a body of knowledge and skills capable of being utilized on its own or as a foundation or prerequisite knowledge for more advanced work in the same or other fields of study. Each trade, when successfully completed, can be used for employment purposes.

BEHAVIOURAL OBJECTIVES

These are educational objectives, which identify precisely the type of behavior a student should exhibit at the end of a course, module, or program. Two types of behavioral objectives have been used in the curriculum. These are:

General Objectives

Specific Learning Outcomes

General objectives are concise but general statements of the behavior of the students on completion of a unit of the week, such as understanding the principles and application in:

Orthographic projection in engineering/technical drawing.

Loci in Mathematics

Basic concepts of politics and government in Political Science

Demand and supply in Economics

Specific learning outcomes are concise statements of the specific behavior expressed in units of discrete practical tasks and related knowledge, which the students should demonstrate as a result of the educational process to ascertain that the general objectives of the course /program have been achieved. They are more discrete and quantitative expressions of the scope of the tasks contained in a teaching unit.

GENERAL EDUCATION IN TECHNICAL COLLEGES

The general education component of the curriculum aims at providing the trainee with complete secondary education in critical subjects like English Language, Economics, Physics, Chemistry, Biology, Entrepreneurship and Computer Studies. While the Trade Theory, Trade Practice, and Related Studies aim at providing training and their applications and as a foundation for post-secondary technical education for the above-average trainee. Hence, it is hoped that trainees who successfully complete their trade and general education components may be able to compete with their secondary school counterparts for direct entry into the universities, polytechnics, or colleges of education (technical) for a Degree, National Diploma (ND) or NCE courses, respectively.

NATIONAL CERTIFICATION

The NTC and ANTC programs are run by Technical Colleges accredited by National Board for Technical Education (NBTE), while the National Business and Technical Examination Board (NABTEB) conducts the final national examination and awards certificates.

Trainees who successfully complete all the courses/modules specified in the curriculum table and pass the national examinations in the trade will be awarded one of the following certificates:

S/NO	LEVEL	CERTIFICATE
	Technical Program	
1.	Craft Level	National Technical Certificate

GUIDANCE NOTES FOR TEACHERS TEACHING THE CURRICULUM

The number of hours stated in the curriculum table may be increased or decreased to suit individual institutions' timetables, provided the entire course contents are properly covered and the goals and objectives of each module are achieved at the end of the term.

The maximum duration of any module in the new scheme is 300 hours. This means that for a term of 15 weeks, the course should be offered for 20 hours a week. This can be scheduled in sessions of 4 hours in a day, leaving the remaining hours for general education. However, (if properly organized and if there are adequate resources), most of these courses can be offered in two sessions a day, one in the morning and the other one in the afternoon. In so doing, some of these programs may be completed in a lesser number of years than at present.

The sessions of 4 hours include the trade theory and practice. It is left to the teacher to decide whether the class should be held in the workshop or in a lecture room.

INTEGRATED APPROACH IN THE TEACHING OF TRADE THEORY, TRADE SCIENCE AND TRADE CALCULATION

The traditional approach of teaching Trade Science and Trade Calculation as separate and distinct subjects in technical college programs is not relevant to the new program, as it will amount to a duplication of the teaching of mathematics and physical science subjects in the course. The basic concepts and principles in mathematics and physical science are the same as in trade calculation and trade science. In the new scheme, therefore, qualified persons in these fields will teach mathematics and physical science, and the instructors will apply the principles and concepts in solving trade science and trade calculation problems in the trade theory classes. To this end, efforts have been made to ensure that mathematics and science modules required to be able to solve technical problems were taken as prerequisites to the trade module.

EVALUATION OF PROGRAM/MODULE

For the program to achieve its objectives, any course started at the beginning of a term must terminate at the end of the term.
Teachers and instructors should therefore devise methods of accurately assessing the trainees to enable them to give the student's final grades at the end of the term. All students who have successfully completed their modules will take a national examination. The final award will be based on the aggregate of the scores attained in the course work and the national examination.

Contents

Table 1: Curriculum Table for National Technical Certificate (NTC) in Industry Mechanics

S/N	SUBJECT CODE	MODULE	YEAR ONE						YEAR TWO						YEAR THREE						Total Hrs/Each
			Term 1		Term 2		Term 3		Term 1		Term 2		Term 3		Term 1		Term 2		Term 3		
			T	P	T	P	T	P	T	P	T	P	T	P	T	P	T	P	T	P	
1	CMA 12-15	Mathematics	2		2		2		2		2		2		2		2		2		**216**
2	CEN 11-17	English	2		2		2		3		3		3		3		3		3		**288**
3	CPH 10-12	Physics	2		2		2		2	1	2	1	2	1	2	1	2	1	2	1	**288**
4	CCH 11-12	Chemistry	2		2		2		2	1	2	1	2	1	2	1	2	1	2	1	**288**
5	CEC 11-13	Economics	2		2		2		2		2		2		2		2		2		**216**
6	CBM 10	Entrepreneurship											2		2						**48**
7	ICT11-15	Computer Studies							1	2	1	2	1	2	1	2	1	2			**180**
8	CTD 11-13	Drawings		3		3		3		3		3		3		4					**264**
9	MEC 11	General Metal Work I			2	5	2	5													**168**
10	MEC 12	General Metal Work II									1	3	1	2							**84**
11	CEI 11	Basic Electricity	2	1	1	2															**72**
12	CIM 121	Material Selection			3																**36**
13	CIM 312	Fluid Power System													2	6					**96**
14	CIM 313	Maintenance & Reliability													2	6					**96**
15	CIM 134	Pipe Fitting					2	5													**84**
16	CIM 215	Taps & Dies							2	4											**72**
17	CIM 116	Hand and Power Tools	2	4																	**72**

18	CIM 317	Mechanical Drive Systems and Pumps													1	3	1	3			**96**
19	CFW 12	Gas welding and cutting					2	4	2	4											**144**
20	CFW 13	Metal Arc Welding							2	4	2	4									**144**
21	MEC 14	Turning									2	4		2							**96**
22	MEC 15	Milling											2	4		2					**96**
23	MEC 17	Grinding											2	4							**72**
			14	8	16	10	16	17	18	19	17	18	19	19	19	25	13	7	11	2	**3216**
			22		**26**		**33**		**37**		**35**		**38**		**44**		**20**		**13**		

MATERIAL SELECTION

PROGRAM:	National Technical Certificate in **Industrial Mechanics**
MODULE:	CIM – Material Selection
DURATION:	HRS
PRE-REQUISITE:	CCH 11 - 12 Chemistry
GOAL:	The module equips trainees with the knowledge, skills, and attitude to understand the functions, characteristics, and applications of material selection.

GENERAL OBJECTIVES:

On completion of this module, the trainee should be able to:

1.0 Introduction to materials: types of materials, properties, and their applications

2.0 Understand Material Selection Process

3.0 Understand Material Designation System

4.0 Understand Steel and Steel Types

5.0 Identification of Finished Steel Products

PROGRAM: NATIONAL TECHNICAL CERTIFICATE IN INDUSTRIAL MECHANICS						
COURSE: CIM 121 – MATERIAL SELECTION			**Course Code: CIM 121**			**Contact Hours: 36HRS**
Course Specifications: General Objective 1.0: Introduction to materials: types of materials, properties, and their applications **Contact Hours: 36HRS**						
Year **Term**	**Theoretical Content**			**Practical Content**		
Week	**Specific Learning Outcome**	**Teacher's Activities**	**Resources**	**Specific Learning Outcome**	**Teacher's Activities**	**Resources for Practical**
1- 2	1.1 Define engineering materials 1.2 Explain the importance of engineering materials 1.3 Identify different types of engineering materials (metals, polymers, ceramics, composites, natural materials) 1.4 Describe the general properties of engineering materials. 1.5 Explain why specific engineering materials	1.1 Discuss the basic concept of engineering materials 1.2 Discuss the importance and significance of engineering materials to everyday life. 1.3 Explain the main categories of materials 1.4 Discuss the general properties of engineering materials using real-life examples	•Multimedia. •Charts, slides. •White board . Markers	Demonstrate with samples of different material Identify different types of materials (metal, polymers, ceramics, composites, natural materials)	Divide students into small groups and provide them with a set of mixed materials. Ask the groups to classify the materials into categories and present their reasons to the class. Perform basic test such as; **Flexibility test: bend** a plastic material vs. a metallic material **Hardness test: scratch** materials with sharp	. Plastics . Woods . Metals . Ceramics

	are chosen for particular applications 1.6 classify material based on their physical and mechanical properties	1.5 Discuss why specific material are chosen for particular applications (e.g. metal for bridges due to strength, etc) 1.6 Discuss the classification of materials based on their physical and mechanical properties.			Pointed object to compare hardness. **Weight test:** compare the weight of materials of similar size (wood vs metal)	
	General Objective 2.0: Understand Material Selection Process					
Week	**Specific Learning Outcome**	**Teacher's Activities**	**Resources**	**Specific Learning Outcome**	**Teacher's Activities**	**Practical Resources**
3 - 4	2.1 Explain the key properties of materials (mechanical, thermal, electrical, etc.) 2.2 Analyze factors influencing material selection (cost, functionality, environment) 2.3 Explain basic principles of material selection for specific application 2.4 Explain how to compare material property charts and selection criteria	2.1 Discuss material properties such as strength, flexibility, thermal conductivity, etc. 2.2 Discuss to ascertain the factors influencing material selection (cost, functionality, environment) 2.3 Discuss basic principles of material selection for specific application 2.4 Demonstrate how to compare material	•Multimedia. •Charts, slides. •White board . Markers	Identify different engineering materials and their applications.	Guide students in a simulated project where they select an appropriate material for a given engineering application. Observe students as they analyze and classify materials.	. Plastics . Woods . Metals . Ceramics

		property charts and selection criteria				
Year **Term**	**General Objective 3.0: Know Material Designation System**					
Week	**Specific Learning Outcome**	**Teacher's Activities**	**Resources**	**Specific Learning Outcome**	**Teacher's Activities**	**Practical Resources**
5 - 6	3.1 Classify Steel materials, e.g., Sheet Metal, Bars, and pipes, etc. 3.2 Explain different material classification systems, such as: **ISO** (International Organization for Standardization) **ASTM** (American Society for Testing and Materials) **SAE** (Society of Automotive Engineers) **DIN** (Deutsches Institut fur Normung – German Standard) **JIS** (Japanese Industrial Standards)	3.1 Discuss the classes of steel material 3.2 Discuss different material classification systems 3.3 Discuss the standardization method of steel products 3.4 Discuss the purpose of the standardized material designation system with examples. 3.5 Discuss designation system of material	•Multimedia •Magnetic Board •Chart •Marker			

	3.3 State the Method of Standardization of Steel Products and provide examples of material designation codes 3.4 Explain Designation System of Material					
	General Objective 4.0: Know Steel and Steel Types					
Week	**Specific Learning Outcome**	**Teachers Activities**	**Resources**	**Specific Learning Outcome**	**Teachers Activities**	**Practical Resources**
7 - 9	4.1 Explain steel and its differences from other materials 4.2 Explain the composition of steel (iron and carbon) and their roles 4.3 Classify types of steel 4.4 Explain how different compositions affect properties like strength, hardness, corrosion resistance, and flexibility. 4.5 Explain the relations of different types of steel to their real-world applications.	4.1 Discuss steel and its differences from other materials 4.2 Discuss the composition of steel (iron and carbon) and their roles 4.3 Discuss the classes of steel and differentiate between various types of steel (e.g carbon steel, alloy steel, stainless steel, tool steel) 4.4 Discuss how different compositions impact properties like strength, hardness, corrosion resistance, and flexibility.	•Multimedia •Magnetic Board •Chart •Marker	Identify different types of steel	Show different steel samples and discuss their properties. Use a spark test or magnet test to differentiate steel types Show how to read steel grade markings or codes.	Different grades of steel Magnet Chart

		4.5 Discuss the relations of different types of steel to their real-world applications.				
	General Objective: 5.0 Identification of Finished Steel Products					
Week	**Specific Learning Outcome**	**Teachers Activities**	**Resources**	**Specific Learning Outcome**	**Teachers Activities**	**Practical Resources**
10 - 12	5.1 Explain steel products 5.2 Explain steel products' importance in construction and manufacturing 5.3 Explain the common types of finished steel products (e.g. rods, bars, sheets, plates, pipes and structural sections) 5.4 Demonstrate the ability to classify steel products using physical samples or images.	5.1 Discuss steel products 5.2 Explain their importance in construction and manufacturing 5.3 Explain common types of finished steel products 5.4 Describe typical applications of each product (e.g. steel rods for reinforcement in construction, steel sheets for car bodies)	•Multimedia •Magnetic Board •Chart •Marker	Identify common types of finished steel products (e.g. rods, bars, sheets, plates, pipes and structural sections) Display real samples or images of different finished steel products (e.g. rods, sheets, pipes, etc.)	Use charts, images and actual steel samples to introduce different finish steel products Show students how to identify steel products based on appearance, shape, texture, and markings.	. Steel rods . Bars . Sheets . Wires . Pipes, etc . Chart

FLUID POWER SYSTEMS

PROGRAM:	National Technical Certificate in **Industrial Mechanics**
MODULE:	**CIM 312: FLUID POWER SYSTEM**
DURATION:	96 HRS
GOAL:	This module is intended to provide the trainee with a fundamental understanding of fluid power systems, focusing on the principles, components, and real-world applications of hydraulics and pneumatics.

GENERAL OBJECTIVES:

On completion of this module, the trainee should be able to:

1. Introduction to fluid power systems
2. Know the principles of the hydraulic and pneumatic systems.
3. Know the components of the pneumatic and hydraulic systems.
4. Be familiar with simple hydraulic and pneumatic circuits
5. Understand the safety of fluid power systems.

PROGRAM: NATIONAL TECHNICAL CERTIFICATE IN INDUSTRIAL MECHANICS						
COURSE: CIM 312 FLUID POWER SYSTEM			**Course Code: CIM**		**Contact Hours: 96 HRS**	
Course Specification: General Objective 1.0: Introduction to fluid power systems **Contact Hour: 96 HRS**						
Year:3 Term:1	**Theoretical Content**			**Practical Content**		
Week	**Specific Learning Outcome:**	**Teachers' Activities**	**Resources**	**Specific Learning Outcome:**	**Teachers' Activities**	**Practical Resources**
1	1.1 Define fluid power systems 1.2 Differentiate between hydraulics and pneumatic systems. 1.3 Explain the importance and applications of fluid power systems in industry and everyday life 1.4 Explain the advantages and limitations of using fluid power systems 1.5 Describe how energy is transferred in fluid power systems	1.1 Discuss fluid power systems 1.2 Explain the differences between hydraulics and pneumatics 1.3 Discuss the importance and applications of fluid power systems in industry and everyday life, citing examples. 1.4 Demonstrate to the student how energy is transferred in fluid power systems	Multimedia Classroom posters. Whiteboard Marker			

Year: 3 Term: 1	**General Objective 2.0: Know the principles of hydraulic and pneumatic systems. Contact Hour**					
Week	**Specific Learning Outcome:**	**Teachers' Activities**	**Resources**	**Specific Learning Outcome:**	**Teachers' Activities**	**Practical Resources**
2 - 3	2.1 Outline the properties of fluids (viscosity, density, pressure, flow rate, force.) 2.2 Explain how pressure is transmitted in fluid using pascal's law 2.3 Explain the behavior of gases under pressure and temperature changes using Boyle's law and Charles law 2.4 Explain hydrostatic and pneumatic pressure using the concepts of force and area relationships. 2.5 Explain the calculation of pressure, force, and flow using fluid power formulas.	2.1 Explain the properties of fluids 2.2 Use visual aids to discuss Pascal's, Boyle's, and Charle's laws 2.3 Solve basic calculations showing pressure and force relationship 2.4 Discuss hydrostatic and pneumatic pressure using force and area relationship	Hydraulic and pneumatic kits for demonstrations. Transparent tubing and manometers for pressure visualization Lab manuals for structured experiments.	2,1 Conduct a lab experiment to show how changing variables affect system performance and fluid behavior under pressure.	2.1 Conduct demonstrations of pressure and force using simple kits 2.2 Facilitate hands-on activities where the students observe fluid movement in transparent tubes 2.3 Organize a lab experiment to show how changing variables impact system performance and fluid behavior under pressure.	Hydraulic and pneumatic kits Transparent tubing and manometers for pressure visualization Lab manuals for structured experiments

Year: 3 Term: 1	**General Objective 3.0: Know the component of hydraulic and pneumatic systems Contact Hour**					
Week	**Specific Learning Outcome:**	**Teachers' Activities**	**Resources**	**Specific Learning Outcome:**	**Teachers' Activities**	**Practical Resources**
4 - 6	3.1 Outline the various hydraulic components: Pumps, cylinders (Actuators), Valves (directional, pressure, flow), Reservoirs, and hoses and fittings 3.2 Outline the various pneumatic components: Compressors, air tanks, pneumatic cylinders and actuators, Valves (directional, pressure, flow), filters, lubricators and regulators, hoses and fittings 3.3 Explain the function of valves (directional control, pressure relief) in fluid power systems 3.4 Explain the role of actuators in converting fluid power into mechanical motion.	3.1 Display and discuss physical components of hydraulic and pneumatic systems 3.2 Demonstrate how to connect components to form a simple working circuit. 3.3 Discuss the role of each component in the system 3.4 Provide schematic diagrams and guide the student to identify components	Hydraulic pumps, pneumatic compressors, valves, and actuators for hands-on activities Circuit assembly kits with hoses and fittings Component identification charts	3.1 Disassemble and assemble simple fluid power system 3.2 Identify basic fluid power system components and their uses.	Organize a lab session where students assemble and disassemble fluid power system	Hydraulic pumps, pneumatic compressors, valves, and actuators for hands-on activities Circuit assembly kits with hoses and fittings Component identification charts

	3.5 Explain how to assemble basic fluid power circuits using hoses and fittings					

Year: 3 Term: 1	**General Objective 4.0: Know simple hydraulic and pneumatic circuits Contact Hour**					
Week	**Specific Learning Outcome:**	**Teachers' Activities**	**Resources**	**Specific Learning Outcome:**	**Teachers' Activities**	**Practical Resources**
7 - 9	4.1 Define hydraulic and pneumatic circuits 4.2 State their purpose in fluid power systems 4.2 Identify basic hydraulic and pneumatic symbols 4.3 Interpret basic hydraulic and pneumatic circuit symbols using standard diagrams. 4.4 Construct simple hydraulic and pneumatic circuits for basic operations such as: Lifting, pressing or moving objects 4.5 Explain how fluid flow and pressure control work within simple circuits 4.6 Outline safe practices when assembling and operating fluid power systems	4.1 Discuss hydraulic and pneumatic circuits 4.2 Explain the purpose of hydraulic and pneumatic circuit in fluid power systems 4.3 Explain basic hydraulic and pneumatic symbols 4.4 Guide the student to interpret basic hydraulic and pneumatic circuit symbols using standard diagrams. 4.5 Guide the student to construct simple hydraulic and pneumatic circuits for basic operations such as: Lifting, pressing or moving objects 4.6 Discuss how fluid flow and pressure	Circuit schematics and symbol charts Testing equipment (pressure gauges, flow meters) Simulation software for virtual circuit design. Hydraulic and pneumatic circuits kits with valves, actuators, and hoses	4.1 Select appropriate components for assembling a simple fluid power system 4.2 Assembly, a simple fluid power system using provided circuit diagrams	4.1 Guide students to select the right components 4.2 Guide student to assemble a simple fluid power system 4.3 Facilitate a circuit troubleshooting exercise where students correct faulty connections 4.4 Guide the student to Demonstrate safe practices when assembling and operating fluid power circuits	Different hydraulic and pneumatic components Toolbox PPEs Circuit diagram

		control work within a circuit. 4.7 Discuss safe practices when assembling and operating fluid power systems				

Year: 3 Term: 1	**General Objective 5.0: Know Safety in fluid power systems** **Contact Hour**					
Week	**Specific Learning Outcome:**	**Teachers' Activities**	**Resources**	**Specific Learning Outcome:**	**Teachers' Activities**	**Practical Resources**
10 - 12	5.1 Explain safe handling of hydraulic and pneumatic equipment 5.2 identify potential hazards in fluid power systems: leaks, burst hoses, high-pressure danger 5.3 Explain PPE and its importance in operating fluid-powered systems 5.4 Explain emergency procedures when working with a pressurized system. 5.5 Explain basic troubleshooting procedures to identify leaks, pressure drops, or faulty components.	5.1 Discuss safe handling of fluid power systems 5.2 Demonstrate proper use of PPE in handling fluid power systems 5.3 Discuss how to identify potential hazards: leaks, burst hoses, high-pressure danger. 5.4 Discuss emergency procedures in working with	PPE (goggles, gloves, ear plug) Maintenance tools (wrenches, fluid gauges, filters) Safety posters Troubleshooting checklists and diagnostic tools	5.1 Conduct troubleshooting on a simple fluid power system 5.2 Carry out basic routine maintenance on a simple fluid power system.	5.1 Organize hands-on maintenance sessions, allowing students to practice checking systems for leaks or wear 5.2 Create troubleshooting scenarios where students diagnose and fix simulated problems	PPEs Wrenches, Gauges Filters Screwdrivers Simple fluid power system

	5.6 Explain routine maintenance procedures, checking for leaks, maintaining pressure levels, and replacing filters	pressurized systems 5.5 Discuss the basic troubleshooting and routine maintenance procedures				

MAINTENANCE AND RELIABILITY

PROGRAM:	National Technical Certificate in **Industrial Mechanics**
MODULE:	CIM 313: MAINTENANCE AND RELIABILITY
DURATION:	96 HRS
GOAL:	This module is aimed at equipping the trainee with the knowledge and skills necessary to ensure machines, equipment, and systems operate efficiently, safely, and with minimal downtime.

GENERAL OBJECTIVES:

On completion of this module, the trainee should be able to:

1. Understand maintenance and reliability concepts
2. Know various types of maintenance strategies.
3. Understand reliability principles
4. recognize tools and techniques in maintenance
5. Know maintenance planning and scheduling
6. Develop communication and teamwork in maintenance

PROGRAM: NATIONAL TECHNICAL CERTIFICATE IN INDUSTRIAL MECHANICS						
COURSE: MAINTENANCE AND RELIABILITY			**Course Code: CIM 313**			**Contact Hours: 96 HRS**
Course Specification	**General Objective 1.0: Understand maintenance and reliability concepts**					
Year: 3 Term: 1	**Theoretical Content**			**Practical Content**		
Week	**Specific Learning Outcome:**	**Teacher's Activities**	**Learning Resources**	**Specific Learning Outcome:**	**Teacher's Activities**	**Practical Resources**
1–2	1.1 Define maintenance and reliability 1.2 Explain their roles in technical fields 1.3 Explain the key concepts of maintenance E.g., preventive, predictive, corrective, and proactive maintenance. 1.4 Explain the importance of maintenance and reliability.	1.1 Explain maintenance and reliability 1.2 Discuss the role of maintenance and reliability 1.3 Discuss key concepts of maintenance such as preventive, predictive, corrective, and proactive maintenance. 1.4 Discuss the importance of maintenance in ensuring equipment performance, safety, and longevity.	Infographics illustrating maintenance strategies Flip charts Multimedia Markers Whiteboard	Demonstrate the importance of maintenance in ensuring equipment performance, safety, and longevity. Identify common maintenance issues	Facilitate a class discussion on how maintenance affects students' everyday experiences (e.g., bicycles, household appliances) Guide students in identifying common maintenance issues in workshop equipment.	Stabilizer Bicycle Household appliances Power hacksaw Pillar drilling machine Lathe machine, etc.

Year: 3 Term: 1	**General Objective 2.0: Know various types of maintenance strategies**					
Week	**Specific Learning Outcome**	**Teachers' Activities**	**Resources**	**Specific Learning Outcome**	**Teachers' Activities**	**Practical Resources**
3–4	2.1 Explain different maintenance strategies 2.2 Differentiate between various maintenance strategies. 2.3 Explain their applications in real-world scenarios 2.4 Describe the concept of condition-based monitoring and its benefits 2.5 Describe the role of predictive maintenance using first-level inspection (using sense organs). 2.6 Explain the advantages and disadvantages of different maintenance strategies	2.1 Discuss the different maintenance strategies 2.2 Explain the difference between various maintenance strategies 2.3 Discuss the applications of maintenance strategies in real-world scenarios. 2.4 Discuss the concept of condition-based monitoring and its benefits 2.5 explain predictive maintenance using first-level inspection, e.g., ear, eye, hand, nose	Maintenance tools (e.g., oil cans, wrenches, gauges) Sample maintenance logs and checklists Flowcharts explaining maintenance processes Whiteboard marker	Identify various maintenance strategies. Demonstrate how to carry out common maintenance strategies	Guide the students to conduct a hands-on demonstration of preventive maintenance tasks (e.g., oiling machinery, checking fluid or lubricant level) Create a maintenance schedule and guide the students to plan for different types of maintenance Organize a role-play activity simulating a maintenance team responding to a breakdown.	Lathe machine Gear box Electric motor Charts etc.

Course Specification	**General Objective 3.0 Understand Reliability principle**					
Year: 3 Term: 1	**Theoretical Content**			**Practical Content**		
Week	**Specific Learning Outcome: #**	**Teacher's Activities**	**Learning Resources**	**Specific Learning Outcome:**	**Teacher's Activities**	**Practical Resources**
5–6	3.1 Explain the importance of reliability in the performance and efficiency in mean time 3.2 Explain Mean Time Between Failure (MTBF) 3.3 Discuss how to calculate Mean Time Between Failures (MTBF) Explain the concept of reliability-centered maintenance (RCM) and how it helps in reducing equipment failures	3.1 Discuss the importance of reliability in the performance and efficiency of machines and systems 3.2 Discuss Mean Time Between Failures (MTBF) 3.3 Calculate MTBF 3.3 Discuss the concept of reliability-centered maintenance (RCM) and how it helps in reducing equipment failures	Charts, posters and textbooks White board Markers	Calculate the MTBF and failure rate of equipment.	Guide how to calculate Mean Time Between Failures (MTBF)	Lathe Machine Pillar drilling machine, etc.

Course Specification	**General Objective 4.0: Know Tools and Techniques in maintenance**					
Year: 3 Term: 1	**Theoretical Content**			**Practical Content**		
Week	**Specific Learning Outcome:**	**Teacher's Activities**	**Learning Resources**	**Specific Learning Outcome:**	**Teacher's Activities**	**Practical Resources**
7 - 9	4.1 Explain the basic tools and equipment used in maintenance activities (e.g., wrenches, multimeters, lubricators) 4.2 Explain the basic troubleshooting techniques to identify equipment problems. 4.3 Explain Documentation of maintenance activities using logs, checklists, and reports 4.4 Explain the importance of following manufacturer guidelines during maintenance.	4.1 Discuss the basic tools and equipment used in maintenance activities (e.g., wrenches, multimeters, lubricators) 4.2 Discuss basic troubleshooting techniques used in maintenance tasks 4.3 Explain documentation in maintenance 4.4 Discuss the process of documenting maintenance activities using logs, checklists, and reports 4.5 Discuss the importance of following manufacturer	Toolkits with wrenches, grease guns. Sample equipment manual and manufacturer guide Charts Marker and board Posters	Use basic tools and equipment to carry out maintenance activities (e.g., wrenches, multimeters, lubricators) Demonstrate simple maintenance tasks like tightening bolts, lubricating moving parts, and replacing worn-out components. Conduct a documentation exercise where students' complete maintenance checklists after practical work.	Guide the student to perform simple maintenance tasks like tightening bolts, lubricating moving parts, and replacing worn-out components. Organize practical sessions where students perform basic maintenance on school equipment (e.g., Lubricating hinges, tightening bolts and nuts) Guide the student document maintenance activities using logs, checklists, and reports	Set of wrenches Set of Pliers Complete toolbox

		guidelines during maintenance.				
Course Specification	**General Objective 5.0 Know maintenance planning and scheduling**					
Year: 3 Term: 1	**Theoretical Content**			**Practical Content**		
Week	**Specific Learning Outcome:**	**Teacher's Activities**	**Learning Resources**	**Specific Learning Outcome:**	**Teacher's Activities**	**Practical Resources**
10 - 11	5.1 Explain maintenance planning and scheduling. 5.2 Explain the factors to consider when prioritizing maintenance tasks 5.3 Explain the importance of planning maintenance to minimize equipment downtime.	5.1 Discuss maintenance planning and scheduling 5.2 Discuss the factors to be considered when prioritizing maintenance tasks 5.3 Discuss the importance of planning maintenance to minimize equipment downtime.	Charts, posters, markers, board	5.1 Create simple maintenance schedules for equipment, considering frequency and type of maintenance required. 5.2 Create maintenance scheduling tools like job cards, etc.	5.1 Guide the student to create simple maintenance schedules for equipment, considering frequency and type of maintenance required. 5.2 Guide student to create maintenance scheduling tool like job cards, etc. 5.3 Guide the students to create simple maintenance schedules for school workshop equipment	Set of wrenches Set of Pliers Complete toolbox Lathe Machine Pillar drilling Machine

Course Specification	**General Objective 6.0 Know communication and teamwork in maintenance**					
Year: 3 Term: 1	**Theoretical Content**			**Practical Content**		
Week	**Specific Learning Outcome:**	**Teacher's Activities**	**Learning Resources**	**Specific Learning Outcome:**	**Teacher's Activities**	**Practical Resources**
12	6.1 Explain the importance of communication in maintenance 6.2 Explain team roles in a maintenance setting, such as craftsman, technician, and supervisor. 6.3 Demonstrate effective communication when reporting maintenance issues and solutions. 6.4 Explain the need to collaborate with peers during group maintenance tasks and problem-solving activities.	6.1 Discuss the importance of effective communication in maintenance work (e.g., reporting issues, following instructions, and coordinating tasks) 6.2 Discuss team roles in a maintenance setting, such as craftsman, technician, and supervisor. 6.3 Discuss the need for effective communication when reporting maintenance issues and solutions 6.4 Discuss the importance of peer collaboration during group maintenance tasks and problem-solving activities.	Charts, posters, flipcharts, multimedia			

PIPE FITTING

PROGRAM:	**NATIONAL TECHNICAL CERTIFICATE IN INDUSTRIAL MECHANICS**
MODULE:	**CIM 134: Pipe Fitting**
DURATION:	**84 Hours**
PRE-REQUISITE	
GOAL:	This module is designed to provide the trainee with fundamental knowledge and practical skills required to install, maintain, and repair pipping systems used in various industries.

GENERAL OBJECTIVES:

On completion of this module, the student should be able to:

1. Understand health and safety regulations guiding pipe fitting operations.
2. Know types of Pipes and Pipe Fittings
3. Know Pipe Fitting tools and their uses
4. Understand the principle of measuring, cutting and threading of pipes
5. Know how to make pipe installation assemblies under supervision

PROGRAM: NATIONAL TECHNICAL CERTIFICATE IN INDUSTRIAL MECHANICS						
COURSE: Pipe Fitting			**COURSE CODE: CIM 134**			**Year: 1** **Term: 3**
Course Specification: General Objective 1.0: Understand health and safety regulations guiding pipe fitting operations.						
Year: 1 **Term: 3**	**Theoretical Content**			**Practical Content**		
Week	**Specific Learning Outcome**	**Teacher's Activities**	**Learning Resources**	**Specific Learning Outcome**	**Teacher's Activities**	**Practical Resources**
1–2	1.1 Define health and safety regulations related to pipe fitting operations. 1.2 Describe the purpose of using Personal Protective Equipment (PPE) in pipe fitting tasks (e.g., gloves, safety goggles, helmets, protective footwear) 1.3 Explain the importance of following workplace safety protocols and regulatory standards 1.4 Explain the importance of maintaining clean and organized workspaces to minimize risks.	1.1 Discuss health and safety regulations related to pipe fitting operations. 1.2 Discuss the purpose of using Personal Protective Equipment (PPE) in pipe fitting tasks (e.g., gloves, safety goggles, helmets, protective footwear) 1.3 Discuss the importance of following workplace safety protocols and regulatory standards 1.4 Discuss the importance of maintaining clean and organized workspaces to minimize risks.	PPE (gloves, goggles, helmets, ear protection) Charts Posters First aid kits and training materials. Hazard identification checklists.	1.1 Identify common hazards associated with pipe fitting, such as chemical exposure, confine spaces, fall risks, and equipment-related injuries 1.2 Demonstrate proper handling, lifting, and transporting of pipes and fittings to prevent injuries.	1.1 Guide the student to Identify common hazards associated with pipe fitting, such as chemical exposure, confine spaces, fall risks, and Guide the student to demonstrate proper handling, lifting, and transporting of pipes and fittings to prevent injuries.	PPEs (goggles, gloves, etc.) Pipes Pipe fittings, etc.

Course Specification: General Objective 2.0: Know types of Pipes and Pipe Fittings						
Year: 1 Term: 3	**Theoretical Content**			**Practical Content**		
Week	**Specific Learning Outcome**	**Teacher's Activities**	**Learning Resources**	**Specific Learning Outcome**	**Teacher's Activities**	**Practical Resources**
3–5	2.1 Define pipes and pipe fittings and their role in pipping systems. 2.2 Explain the different types of pipes commonly used in plumbing and industrial applications, such as: **Metal Pipes** (e.g., steel, copper, cast iron) **Plastic pipes** (e.g., PVC, CPVC, PEX) Concrete and Ceramic Pipes (for specific drainage and sewage systems) 2.3 Describe the characteristics and applications of various pipe materials (e.g., corrosion resistance, flexibility, temperature tolerance) 2.4 Mention the different types of pipe fittings. E.g.	2.1 Discuss pipes and pipe fittings and their role in pipping systems. 2.2 Discuss the different types of pipes 2.3 Discuss the characteristics and applications of various pipe materials (e.g., corrosion resistance, flexibility, temperature tolerance) 2.4 Discuss the types of pipe fittings and their functions 2.5 Discuss threaded, welded, and flanged connections in pipe fitting. 2.6 Discuss the importance of standard pipe markings (e.g., pressure ratings, material codes)	Physical samples of pipes and fittings Posters and charts Pipe size charts and specification sheets Multimedia. Whiteboard Marker	2.1 Identify the different types of pipes commonly used in plumbing and industrial applications. 2.1 Identify different types of pipe fittings, including: Elbow, Tees, Coupling, reducers, unions, caps, plugs, flanges, and valves 2.2: Identify the different types of pipes commonly used in plumbing and industrial applications, such as: **Metal Pipes** (e.g., steel, copper, cast iron) **Plastic pipes** (e.g., PVC, CPVC, PEX) Concrete and Ceramic Pipes (for	1.1 Display samples of different pipes and fittings, allowing students to handle them. Guide the student to identify the different types of pipes commonly used in plumbing and industrial applications, such as: **Metal Pipes** (e.g., steel, copper, cast iron) **Plastic pipes** (e.g., PVC, CPVC, PEX) Concrete and Ceramic Pipes (for specific drainage and sewage systems) 2.4 Guide the student to list and identify different types of pipe fittings, including: Elbow, Tees, Coupling, reducers, unions, caps,	Metal pipes Plastic pipes Ceramic pipes Different pipe fittings

	Elbow, Tees, Coupling, reducers, unions, caps, plugs, flanges, and valves 2.5 Explain the functions of pipe fittings 2.6 Differentiate between threaded, welded, and flanged connections in pipe fitting. 2.7 Explain the importance of standard pipe markings (e.g., pressure ratings, material codes)			specific drainage and sewage systems) 2.3 Select appropriate pipes and fittings based on their application, material compatibility, and system requirements (e.g., water supply, gas lines, drainage). 2.4 Measure and identify pipe sizes and fitting dimensions using proper tools.	Plugs, flanges, and valves Guide the student to know how to select appropriate pipes and fittings based on their application, material compatibility, and system requirement (e.g., water supply, gas lines, drainage). Conduct a group activity where students match fittings to their respective applications. Show videos of pipping installations in various environments (e.g., homes, factories, hospital)	

Course Specification: General Objective 3.0: Know Pipe Fitting tools and their uses						
Year: 1 Term: 3	**Theoretical Content**			**Practical Content**		
Week	**Specific Learning Outcome**	**Teacher's Activities**	**Learning Resources**	**Specific Learning Outcome**	**Teacher's Activities**	**Practical Resources**
6–7	3.1 Describe common pipe fitting tools used in plumbing and industrial applications 3.2 Describe the function of each tool in the pipe fitting process 3.3 Differentiate between tools used for cutting, threading, measuring, joining, and tightening pipes. 3.4 Explain the importance of using the correct tool	1.1 Explain common pipe fitting tools used in plumbing and industrial applications 1.2 Discuss the function of each tool in the pipe fitting process 1.3 Discuss the importance of using correct tools	Pipe wrenches, cutters, reamers, threading dies. Work benches and practice materials. Pipe fitting and plumbing tools Chart Poster and flipcharts Multimedia	3.1 Select the appropriate tool based on the type of pipe material (e.g., metal vs plastic) and fitting task. 3.2 Use the appropriate tools for pipe fitting work.	Facilitate a tool identification quiz Guide to conduct a demonstration of how to use various pipe fitting tools	Pipe wrenches, cutters, reamers, threading dies. Work benches and practice materials
Course Specification: General Objective 4.0: Understand the principle of measuring, cutting and threading of pipes						
Year: 1 Term: 3	**Theoretical Content**			**Practical Content**		
Week	**Specific Learning Outcome**	**Teacher's Activities**	**Learning Resources**	**Specific Learning Outcome**	**Teacher's Activities**	**Practical Resources**
8–10	4.1 Explain the difference between the imperial and metric system of measurement.	4.1 Discuss imperial and metric system of measurement.	Micrometer Vernier Calipers External Internal Protractors	4.1 Identify the tools required for measuring, cutting and threading	4.1 Guide the student to identify the tools required for measuring, cutting and threading.	Micrometer Vernier Calipers External Internal Protractors

	4.2 Explain the difference between gauging and measuring. 4.3 List types measuring Tools 4.4 Describe the types of micrometers, e.g., a. Outside micrometer b. Inside micrometer c. Depth micrometer d. Screw-thread micrometer etc. 4.5 Describe how to use a micrometer to measure (one hundredth of a millimeter). 4.6 Explain the principles of Vernier micrometer. 4.7 Explain how to use Vernier caliper	4.2 Discuss the difference between gauging and measuring 4.3 Describe types of measuring tools 4.4 Discuss the types of micrometers e.g: a. Outside micrometer b. Inside micrometer c. Depth micrometer d. Screw-thread micrometer etc. 4.5 Discuss the use of a micrometer to measure (One hundredth a millimeter). 4.6 Discuss the principles of Vernier micrometer. 4.7 Discuss how to use Vernier caliper 4.8 Discuss a 25-division Vernier caliper and a	Gauges Tapes. Dial indicators Cutting tools (pipe cutters, saws) Threading tools (dies, taps, threading machines) Scribers Safety equipment (gloves, goggles) Charts, posters.	4.2 Measure pipes accurately using appropriate tools (e.g., tape measure, calipers, pipe gauges) 4.3 Mark cutting points on pipes using scribes or markers for precision 4.4 Select the correct cutting tools based on the pipe material (e.g., hacksaw for metal, pipe cutter for plastic) 4.5 Perform clean and accurate cuts on pipes, ensuring smooth and straight edges 4.6 Use deburring tools or reamers to remove burrs and smooth pipe edges after cutting. 4.7 Demonstrate the threading process	4.2 Guide the students to measure pipes accurately using appropriate tools (e.g., tape measure, calipers, pipe gauges). 4.3 Demonstrate to the students how to mark out, select appropriate tools, perform a clean cut, deburr, and thread a workpiece. 4.4 Conduct a hands-on session where students cut and thread pipes 4.5 Guide students while they practice deburring and reaming. 4.6 Guide student to cut thread using dies	Gauges Tapes. Dial indicators Cutting tools (pipe cutters, saws) Threading tools (dies, taps, threading machines) Scribers Safety equipment (gloves, goggles) Charts, posters

	4.8 Explain the difference between a 25-division Vernier caliper and a 50-division Vernier caliper. 4.9 Explain the importance of accurate measurement, cutting, and threading in pipe fitting. 4.10 Describe the purpose of threading pipes	50-division Vernier Caliper 4.9 Discuss the importance of accurate measurement, cutting, and threading in pipe fitting. 4.10 Explain the purpose of threading pipes		using manual pipe dies.		
Course Specification: General Objective 5.0: Know how to make pipe installation assembly under supervision.						
Year: 1 Term: 3	**Theoretical Content**			**Practical Content**		
Week	**Specific Learning Outcome**	**Teacher's Activities**	**Learning Resources**	**Specific Learning Outcome**	**Teacher's Activities**	**Practical Resources**
11 - 12	5.1 Explain the basic principles of pipe installation 5.2 Explain the importance of following instruction during installation	5.1 Discuss the basic principles of pipe installation 5.2 Discuss the importance of following instruction during installation 5.3 Discuss the requirements for installation	Charts and posters Textbooks Whiteboard Marker	5.1 Interpret simple pipe layout diagrams or blueprints 5.2 Demonstrate how to align, connect, and secure pipes using appropriate methods (e.g., threading, welding, gluing, clamping)	Guide students on how to read and interpret piping diagrams. Guide student through the installation process Facilitate a troubleshooting session on identifying	Pipping diagrams and blueprints. Pipes and fittings for practical assembly. Leak testing equipment (e.g., pressure gauges, soapy water)

	5.3 Explain installation requirements			5.3 Select and install the correct pipe fittings (e.g., elbows, tees, couplings, based on system requirement) 5.4 Use appropriate tools (e.g., pipe wrenches, pipe threaders, pipe benders) safely and effectively during assembly. 5.5 Test the installed pipes	common installation errors. Guide student to perform leak test	

TAPS AND DIES

PROGRAM:	National Technical Certificate in **Industrial Mechanics**
MODULE:	**CIM 215: Tap and Dies**
DURATION:	**Hours: 72HRS**
PRE-REQUISITE	
GOAL:	This module is primarily designed to equip the trainees with the skills necessary to create internal and external threads on various materials using taps and dies.

GENERAL OBJECTIVES:

On completion of this model, the students should be able to:

1. Know appropriate drills, taps and die tools for a successful threading operation
2. Understand the rudiments and techniques of threading operations
3. Know how to perform internal thread cutting operation
4. Know how to perform external thread cutting operation

PROGRAM: NTC IN INDUSTRIAL MECHANICS						
COURSE: **TAPS AND DIES**			Course Code: CIM			**Year: 2 Term: 1**
Course Specification: General Objective 1.0 Know appropriate drills, taps and die tools for a successful threading operation						
Year: 2 Term: 1	**Theoretical Content**			**Practical Content**		
Week	**Specific Learning Outcome**	**Teacher's Activities**	**Learning Resources**	**Specific Learning Outcome**	**Teacher's Activities**	**Practical Resources**
1–2	1.1 Explain threading 1.2 List the tools used for threading 1.3 Explain the applications of taps and dies 1.4 Identify different types of taps (e.g., taper, plug, bottoming taps) and dies (e.g., round dies, adjustable dies) and their specific uses 1.5 Explain the functions and applications of each tool in the threading process	1.1 Discuss threading, 1.2 Explain the tools used for threading 1.3 Discuss the applications of taps and dies 1.4 Describe the different types of taps and dies 1.5 Discuss the functions and applications of each tool in the threading process. .	Samples of threaded fasteners (nuts, bolts, screws) Charts of thread types and specifications. Diagram and posters Whiteboard Marker	1.1 Identify different threading and their applications 1.2 Select the correct drill bit size for pre-tapping holes based on thread size specifications. 1.3 Identify different types of taps and dies	1.1 Show students threaded fasteners and components to illustrate their applications 1.2 Guide students on how to select the correct drill bit size for pre-tapping holes based on thread size specifications 1.3 Guide student to identify different types of taps and dies	Round dies Adjustable dies Taper plug Bottoming taps Drill bits Bolts, nuts, and screws

Year: 2 Term: 1	**General Objective 2.0: Understand the rudiments and techniques of threading operations Contact Hour 1-2**					
Week	**Specific Learning Outcome**	**Teacher's Activities**	**Learning Resources**	**Specific Learning Outcome**	**Teacher's Activities**	**Practical Resources**
3–4	2.1 Differentiate between internal threading (tapping) and external threading (using dies) 2.2 List different types of threads (e.g., metric, imperial, fine, coarse) 2.3 Explain the applications of each type of thread in 2.2 above.	2.1 Explain internal threading (tapping) and external threading (using dies) 2.2 Discuss different types of threads (e.g., metric, imperial, fine, coarse) 2.3 Discuss the applications of each type of thread in 2.2 above.	Charts and posters Diagrams of different threading system Sample taps and dies	2.1 Select the appropriate tools (taps, dies, thread gauges, cutting fluids) based on material and thread type.	2.1 Guide students to select appropriate tools (taps, dies, thread gauges, cutting fluids) based on material and thread type.	Taps Dies Thread gauges Cutting oil

Year: 2 Term: 1	**General Objective 3.0: Know how to perform internal thread-cutting operations.**					
Week	**Specific Learning Outcome**	**Teacher's Activities**	**Learning Resources**	**Specific Learning Outcome**	**Teacher's Activities**	**Practical Resources**
5–8	3.1 Explain the internal thread 3.2 Differentiate between hand taps,	3.1 Discuss the internal thread 3.2 Explain hand taps, my machine taps, and thread insert	Hand taps Machine taps Thread inserts Whiteboard Marker	3.1 Select appropriate tools and materials 3.2 Drill the correct hole for internal threading	3.1 Guide students to select appropriate tools and materials 3.2 Guide students to	Drill bits Set of taps Tap wrench Lubricant Bench vice Drilling Machine

	machine taps, and thread inserts. 3.3 Describe the internal thread-cutting process 3.4 Explain Workpiece Preparation for Internal Threading 3.5 Explain how to cut internal threads using a tap wrench manually 3.6 Describe common tap defects and how to avoid them	3.3 Explain the internal thread-cutting process 3.4 Discuss workpiece preparation for internal threading 3.5 Discuss how to manually cut an internal thread using a tap wrench 3.6 Discuss common tap defects and how to avoid them		3.3 Perform manual internal thread cutting	prepare workpiece for internal threading 3.3 Guide students to perform manual internal thread cutting.	
Year: 2 Term: 1	**General Objective 4.0: Know how to perform external thread-cutting operations.**					
Week	**Specific Learning Outcome**	**Teacher's Activities**	**Learning Resources**	**Specific Learning Outcome**	**Teacher's Activities**	**Practical Resources**
9–12	4.1 Explain the external thread 4.2 Describe manual and machine	4.1 Discuss the external thread 4.2 Explain the manual and machine external thread-cutting process	Die Die, holder, Metal rod Whiteboard Marker	4.1 Select appropriate tools and materials	4.1 Guide students to select the correct tools 4.2 Guide students to	Die sets Die, holder Metal rods and threaded fasteners

	external thread-cutting processes. 4.3 Explain workpiece preparation for external threading 4.4 Explain how to cut external threads using a die manually 4.5 Describe common die defects and how to avoid them	4.3 Discuss workpiece preparation for external threading 4.4 Discuss how to manually cut an external thread using a die 4.5 Discuss common die defects and how to avoid them		4.2 Perform manual external thread-cutting	practice external threading on metal rods 4.3 Conduct a group activity where students pair taps and die with their correct applications.	Cutting fluids and lubricants

HAND AND POWER TOOLS

PROGRAM:	National Technical Certificate in **Industrial Mechanics**
MODULE:	**CIM 116: Hand and Power Tools**
DURATION:	**Hours 72HRS**
PRE-REQUISITE	
GOAL:	This module introduces trainees to the fundamentals of power and hand tools, focusing on their identification, operation, maintenance, and safety procedures.

GENERAL OBJECTIVES:

On completion of this model, the students should be able to:

1. Know Hand and power tools
2. Understand Safe handling and maintenance of tools
3. Know how to use basic hand tools
4. Know how to use basic power tools
5. Know Tool selection for specific tasks

Year: 1 Term: 1	**General Objective 1.0: Know hand and power tools.**					
Week	**Specific Learning Outcome**	**Teacher's Activities**	**Learning Resources**	**Specific Learning Outcome**	**Teacher's Activities**	**Practical Resources**
1–2	1.1 Explain hand and power tools and their applications 1.2 List examples of hand and power tools 1.3 Classify tools based on function (cutting, fastening, measuring, holding) 1.4 Different between hand tools and power tools 1.5 Explain the importance of tools in various trades (e.g., carpentry, plumbing, mechanics)	1.1 Discuss hand and power tools and their applications 1.2 Display common tools and explain their uses	Hand and Power tools (hammers, drills, pliers, wrenches, screwdrivers) Charts and posters showing different tools Videos demonstrating tool usage.	1.1 Identify basic hand and power tools (e.g., hammers, screwdrivers, drills, saws)	1.1 Display common hand and power tools 1.2 Guide students to identify different hand and power tools with their applications	Torque Wrench Grinders Electric drill Cordless drill Wrenches Hammers Screwdrivers Saws Micrometer Vernier Caliper Dial indicator, etc.

Year: 1 Term: 1	**General Objective 2.0: Understand safe handling and maintenance of tools.**					
Week	**Specific Learning Outcome**	**Teacher's Activities**	**Learning Resources**	**Specific Learning Outcome**	**Teacher's Activities**	**Practical Resources**
3–4	2.1 List of general safety rules for handling hand and power tools 2.2 Describe the importance of PPE (Personal protective Equipment) 2.3 Explain how to inspect, clean and store tools properly 2.4 Explain proper lifting and handling techniques for heavy tools.	2.1 Explain the general safety rules for handling hand and power tools 2.2 Demonstrate how to check tools for damage before use. 2.3 Discuss the proper storage techniques to prevent tool damage. 2.4 Demonstrate the proper lifting and handling techniques for heavy tools. 2.5 Discuss real-life accidents related to improper tool use and how to prevent them	Safety wears (gloves, goggles, ear plug/muff) Tools: instructional manuals and safety guidelines. Demonstration tools in different conditions (new, worn out, damage)			
Year: 1 Term: 1	**General Objective 3.0: Know how to use basic hand tools.**					
Week	**Specific Learning Outcome**	**Teacher's Activities**	**Learning Resources**	**Specific Learning Outcome**	**Teacher's Activities**	**Practical Resources**
5–7	3.1 Explain the proper usage of measuring tools (tape measure, ruler, square)	3.1 Discuss the correct technique for using each type of hand tool.	Measuring tools (tape measures, rules). Cutting tools (saws, utility knives)	3.1 Demonstrate the correct technique for using each type of hand tool.	3.2 Organize hands-on exercises where students measure,	Measuring tape Rule Scriber Center punch Precision square

	3.2 Explain the correct use of cutting tools, e.g., Handsaws, utility knives 3.3 Explain the proper usage and operation of fastening tools (screwdrivers, wrenches, and pliers)		Fastening tools (screwdrivers, pliers) Wood and metal samples for practice.	3.2 Use different tools to carry out task	cut, and fasten materials 3.3 Supervise students as they practice using tools on wood or metal	Try square Micrometer Vernier caliper Saws Wrenches Screwdrivers etc. Wood, hollow pipes, and metal samples PPEs
Year: 1 Term: 1	**General Objective 4.0: Know how to use basic power tools.**					
Week	**Specific Learning Outcome**	**Teacher's Activities**	**Learning Resources**	**Specific Learning Outcome**	**Teacher's Activities**	**Practical Resources**
8–10	4.1 Explain the proper identification of key power tools such as electric drills, jigsaws, and hand grinders 4.2 Explain how to safely operate basic power tools 4.3 Explain the use of power tools to perform operations such as drilling holes, cutting wood	4.1 Discuss the proper identification of key power tools 4.2 Discuss safety in operating power tools 4.3 Discuss the use of power tools to drill, cut grind, etc.	Electric drills, jigsaws, angle grinders Extension cords and workbench. Protective equipment (goggles, gloves) Practical materials (wood planks, metal sheets)	4.1 Demonstrate the setup of power tools 4.2 Demonstrate how to safely operate basic power tools 4.3 Use power tools to drill, cut, grind, etc.	4.1 Guide students on the setup of some power tools 4.2 Guide students on how to safely operate power tools to cut, grind and drill samples 4.3 supervise hands-on practice sessions, ensuring	Cordless drill Hand drill Hand grinder Jigsaws PPEs

	and grinding surfaces				correct use of tools.	
Year: 1 Term: 1	**General Objective 5.0: Know tool selection for specific tasks.**					
Week	**Specific Learning Outcome**	**Teacher's Activities**	**Learning Resources**	**Specific Learning Outcome**	**Teacher's Activities**	**Practical Resources**
11–12	5.1 Explain the process of selecting appropriate tools for measuring, cutting, and assembling materials. 5.2 Explain the identification of suitable tools for woodworking and metalworking 5.3 Explain how to justify the choice of tools for specific tasks based on material type and project requirements.	5.1 Discuss the process of selecting the appropriate tools for specific task 5.2 Discuss the identification of suitable tools for woodwork and metal work 5.3 Discuss why certain tools are more effective for specific material and tasks	A variety of materials (wood, metal, plastic) Toolkits for student use Scenario cards with task descriptions. Whiteboard Markers	5.1 Select appropriate tools 5.2 Execute a simple project	5.1 present different scenarios to the students (e.g., assembling furniture, cutting metal) and have student choose appropriate tools 5.2 Organize group activities where students plan and execute a small project using selected tools	A variety of materials (wood, metal, plastic) Toolkits for student use Scenario cards with task descriptions. PPEs

MECHANICAL DRIVE SYSTEMS AND PUMPS

PROGRAM:	National Technical Certificate in **Industrial Mechanics**
MODULE:	**CIM 317: MECHANICAL DRIVE SYSTEMS AND PUMPS**
DURATION:	**Hours 96HRS**
PRE-REQUISITE	
GOAL:	This module is primarily designed to equip the trainees with the fundamental knowledge and practical skills required to understand, operate, maintain, and troubleshoot mechanical drive systems and pumps used in industries.

GENERAL OBJECTIVES:

On completion of this model, the students should be able to:

1. Understand the definitions, functions, applications, and classifications of drive components.
2. Understand the definition, principles, and method of selecting pumps.
3. Understand the principles and process of packing, sealing, repairing, and maintaining pumps.
4. Know the function, types, and classification of belt and chain drives.
5. Know the functions and types of gears in a transmission system.
6. Understand the definition, principles, and applications of valves used in engineering.

Year 3, Term 1&2	**General Objective 1.0: Understand the definitions, functions, applications, and classifications of drive components.**					
Week	**Specific Learning Outcome**	**Teacher's Activities**	**Learning Resources**	**Specific Learning Outcome**	**Teacher's Activities**	**Practical Resources**
1–4	1.1 Define mechanical drive systems 1.2 Explain the importance of mechanical drive systems in power transmission. 1.3 Identify common mechanical drive and explain their application in industries 1.4 List the classes of mechanical drives based on types. E.g. **Frictional Drives** (belt drives) **Positive drives** (chain drives) **Gear Drives** (Spur gear drives, bevel gears)	1.1 Discuss mechanical drive systems 1.2 Discuss common mechanical drives and explain their application in industries 1.3 Discuss the classes of mechanical drives	Textbooks Multimedia Charts and posters Whiteboard Marker	1.1 Identify the classes of mechanical drives and their applications in industries. 1.1 Identify different types of couplings and gears	1.1 Display different mechanical drives 1.2 Guide student to identify different drives and state their application	Models of power drives Belt Chain Gears Couplings

	Coupling Drives (Flexible, rigid, and fluid coupling drives) 1.5 Explain the advantages of one class of drive over the others.					
	General Objective 2.0: Understand the definition, principles, and method of selecting pumps.					
5–8	2.1 Explain pump 2.2 State the function of pump 2.3 Outline the classes of pump a) Gear pump b) Rotary pump c) Centrifugal pump d) Reciprocating pump 2.2 Explain the methods and system requirements in selecting pumps for use. 2.3 Explain various pumping systems, e.g: a. Water pumping systems b. Waste handling systems.	2.1 Discuss pump, its function, classification and applications. 2.2 Discuss the methods and system requirements in selecting pumps for use. 2.3 Discuss the various pumping systems. 2.4 Discuss the basic principles of gear pumps, rotary pumps, and centrifugal pumps. 2.5 Discuss the difference	Textbooks Multimedia charts Picture of pumps. Samples of pumps.	2.1 Sketch and label the following: Gear pump, rotary pump, centrifugal pump, reciprocating pump	2.1 Guide students on how to sketch the types of pump	Gear pump Centrifugal pump Piston pump

	2.4 Describe the basic principles of gear pumps, rotary pumps, and centrifugal pumps. 2.5 Explain the difference between centrifugal and rotary pumps.	between centrifugal and Rotary pumps.				
	General Objective 3.0: Understand the principles and process of packing, sealing, repairing, and maintaining of pump.					
9–12	3.1 Explain the principles and process of packing a pump 3.2 Outline the principles and process of sealing a pump. 3.3 Outline the importance of packing and sealing equipment 3.4 List different types of materials for packing. 3.5 Outline the types of sealing e.g., mechanical seal. 3.6 Explain the types of packing gland.	3.1 Discuss the principles and process of packing and sealing a pump. 3.2 Discuss the importance of packing and sealing Equipment 3.3 Discuss different types of materials for packing. 3.4 Discuss types of sealing e.g., mechanical seals. 3.5 Discuss the types of packing glands.	Textbooks Chart Posters pumps Pump seals and glands	3.1 Select the correct types of materials for packing 3.2 Carry out the procedures of packing and sealing a pump 3.3 Identify types of sealing, e.g., mechanical seal. 3.4 Installing packing materials in pumps	3.1 Guide students to select the correct types of materials for packing 3.2 Guide students on the procedures of packing and sealing a pump 3.3 Demonstrate the method of installing packing materials in pumps.	Packing glands Mechanical seals Pumps Wrenches Screwdrivers Workbench

	3.7 Explain the method of installing packing materials in pumps. 3.8 State the safety precautions to be observed when packing and sealing equipment.	3.6 Discuss the method of installing packing materials in pumps. 3.7 Discuss the safety precautions to be observed when packing and sealing equipment.				
	General Objective 4.0: Know the function, types, and classification of belt and chain drives.					
1–4	4.1 State the functions and applications of belt drives. 4.2 Explain the types and classification of belts, e.g. a. Round belt b. Flat belt c. V belt d. Toothed belt e. Link belt 4.3 Explain the characteristics, features of belt drive. 4.4 Explain creep and hysteresis in belt drives.	4.1 Discuss the functions and applications of belt drives. 4.2 Discuss the types and classification of belts as listed in 6.2 4.3 Discuss the characteristics and features of belt drive. 4.4 Discuss creep and the causes of creep and hysteresis in belt drives.	Textbooks Charts Multimedia	4.1 Identify the classes of belt 4.2 Disassemble and assemble a belt drive on a machine 4.3 Disassemble and assemble a chain drive on a machine	4.1 Display different classes of belt 4.2 Guide students to identify classes of belt 4.3 Guide students to disassemble and assemble belt and chain drives on a machine.	Toolbox Round belt Flat belt V belt Toothed belt PPEs

	4.5 Outline the causes of creep and hysteresis 4.6 Explain why the performance of the drive depends more on the pulley type than the belt section. 4.7 Explain the functions and application of chain drive. 4.8 Explain types of chain in industry, e.g. i. Metric chains ii. Engineers chain iii. Revenue chain iv. Band chain 4.9 Explain the terms concentric, parallel, and vertical and right angle shaft reducers in chain drives.	4.5 Discuss why the performance of the Drive depends more on the pulley type than the belt section. 4.6 Discuss the functions and application of chain. Discuss types of chain in industry 4.7 Discuss the terms concentric, parallel, and vertical and right-angle shaft reducers in chain drive.		Identify types of chain in industry as stated in 7.2 Identify concentric, parallel, vertical and right angle shaft reducers in chain drivers	Show students the different types of chains Show students concentric, parallel, vertical and right angle shaft reducers in chain	
	General Objective 5.0: Know the functions and types of gears in a transmission system.					
5–8	5.1 Define gear 5.2 Explain the functions of gear in a transmission	5.1 Discuss gears and the functions of gears in transmission System	Textbooks Charts multimedia	5.1 Identify various types of gear	5.1 Display different types of gears	Gear box Toolbox PPEs Spur gear

	system. 5.3 Describe the following types of gears: a. spur gears b. helical gears c. herringbone gears d. bevel gears e. worm gears 5.4 Explain the importance and application of gear in transmitting motions. 5.5 Outline causes of gear misalignment (out of mesh).	5.2 Discuss the various types of gears used in engineering. 5.3 Discuss the importance and applications of gears in transmitting motion. 5.4 Discuss causes of gear Misalignment		5.1 Select the various types of gears used in engineering 5.2 Carry out gear assembling of a gearbox	5.2 Guide students to select appropriate gears 5.3 Guide students to carry out assembling of gears	Helical gear Herringbone gear Bevel gear Worm gear
	General Objective 6.0: Understand the definition, principles, and applications of valves used in engineering.					
9–12	6.1 Explain valves 6.2 Explain the principles of valves 6.3 Describe the various types of valve, e.g., Globe valves Piston valve Gate valve Butterfly valve Ball valve	6.1 Discuss the principles of valves 6.2 Discuss the various types of valves 6.3 Discuss the different applications of valves used in engineering.	Textbooks Charts multimedia	6.1 Identify the various types of valves 6.2 Carry out method of sealing a valve 6.3 Carry out maintenance work on a given valve.	6.1 Show students the different types of valves 6.2 Demonstrate to students the application of valves in a given engineering operation	Globe valve Piston valve Gate valve Butterfly valve Ball valve Diaphragm valve Toolbox Seals PPEs

	6.4 Explain the different application of valves. 6.5 Describe the method of sealing a valve. 6.6 Explain the maintenance of valves.	6.4 Discuss the method of sealing a valve. 6.5 Discuss the care maintenance of valves.			6.3 Show student's methods of sealing a valve 6.4 Show students how to carry out Maintenance work on a given valve.	

Guidelines for Book Writers

NATIONAL TECHNICAL CERTIFICATE AND ADVANCED NATIONAL TECHNICAL CERTIFICATE

GUIDELINES FOR TEXTBOOK WRITERS

The following guidelines are suggestions from the Engineering Committees to the writers of the textbooks for the new curricula. They are intended to supplement the detailed syllabuses that have been produced and that define the content and level of the courses.

Authors should bear in mind that the curriculum has been designed to give the students a broad understanding of applications in industry and commerce, and this is reflected in the curriculum objectives.

One book should be produced for each syllabus

Page size should be A4

The font size should be 12 points for normal text and 14 points where emphasis is needed.

Line spacing should be set to 1.5 lines

Headings and subheadings should be emboldened

Photographs, diagrams, and charts should be used extensively throughout the book, and these items must be up-to-date

In all cases, the material must be related to industry and commerce, using real-life examples wherever possible so that the book is not just a theory book. It must help the students to see the subject in the context of the ´real word.'

The philosophy of the courses is one of an integrated approach to theory and practice, and as such, the books should reflect this by not making an artificial divide between theory and practice.

Examples should draw from Nigeria wherever possible, so that the information is set in a country text.

Each chapter should end with student self-assessment questions (SAG) so that students can check their own mastery of the subject.

Accurate instructions should be given for any practical work, having first conducted the practical to check that the instructions do indeed work.

The books must have a proper index or table of contents, a list of references, and an introduction based on the overall course philosophy and aims of the syllabus.

Symbols and units must be listed, and a unified approach is used throughout the book.

In case of queries regarding the contents of the books and the depth of information, the author must contact the relevant curriculum committee via the National Board for Technical Education.

The final draft version of the books should be submitted to Nigerian members of the curriculum working groups for their comments regarding the content in relation to the desired syllabus.

LIST OF BOOKS AND REFERENCES

“Machine Tools Handbook” by K. A. Lee
covers basic metalworking techniques, tools, and machine operation principles.

“Fundamentals of Metalworking" by A. A. B. M. Khan
Offers a clear understanding of metalworking processes, materials, and tools

"Introduction to Metalworking" by P. A. F. Olayemi
A guide that covers the basics of metalworking, including safety, materials, and tools used in metal fabrication.

"Materials Science for Engineers" by K. O. I. Ige
Provides insight into the properties and behavior of materials, with practical implications for engineering design.

"Materials Science and Engineering: An Introduction" by William D. Callister
A detailed textbook on the structure, properties, and processing of materials.

"Materials Selection in Mechanical Design" by Michael F. Ashby
This book guides on selecting the right materials for engineering applications.

"Hydraulic Systems Design and Maintenance" by O. O. Aladejana
A practical guide to understanding and maintaining hydraulic and pneumatic systems commonly used in industry.

"Principles of Industrial Maintenance" by O. O. Olatunji
A comprehensive resource on the principles of maintenance, including maintenance management, tools, and best practices.

"Fluid Power with Applications" by Anthony Esposito
This book covers the basics of fluid power, including hydraulics and pneumatics.

"Introduction to Fluid Power" by James R. D.
A detailed guide to fluid power systems in industry, including theory and practice.

"Modern Plumbing and Pipe Fitting Techniques" by O. A. Adebayo
Introduces the theory and practice behind plumbing systems, focusing on pipefitting techniques commonly used in Nigeria.

"Maintenance Engineering Handbook" by Keith Mobley
A comprehensive resource on maintenance management, planning, and reliability.

"Maintenance Reliability Best Practices" by Ramesh Gulati
Practical guide to improving maintenance systems and increasing reliability.

"Pipefitting Level 1" by NCCER
Textbook for understanding pipefitting basics, including tools and safety practices.

"Modern Pipefitting" by Russell H. Pannell
Detailed coverage on pipefitting methods, tools, and techniques used in the industry.

"Practical Guide to Tap & Die" by George Goodfellow
A focused manual on the use of taps and dies for threading operations.

"The Complete Modern Blacksmith" by Alexander G. Weygers
A classic text on metalworking, including tapping and die use for beginners.

"Basic Machining Techniques: Tap and Die" by A. S. Salami
A book that covers the practical application of tap and die in machining and metalworking, specifically for industrial mechanics students.

"The Complete Home Workshop: Hand Tools & Power Tools" by Thomas J. Cumpston
A comprehensive guide to both hand and power tools used in industrial settings.

"Fundamentals of Machine Tools" by W. H. Leland
This book covers both hand tools and power-driven tools used in the machining process.

"Workshop Practice for Technical Students" by M. B. Bakare
A hands-on guide covering the safe and effective use of hand and power tools in mechanical and industrial workshops.

"Mechanical Power Transmission" by Philip J. Simmonds
Covers various mechanical drive systems such as belts, pulleys, chains, and gears.

"Centrifugal Pumps: Design and Application" by Val S. Lobanoff
A thorough guide to understanding the design, operation, and application of centrifugal pumps.

"Mechanical Drives: Design, Application, and Maintenance" by G. A. Ogundele
A resource on mechanical drive systems, including gears, pulleys, and belts, along with their maintenance and troubleshooting.

"Gas Welding and Cutting" by E. O. Fagbemi
A practical guide focused on the use of oxy-acetylene welding and cutting techniques.

"Welding: Principles and Applications" by Larry Jeffus
An extensive guide to gas welding and cutting processes, with practical insights.

"The Oxy-Acetylene Handbook" by Roy A. Parisher
Specializes in oxy-acetylene welding and cutting techniques.

"Introduction to Welding Techniques" by M. A. O. Shittu
A comprehensive overview of various welding methods with a special focus on metal arc welding.

"Welding Technology" by Richard L. Little
Comprehensive book covering all welding technologies, with specific focus on arc welding.

"The Art of Welding" by Edward R. Bauer
Provides an overview of arc welding techniques, including tips for professionals.

"Machining Fundamentals" by John R. Walker
Covers the essentials of machining, including turning, and other fundamental processes.

"Lathe Operation" by K. C. John
Focuses on the basics of turning operations on a lathe machine.

"The Milling Machine for Home Machinists" by Harold Hall
An excellent guide for both beginners and experienced machinists interested in milling.

"Advanced Milling Technology" by James A. Martell
An in-depth look at the principles and techniques of advanced milling.

"Grinding Technology: Theory and Applications of Machining with Abrasives" by Stephen M. Stout
This book explains the science of grinding, including practical and theoretical aspects.

"Principles of Modern Grinding Technology" by W. Brian Rowe
A modern approach to grinding, covering both the theory and industrial applications.

LIST OF LABORATORIES:

Physics Laboratory

Mechanical workshop

Chemistry

Metal Work.

Technical Drawing Lab

MINIMUM LIST OF TOOLS AND EQUIPMENT
MECHANICAL ENGINEERING CRAFT PRATICE TOOL LIST.

S/NO	TOOLS	MINIMUM QUANTITY REQUIRED	QUANTITY AVAILABLE	ADDITIONAL QUANTITY REQUIRED
1	**FITTING** Vices 150mm	 20		
2	Benches	10		
3	Hacksaw FRAMES	20		
4	Files 250mm flat rough 10” Hand rough 10” Round rough 10” Three rough 10” Square rough 10” Half round 2nd cut 200mm Warding file 100” Retail file Wallets of warding files	20 each ,, ,, ” ” ” ” ” ” ”		
5	Steel rules (12”) 300m	50		
6	Tape rule 1000mm	20		
7	Dividers	30		
8	Scribers	50		
9	Pocket size (200mm) calipers Vanier digital	10		
10	Centre punches	50		
11.	Hammer small size	20		
12.	Hammer medium size	10		
13.	Oil can	30		

14.	Pair of Pliers 150mm	20		
15.	Toolbox & lock	30		
16.	Odd-leg calipers	20		
17.	Engineers Squares 100	15		
18.	Screwdrivers 200mm	50		
19.	Pair of tin snips Nippy vice	25		
	Basic Electricity			
20.	Multimeters (digital)	10		
21.	Insulation testers	5		
22.	Soldering irons	20		
23.	Wire strippers	20		
24.	Electrical tape	2 packs		
25.	Circuit boards and components (resistors, capacitors, switches, etc.)	Assorted		
26.	Small electrical motors	10		
	Material Selection			
27.	Material samples (steel, aluminum, copper, plastics, etc.)	Assorted		
28.	Hardness testing kits	5		
29.	Surface finish gauges	5		
30.	Material charts and reference guides	20		
31.	Tensile testing machine	1		
	Fluid Power System			
32.	Pneumatic Compressors	2		
33.	Hydraulic pumps	2		
34.	Hydraulic cylinders	10		
35	Pneumatic valves and actuators	10		
36.	Manometers (pressure gauges)	10		
37.	Tubing (flexible and rigid)	Assorted		

38.	Fittings and connectors	Assorted		
39.	Fluid reservoirs	5		
	Maintenance & Reliability			
40.	Torque wrenches	5		
41.	Grease guns	5		
42.	Bearing pullers	5		
43.	Hydraulic jacks	5		
44.	Oiling and lubrication systems	5		
	Pipe Fitting			
45.	Pipe benders	5		
46.	Pipe cutters	5		
47.	Pipe threaders	5		
48.	Pipe wrenches	10		
49	Soldering torches	5		
50	Fittings (elbows, tees, couplings)	Assorted		
51	Pipes (PVC, copper, steel, etc.)	Assorted		
	Taps & Dies			
52.	Tap and die sets (various sizes)	5 sets		
53.	Threading lubricant	Assorted		
54.	Tapping tools	10		
55.	Dies	10		
56.	Tap wrenches	10		
	Hand and Power Tools			
57.	Drills (electric, corded or cordless)	10		
58.	Angle grinders	5		
59.	Power Band saws	2		
60.	Bench grinders	4		
61.	Sanders	2		
	Mechanical Drive Systems and Pumps			

62.	Pulley and belt systems (various sizes)	Assorted		
63.	Chain and sprocket systems	Assorted		
64.	Gearboxes (different types)	5		
65.	Electric motors (variety of sizes)	10		
66.	Pumps (centrifugal, diaphragm, gear)	5		
	Gas Welding and Cutting			
67.	Oxyacetylene welding kits (tanks, hoses, regulators, welding torch, cutting torch)	5 kits		
68.	Protective gloves	50		
69.	Welding goggles	50		
70.	Welding face shields	30		
71.	Welding aprons	20		
72.	Gas cylinders (oxygen and acetylene)	5 Sets		
73.	Welding rods	Assorted		
74	Fire extinguishers	2		
	Metal Arc Welding			
75.	Arc welding machines	5		
76.	Welding electrodes	Assorted		
77.	Welding jackets	20		
78.	Electrode holders	5		
79.	Ground clamps	5		
	Fitting Workshop Equipment			
80.	Table Drilling machines	8		
81	Drilling machines Pillar	4		
82.	Drilling machines Radial	4		
83	Cord hand drilling machines	10		
84	Cordless Hand Drilling m/cs	10		
85.	Surface table 1200 x 1200mm (4'x4')	1		

86.	Surface plates 500 x 500 mm (18”x18”)	5		
87.	Surface Gauge	10		
88.	Vanier Height Gauges	4		
89.	Vee Blocks 100 x 100 mm pairs	4		
90.	Vee Blocks 200mm	10		
91.	Parallel strips (pairs) 37 x 25x300	30		
92.	Flat scrapers	4		
93.	Half-round scrapers	15		
94.	Triangular scrapers	15		
95.	Stock and Dies	20		
96.	Metric sets 3mm–12mm	10		
97.	(BA) 150 sets 0-10	5		
98.	Sockets spanners 3-22mm	15		
99.	Open-ended 3-22 mm (spanner)	10		
100.	Pedestal Grinders	5		
101.	Reamers 3-25 mm	3 set		
102.	Machine Reamers 3.25mm	3		
103.	Dial Gauge	3		
104	Chisels Flat Round Diamond Cross cut	10 each “ “ ,, “		
105	Drills Straight shank 11/2 – 10mm Straight shank 6 – 15mm Tapered shank 3 –	5 each “ ” ”		

	22mm			
106	Drift	10		
107	Heat treatment furnace (medium size)	3		
108	Micrometer 0-25 25 – 50 50 – 75 75 – 100 100 – 125 125 – 150	3 3 3 3 3 3		
109	Protractors	10		
110	Bevel Square	3		
111	Combination sets	3		
112	Vanier	3		
113	Limit Gauge	2		
114	Plug gauges	2		
115	Slip gauges (set)	10		
116	Feeler 05 – 64	2		
117	Engineers squares 150mm	2		
118	Caliper	2		
119	Screw pitch gauges	2		
120	Blacksmith forge (gas)	2		
121	Blacksmith Tools	2 each		
122	Anvil, hammers, chisels fuller, shape	2 each		
123	Block, pinches, and drifts	2		
124	Tongues of different types	2 each		
125	Arbor press	2 each		
126	Extractors	2		
127	Snips (Tin sheet) 200mm	2		
128	Stud extractors	2		

129	Circlip plier (internal & external)	2		
130	Pipe wrench 250mm	2		
131	Pipe wrench 250mm	2		
132	Self-grip wrench of mole grip	1		
133	Pipe Bender	1		
134	Guillotine machine	5		
135	G. Clamp	5		
136	Tool maker clamp	5		
	Turning			
137	Centre lathe 150	5		
138	Large size lathe 250	5		
139	Three jaw chuck	5		
140	Four jaw chuck independent and self-centering	2 each		
141	Face plate	1		
142	Taper turning attachment	1 each		
143	Driving plate	2		
144	Driving dog	1		
145	Mandrel– one each of all sizes	"		
146	Capstan and Turret lathes	"		
147	Screwing machine	5 each		
148	**Instruments Measuring** Vernier caliper	"		
149				
150	Micrometers 0-25 25 - 50 **75** - 100	" " "		
151	Boring tools	"		
152	Adjustable mandrill	"		
153	Sleeves: 0 – 1	1 each		

	1 - 2 2 - 3 3 - 4 4 – 5			
154	Centre drills	"		
155	Drill – sizes – all sizes	"		
156	Reamers: Parallel shank of all sizes	1 each		
157	Taper reamers – one each of all sizes	,,		
158	Adjustable reamers	,,		
159	**Milling Cutters** Complete gauge of slab cutters	"		
160	Complete set of gearing cutters	"		
161	Assorted slitting saws	"		
162	Assorted side and face cutters	"		
163	Assorted end mills	"		
164	Assorted shell and mills	"		
165	Double angle cutters	"		
166	Single (60) left and right	"		
167	45° cutter (left and right)	"		
168	Complete range of form cutters (concave and convex)	"		
169	30° single cutters (left and right)	"		
170	Universal boring heads	"		
171	Slot drills	2 each		
172	Face mill	2 each		
173	**Milling Machines** Plain milling machine	,,		
174	Vertical milling machine	2 each		
175	Universal milling machine	"		

176	**Accessories** Dividing head	”		
177	Tail stock	”		
178	Indexing plate	”		
179	Collect chucks	”		
180	30mm dia. Arbors	”		
181	Rotary table	”		
182	Slotting attachment	”		
83	Can milling attachments	”		
184	Coolant pump	”		
185	Milling clamps	”		
186	Milling collars	”		
187	Universal vice	”		
188	Vertical attachment	2 each		
189	Medium parallel strips	2 each		
190	**Drilling Machines** Portable breast drill	“		
191	Sensitive drilling machine	“		
192	Pillar drilling machine	”		
193	Radial drilling machine	”		
194	Drilling machine vice	”		
195	Solid angle plate	”		
196	Adjustable angle plate	”		
197	Drills (1mm dis – 6mm dia.)	”		
198	Drills (6mm dia. – 12mm dia.)	”		
199	Taper shank drills (13mm) diameter-40mm diameter (in steps of 0.5mm)	”		
200	Taper sleeves of all sizes	”		
201	Machine reamer 6mm dia. to 25mm dia..	”		

202	Adjustable reamer	”		
203	Floating reamer	”		
204	Small vee block	2 each		
205	Large vee block	”		
206	Countersinking tool of different sizes	”		
207	Counter boring tools of different sizes	“		
208	Parallel strips: - Medium size	“		
209	Large size	“		
210	Jacob chuck	2 each		
211	Jacob chuck key	“		
212	Boring bar micrometer	”		
213	**Grinding Machine**			
214	Grinding wheels (variety of grits)	Assorted		
215	Protective goggles	30		
216	Surface grinder	5		

List of Development Participants

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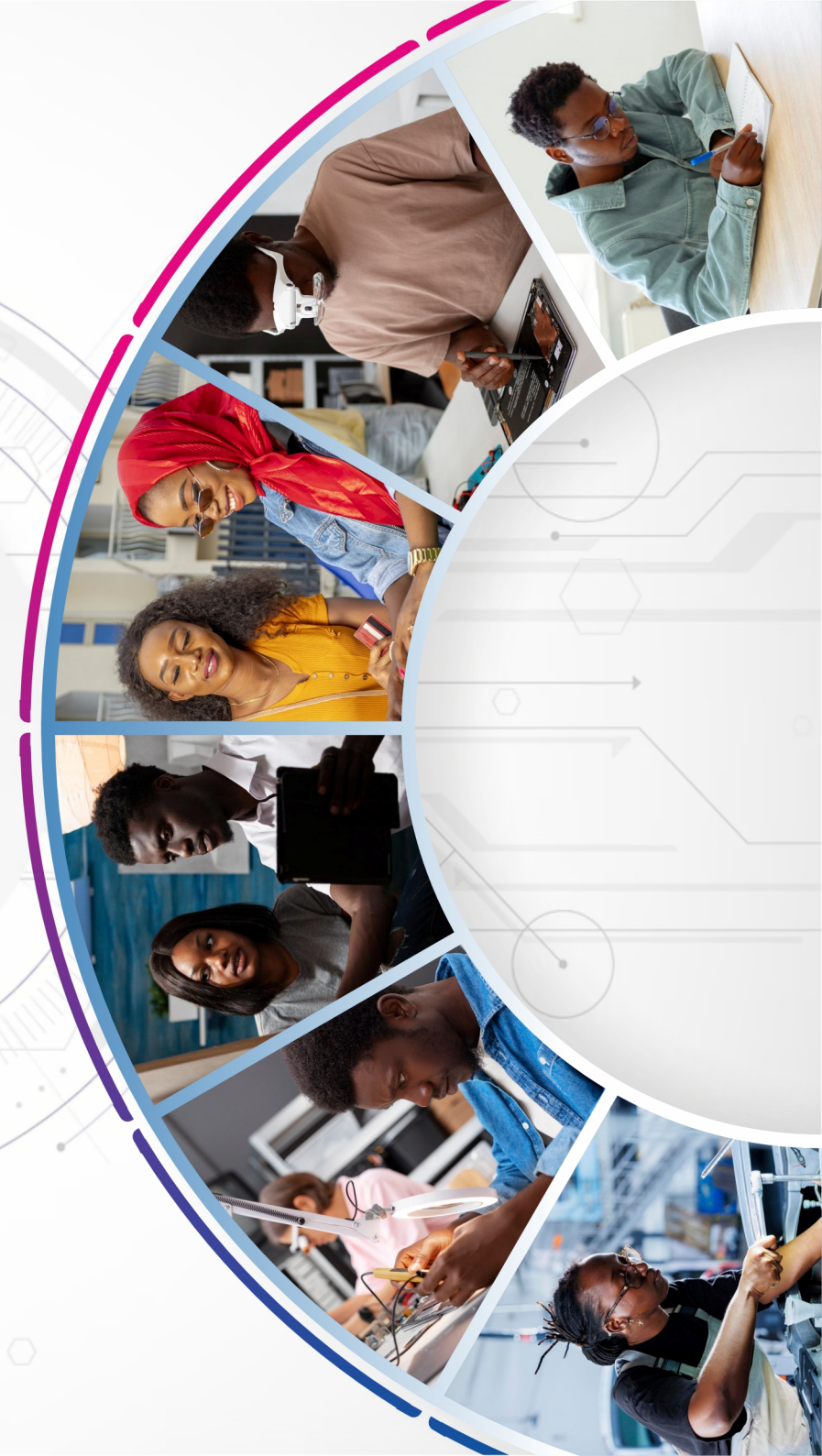

World Bank – National Board
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