



NATIONAL VOCATIONAL TRAINING INSTITUTE

TESTING DIVISION

TRADE TESTING REGULATIONS AND SYLLABUS

TRADE: CONSTRUCTION MACHINERY MECHANICS

LEVEL: CERTIFICATE ONE

CONSTRUCTION MACHINERY MECHANICS - CERTIFICATE ONE

A. INTRODUCTION

- i. The review of this syllabus has been generally influenced by the demands of industries due to its continuous change as a result of technological advancement and the changing needs of society. It was also influenced by the TVET reforms under the directions of the new educational reforms with the view to opening up further education and training opportunities to TVET graduates.

The certificate TWO syllabus is designed to respond to the following level descriptors:

QUALIFICATION	KNOWLEDGE LEVEL	SKILLS AND ATTITUDE:
Certificate II	<ol style="list-style-type: none">1. To demonstrate broad knowledge base with substantial depth in area(s) of study.2. To demonstrate a command of analytical interpretation of range of data.3. To present results of study accurately and reliably.	<ol style="list-style-type: none">1. Needs varied skills and competencies in different tasks under various contexts.2. Require a wide range of technical and supervisory skills.3. Would be employed in different contexts.

- ii. The rationale of this syllabus is to establish the level of knowledge and skills required by mechanics over a wide range of applications, including the development of an ability to diagnose faults, recommend means of rectifying these faults and to test and analyze the performance of the vehicle after repairs or modification has been completed.

B. GENERAL OBJECTIVES

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

- i) understand the Basic Mechanical operations essential for the repairs and maintenance of Construction Equipment
- ii) To give trainee a thorough knowledge of the Construction Machinery Equipment including their auxiliary systems emphasizing basic similarities and differences.

C. THE COURSE COMPONENTS

Trade Theory
Science and Calculation
Trade Drawing
General Paper
Trade Practical

EXAMINATION: The candidates would be examined in the FIVE components listed above.

Practical work must be carefully planned to illustrate application of the theory and to provide maximum opportunity for shop practice, laboratory work and demonstration.

D. KNOWLEDGE AND SKILLS REQUIREMENT

The prime objective of the programme is to provide the skills of the trade in a manner that will best meet the needs of the trade in Construction Machinery Equipment.

E. ENTRY TO THE COURSE

Minimum education : Must have passed JHS or SHS examination. Age – 16 years and above.
However, the selection of the students for the course is within the discretion of the head of the Institution

F. ELIGIBILITY FOR ENTRY TO EXAMINATION

Candidates may enter for examination only as internal candidate that is those who at the time of entry to the examination are undertaking (or have already completed the course at an approved establishment).

G. EXTERNAL EXAMINERS

The practical work of candidates will be assessed by an external examiner appointed by the Trade Testing Commissioner.

I. EXAMINATION RESULTS AND CERTIFICATES

Each candidate will receive record of performance given the grade of performance for the components Taken. These are:

- i) Distinction
- ii) Credit
- iii) Pass
- iv) Referred/Fail

Certificates would be issued to candidates who pass in all the components

NOTE

All Technical and Vocational trainees who aspire to take advantage of the opportunities opened to them in the educational reforms should NOTE that for a trainee to progress to certificate Two (2) a pass in Certificate one (1) is a requirement.

J. APPROVAL OF COURSE

Institutions or other establishments intending to prepare trainees for the Examination must apply to:

THE COMMISSIONER
TESTING DIVISION
NVTI HEAD OFFICE
P. O. BOX MB 21, ACCRA

K. ACKNOWLEDGEMENT

NVTI wishes to acknowledge the preparatory material done by the team of experts, which have been incorporated into this syllabus.

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Government's desire to improve the lot of Technical/Vocational Training, which led to the preparation of this syllabus, is hereby acknowledge.

CERTIFICATE ONE -TRADE THEORY

TASK		CRITICAL POINTS	SUB- POINTS	INSTRUCTIONAL TECHNIQUE
1.0	SAFETY PRECAUTION	1.1 Differentiate between the various types of safety precaution.	1.2 Types of safety in the workshop. <ul style="list-style-type: none"> • Personal safety • Workshop safety 	1.3 Discuss with the students on <ul style="list-style-type: none"> • Personal safety. • Workshop safety.
2.0	TOOLS AND EQUIPMENTS	2.1 Tools and Equipments in the workshop.	2.2 Uses of: <ul style="list-style-type: none"> • Hand tools. • Cutting tools. • Striking tools • Care and maintenance 	2.3 Discuss/Demonstrate the importance, uses, care and maintenance (real object)
3.0	TESTING MEASURING INSTRUMENT AND GAUGES	3.1 Types of measuring devices and gauges <ul style="list-style-type: none"> • Rule, Micrometer Venier Caliper. 3.2 Gauges; <ul style="list-style-type: none"> • Dial Gauge, Go-no-go gauge, compression gauge, Tyre pressure gauge. 	3.2 Measuring instruments <ol style="list-style-type: none"> i. Feeler Gauge ii. Micrometer iii. Venier Caliper iv. Steel rule v. Tyre pressure gauge, etc. 	3.3 Discuss with students the use of the following measuring and testing instruments.
4.0	STARTING, MOVING AND STOPPING OF EQUIPMENT	4.1 Pre-start check, Inspection and emergency shut down of equipment.	4.2 Procedures of shutting down equipments and pre-start checks.	4.3 Demonstrate the procedure of shutting down equipment and pre-starts check
5.0	LOCKING DEVICES	5.1 Thread types and sizes (B.S.F., B.A., U.N.F., U.N.C.) Nuts, Bolt wing nut, etc. 5.2 Lock Devices. Locking plate, self locknut, locking wires. 5.3 Sealants. Gasket, Sealing Compound	5.2 Various types of thread types and sizes. Locking devices and sealants.	5.3 Discussion with students the various types of locking devices.

CERTIFICATE ONE TRADE THEORY

TASK		CRITICAL POINTS	SUB- POINTS	INSTRUCTIONAL TECHNIQUE
6.0	MATERIALS	6.1 .1 Definition of materials <ul style="list-style-type: none"> • Ferrous metals • Non ferrous metals 6.1.2 Strength of materials <ul style="list-style-type: none"> • Ductility • Me liability • Brittleness • Plasticity, etc 	6.2 The definition and various types of materials	6.3 Discuss with students the properties of materials, Laboratory test to determine properties of materials
7.0	BASIC METAL WORK	7.1 Processes <ul style="list-style-type: none"> • Filling • Sawing • Drilling • Marking out, etc 	7.2 Understanding the following terms: <ul style="list-style-type: none"> • File classification • Sawing blade TPI • Drilling Drill bit sizes • Marking out, etc 	7.3 <ul style="list-style-type: none"> • Guide trainees to identify tools with real objects. Demonstrate its uses • Marking out, etc
8.0	ENGINES	8.1 Two stroke cycle (C.I.)	8.2 Operating - Principles of Two stroke cycle Diesel Engine (C.I.)	8.3 Discuss the operating principle of Two stroke cycle Diesel Engine.
9.0	ENGINES	9.1 Four Stroke Cycle Diesel (C.I.).	9.2 Operating Principles of Four Stroke Cycle Diesel Engine (C.I.)	9.3 Discuss the operating principle of Four Stroke cycle Diesel Engine.
10.0	ENGINE COMPONENTS	10.1 Main parts of Engine Components and Auxiliary.	10.2 Functions of Engine Components eg. <ul style="list-style-type: none"> • Piston • Crankshaft • Cylinder Block • Cylinder Head, etc 	1.3 Discuss/identification with the students the functions of the following <ul style="list-style-type: none"> • Piston • Crankshaft • Cylinder Block • Cylinder Head, etc

CERTIFICATE ONE TRADE THEORY

TASK		CRITICAL POINTS	SUB- POINTS	INSTRUCTIONAL TECHNIQUE
11.0	ENGINE TYPES	11.1 Multi Cylinder <ul style="list-style-type: none"> • In-Line • Vee-Shape or Twin • Flat or Vertical Oppose. 	11.2 Differentiate between Engine Types <ul style="list-style-type: none"> • In-Line • Vee-Shape or Twin • Flat or Vertical Oppose. 	11.3 Discuss with students the difference between the types of Engines; <ul style="list-style-type: none"> • In-Line • Vee-Shape or Twin • Flat or Vertical Oppose.
12.0	ENGINE FIRING ORDERS	12.1 Four and Six Cylinder Engine.	12.2 The firing order of Four and Six cylinder Engine.	12.3 Explain the firing orders of Four and Six Cylinder Engine
13.0	CYLINDER BORE	13.1 The Bore, Stroke, clearance volume, Swept volume, Engine Capacity	13.2 Define the terms listed in 13.1	13.3 Explain the meaning of the following terms in the critical points.
14.0	COMBUSTION CHAMBER DESIGN	14.1 Types of Combustion Chamber design.	14.2 Types of combustion chamber and its design.	14.3 Explain the types of combustion chamber design and its effects.
15.0	CYLINDER BLOCK	15.1 Types of Cylinder Block <ol style="list-style-type: none"> a) Integral construction b) Separate construction 	15.2 The Construction of the cylinder block; <ol style="list-style-type: none"> a) Integral construction b) Separate construction 	15.3 Discuss with students the difference in construction of cylinder block construction.
16.0	CYLINDER LINER	16.1 Types of Cylinder Liners <ol style="list-style-type: none"> a) Dry Liner b) Wet Liner 	16.2 Advantages and disadvantages of: <ol style="list-style-type: none"> a) Dry Liner b) Wet Liner 	1.6 Discuss with the students the difference in construction of <ol style="list-style-type: none"> a) Dry Liner b) Wet Liner
17.0	CYLINDER HEADS	17.1 Types of Cylinder Heads and its <ul style="list-style-type: none"> • Advantages • disadvantages 	17.2 The types of cylinder heads including their advantages and disadvantages.	17.3 Discuss with students the difference in construction of Cylinder Heads.
18.0	PISTON AND PISTON PIN	18.1. Types of Pistons, Advantages and Disadvantages. 18.12 Types of Piston Pin.	18.2 The types of Piston, Construction including Piston pin <ul style="list-style-type: none"> • Advantages • Disadvantages 	18.3 Discuss with students function of Pistons, Construction. Advantages and disadvantages.

CERTIFICATE ONE TRADE THEORY

TASK		CRITICAL POINTS	SUB- POINTS	INSTRUCTIONAL TECHNIQUE
19.0	PISTON RINGS	19.1 Types of Piston Rings.	19.2 The functions and the types of Piston rings.	19.3 Discuss the functions of Piston ring with students and their types.
20.0	CONNECTING ROD	20.1 Purpose of the Connecting Rod.	20.2 The function of the Connecting Rod, Material used.	20.3 Discuss the function of Connecting rod and the material used.
21.0	ENGINE BEARINGS	21.1. The purpose of Engine bearing. 21.2 the material use.	21.2 The purpose, types and material used for Engine bearing.	21.3 Explain the purpose, material used and types of Engine bearing.
22.0	CRANKSHAFT	22.1 The Purpose of the Engine Crank Shaft. 22.2 The material use.	22.2 The Purpose of the Crankshaft and its constructional features.	22.3 Explain the Constructional features of the Crank shaft
23.0	CAMSHAFT	23.1 The purpose of the Cam shaft. 23.2 The material used.	23.2 The purpose of the Cam shaft and its constructional features.	23.3 Explain the Constructional features of the Cam shaft
24.0	VALVE GUIDE	24.1 The purpose of the valve. Valve Guide	24.2 The function of valve, types and material use. 24.2. The function of the valve guide, types and constructional features	24.3 Explain the Constructional features of valve, valve guide.
25.0	TIMING GEARS	25.1 The purpose of the Timing Gear, Types and Material use.	25.2 The purpose of the Timing Gear and Constructional features.	25.3 Explain the purpose and the Constructional features of the Timing Gear.
26.0	GASKET	26.1 The purpose of the Cylinder head gasket and the material used.	26.2 The purpose of the cylinder head Gasket and Constructional features.	26.3 Explain the purpose and the Constructional features of Cylinder head gasket.
27.0	FLY WHEEL	27.1 The purpose of the Fly Wheel and the material use for its Construction.	27.2 The purpose of the Fly Wheel and its Constructional features.	27.3 Discuss with students the purpose of Fly Wheel and its Constructional features.

CERTIFICATE ONE TRADE THEORY

TASK		CRITICAL POINTS	SUB- POINTS	INSTRUCTIONAL TECHNIQUE
28.0	VIBRATION DAMPER BALANCERS	28.1 The purpose of the Vibration Damper and balancers.	28.2 The purpose of the vibration damper and its Constructional features.	28.3 Discuss with students the purpose of vibration damper and its Constructional features
29.0	CRANK CASE VENTILATION	29.1 Operation of the Crankcase ventilation system.	29.2 The purpose and the types of Crankcase Ventilation System.	29.3 Explain to students the purpose of the Crankcase ventilation system and its constructional features.
30.0	COOLING SYSTEM	30.1 Types of Cooling Systems <ul style="list-style-type: none"> • Air Cooling • Liquid Cooling 	30.2 The purpose and types of Cooling System.	30.3 Discuss with students the functions of Cooling System.
31.0	AIR COOLING SYSTEM	31.1 Main components in the Air Cooling System	31.2 The purpose of the Air Cooling System and the Constructional features.	31.3 Explain the purpose of the Air Cooling System and its Constructional features.
32.0	LIQUID COOLING SYSTEM	32.1 Main components in the Liquid Cooling System	32.2 The purpose of the Liquid Cooling System and the Constructional features.	32.3 Explain the purpose of the Liquid Cooling System and its Constructional features.
33.0	LUBRICANT	33.1 Classification of Lubricant (S.A.E. and A.P.I.)	33.2 The viscosity number and viscosity index.	33.3 Discuss with students viscosity of an oil and viscosity index.
34.0	LUBRICATION SYSTEM	34.1 The purpose and types of lubrication system	34.2 The main components of the lubrication system.	34.3 Discus with student the purpose and the main component of the lubrication system.
35.0	INDUCTION SYSTEM	35.1 The purpose and types of induction system.	35.2 The types, operation and identification of components.	35.3 Discuss with student the constructional detail of the induction system.
36.0	FUEL SYSTEM	36.1 Spark ignition engine and compression ignition engine.	36.2 The purpose of the diesel system.	36.3 Discuss with student the purpose and identification of the Fuel system.

CERTIFICATE ONE TRADE THEORY

TASK		CRITICAL POINTS	SUB- POINTS	INSTRUCTIONAL TECHNIQUE
37.0	FUEL SYSTEM FILTRATION	37.1 The importance of Filtration and lubrication in the fuel system.	37.2 The Layout and the main components of the fuel system.	37.3 Discuss with students the Lay out and Component parts of the fuel system.
38.0	OXY-ACETYLENE	38.1 Types of oxy-Acetylene welding	38.2 The procedure and the precaution of oxy-Acetylene welding.	38.3 Demonstrate with students the procedure of oxy-Acetylene welding flames
39.0	CLUTCH	39.1 Types of Clutches	39.2 The difference between frictional and Hydraulic Clutches.	39.3 Describe the constructional feature of Frictional and Hydraulic Clutches.
40.0	GEAR BOX	40.1 Types of Gear Box <ul style="list-style-type: none"> • Manual Gear Box • Automatic Gear Box 	40.2 The types and operation of a manual transmission; <ul style="list-style-type: none"> • Sliding Mesh • Constant Mesh • Synchromesh 	40.3 With the aid of diagram describe the following; <ul style="list-style-type: none"> • Sliding Mesh • Constant Mesh • Synchromesh
41.1	SELECTOR FORK INTER LOCK MECHANISM	41.1 The Selector Fork and the Inter lock mechanism.	41.2 <u>Operation</u> <ul style="list-style-type: none"> • Selector fork • Inter lock mechanism • Remote control 	41.3 Discuss with students the constructional features of Manual Gear Box with the aid of sketches.
42.0	HYDRAULIC SYSTEM	42.1 Terms in Hydraulic System. List the advantages in hydraulic system.	42.2 The basic principles of the hydraulic system.	42.3 Discuss with students the main functions of components in the hydraulic system.
43.0	BRAKING SYSTEM	43.1 Lay out of the Braking System	43.2 The purpose and operation of the Braking System.	43.3 Describe the principles of operation of the Braking system.

CERTIFICATE ONE TRADE THEORY

TASK		CRITICAL POINTS	SUB- POINTS	INSTRUCTIONAL TECHNIQUE
44.0	BATTERY	44.1 Purpose of the Battery	44.2 The Component parts of the Battery.	44.3 Discuss with students the constructional features of the Battery
45.0	STARTING SYSTEM	45.1 Functions and Operation of the Starting System.	45.2 Lay out and purpose of the main components of the starting system.	45.3 Discuss the purpose, layout of the Starting System.
46.0	CHARGING SYSTEM	46.1 Functions and operation of the Charging System	46.2 General principles of A.C and D.C. generators	46.3 Discuss the principles of operation of A.C. and D. C. generators
47.0	UNDER CARRIAGE	47.1 General description of under carriage.	47.2 The reason for Track Alignment.	47.3 Demonstrate to students how to carry out Track Alignment.
48.0	POWER TAKE-OFF (P.T.O.)	48.1 Purpose and operation of Power Take off (P.T.O)	48.2 Testing and Adjusting Power Take off (P. T. O.)	48.3 Describe the principles of operation of Power Take off (P.T.O)
49.0	WINCHES AND CABLE CONTROL	49.1 Principles and operation mechanical and hydraulics winches.	49.2 The constructional features of Mechanical Winch and hydraulic winch.	49.3 Discuss with student the basic principles and operation of a mechanical and hydraulic winch.
50.0	BASIC ELECTRONICS	50.1 Functions of electronics components in the heavy duty equipments	50.2 Basic electronics components in the Heavy duty equipments.	50.3 Discuss with student the Basic principle and functions of electronic components in the Heavy duty mechanics

CERTIFICATE ONE - TRADE SCIENCE AND CALCULATIONS

TASK	CRITICAL POINT	SUB - POINT	INSTRUCTIONAL TECHNIQUE
1.0 HEAT AND TEMPERATURE	1.1 Conduction, Convection and radiation. Thermal expansion, linear, superficial and cubical expansion, heat capacity and coefficient of linear expansion.	1.2 Measuring temperature, freezing and boil point of water and expansion and contraction of solids, liquids and gasses.	1.3 Guide students to solve simple problems related to the motor vehicle.
2.0 HEAT TREATMENT OF METALS	2.1 Annealing, normalizing, hardening, tempering. Properties of materials: elasticity, ductility, toughness, hardness and brittleness.	2.2 Classification of various metals	2.3 Demonstrate with the students the various heat treatments in the laboratory workshop.
3.0 STRESS AND STRAIN	3.1 Definition of Stress, Strain, Tensile, compressive and shear stress. Hooke's law, Young modulus in relation to the stiffness of material.	3.2 Problems involving direct stress and strain. Make a load extension graph for mild steel	3.3 Guide students to solve simple problems involving stress and strain. Demonstrate at laboratory stress and strain
4.0 ENERGY	4.1 Definition of energy, types, examples: potential, kinetic and chemical.		4.3 Explain/Guide students to calculate simple problems on energy relating to motor vehicle. Eg. Kinetic, potential and chemical
5.0 WORK	5.1 Definition of work (as a form of energy). Work done in linear motion and work done in angular motion.	5.2 Simple calculations relating to motor vehicle.	5.3 Assist student to calculate simple problems on work done relating to motor vehicle.

TASK	CRITICAL POINT	SUB - POINT	INSTRUCTIONAL TECHNIQUE
6.0. COMBUSTION AND FUELS	6.1 Definition and explanation of combustion in petrol and diesel engine composition of petrol. Composition of diesel air/fuel ratio. Properties of fuel.	6.2 Definition of calorific value, volatility, flash point, octane rating, cetane rating, ignition quality.	6.3 Guide students to know about combustion fuel with the aid of sketches or charts.
7.0 POWER	7.1 Definition of Power as a rate of doing work	7.2 Power Unit	7.3 Assist students to know about engine power. Simple calculation relating to engine power.
8.0 MOMENTS	8.1 Definition of moments. <ul style="list-style-type: none"> • Principle of moment • Centre of gravity • Torque 	8.2 Classes of levers.	8.3 Guide students to solve calculations on moment and torque relating to motor vehicle.
9.0 COMPRESSION RATIO	9.1 Definition of swept volume, clearance volume, stroke, bore, TDC, BDC and Compression ratio.	9.2 Causes and effects of Detonation, Pre-ignition, Running-on and Diesel Knock.	9.3 Assist students to solve simple calculations on compression ratio.
10.0 DENSITY	10.1 Definition of density and relative density	10.2 Simple calculations on density and relative density	10.3 Guide students to calculate simple problems on density and relative density.
11.0 THERMOMETERS	11.1 Four types of thermometers ; liquid in-glass, bimetallic gas thermometer and pyrometers.	11.2 The working principles of four types of thermometers	11.3 Assist students to identify and sketch thermometers.
12.0 PRINCIPLES OF ELECTRICITY (DRY AND WET CELL)	12.1 DC and AC current, Ohm's law	12.2 Advantages and disadvantages	12.3 Assist students to identify and sketch know principles of Electricity and solve simple problems in series and parallel circuits.

TASK	CRITICAL POINT	SUB- POINT	INSTRUCTIONAL TECHNIQUE
13.0 MACHINES	<p>13.1 Machine as a device for changing the magnitude and line of action of a force.</p> <p>Determination of overall gear ratio of a simple machine.</p>	13.2 Force ratio, movement ratio and efficiency of a simple machine system.	13.3 Guide students to know about simple machine and solve problems relating to motor vehicle.
14.0 FRICTION	14.1 The conditions under which friction takes place. E.g. Boundary and Dry friction	<p>14.2 Kinetic and static friction. Advantages and Disadvantages of friction with special reference to motor vehicle.</p> <p>The Co-efficient of friction.</p>	14.3 Assist students to know friction in relation to motor vehicle.

TRADE DRAWING CERTIFICATE ONE

TASK	CRITICAL POINT	SUB- POINT	INSTRUCTIONAL TECHNIQUE
1.1 INTRODUCTION TO DRAWING	1.2 Types of lines, construction and lettering.	1.2 Firm lines, border lines, centre lines etc.	1.3 Assist students to construct lines,
2.0 INTERPRETATION OF SIMPLE SKETCH OF SOLIDS.	2.1 The purpose: Diagrams, sketches and Drawing.	2.2 Diagrams to illustrate various components.	3.2 Guide students to use lines and simple sketches of solids.
3.0 GEOMETRICAL CONSTRUCTION	3.1 Triangles, Squares, Rectangles, Ellipse, Circles and its parts, prisms and frustum of cones	3.2 Tools Compass, protractor, ruler, divider to construct triangles, squares, rectangles, ellipse, circles and its parts, prisms and frustum of cones	3.3 Assist students to construct Geometrical drawings.
4.0 ORTHOGRAPHIC PROJECTION	4.1 Sketching and drawing of simple component in orthographic projection (first and third angle with dimensions).	4.2 Drawing of the three views e.g. Front, end and plan.	4.3 Assist students to draw the orthographic projection.
5.0 DRAWING OF POLYGONS	5.1 Pentagon, hexagon, heptagon, octagon, etc. Using the division of lines and the general method.	5.2 Drawing of bolts with a given specification. Assignment	5.3 Help student to construct the various polygons by using the division of lines or general method.
6.0 TOLERANCE	6.1 Introduction to limits, fit and tolerance. Dimensioning of sketches and drawing.	6.2 Indicating the upper limit and the lower limit	6.3 Assist students to draw tolerance.

TASK	CRITICAL POINT	SUB- POINT	INSTRUCTIONAL TECHNIQUE
7.0 EXPLODED AND SECTIONAL VIEWS	7.1 Exploded and sectional view of components and assemblies.	7.2 Basic ideas in assembling various components	7.3 Assist students in assembling various automotive components.
8.0 DRAWING OF ELECTRICAL COMPONENTS. 9.0. FREE HAND SKETCH	8.1 Conventional representation of battery, earth connection, contact breaker points, fuse, resistor, capacitor, winding, lamp switch. 9.1. Coil ignition system, valve timing diagram, mechanical fuel pump, water pump, petrol injection systems, line diagram of lubrication system, oil pump, oil filter (By-pass and full flow) spark plugs, rear axle construction, hub construction, straight tooth gear, helical gear, line diagram of propeller shaft, universal joint, crown wheel and pinion assembly, drum and disc brake assembly, master cylinder, engine, gear box rear axle, braking steering and suspension, types of steering gear boxes, types of tyre design	8.2 Symbols of various electrical components 9.2. Simple components in first and third angle projections	8.3 Guide students to draw various electrical components. 9.3. Assist students to sketch simple components in first and third angle projections.

CERTIFICATE ONE - PRACTICALS

TASK		CRITICAL SKILLS	SUB-SKILLS	INSTRUCTIONAL TECHNIQUE
1.0	SAFETY	1.1 Types of safety in workshop.	1.2 Types of Safety in the workshop. a) Good Ventilation i) Proper Storage of Inflammable materials. ii) Cleanness of shop. iii) Proper use of protective clothing iv) Use of Rigid support for raised vehicles e.g. (Axlestand), etc. Safety rule relating to Construction Machines e.g. Working attachments, Radiator pressure cup.	1.3 Discuss with the students the following: i) Importance of safety in the workshop. ii) Effect of non-adherent to safety practices. 1.3.2 Differentiate between personal and workshop safety.
2.0	TOOLS AND EQUIPMENTS	2.1 The correct tools and equipment for a given operation.	2.2 a) <u>Hand Tools</u> i. Torque Wrench ii. File iii. Chisel iv. Hammer b) Valve Spring Compressor. c) Spanners (Assorted) d) Special purpose Equipments. i) Vacuum Gauges ii) Pressure Test Gauge iii) Impact wrenches iv) Dial Gauges	2.3 Demonstrate to students how to use Hand Tools. Discuss how the Measuring Instrument and any other equipment listed are used in the Heavy Duty Industry.

CERTIFICATE ONE - PRACTICALS

TASK		CRITICAL SKILLS	SUB-SKILLS	INSTRUCTIONAL TECHNIQUE
2.0	TOOLS AND EQUIPMENTS		v) Coolant Gauge vi) Temperature Gauge e) Other Workshop Equipments. i. Hydraulic Press ii. Drilling Machine iii. Air Compressor iv. Bench Vice v. Grinding Machine vi. Trolley Jacks vii. Mobile Cranes f) Steam cleaning	
3.0	MEASURING AND TESTING INSTRUMENTS	3.1. Types of measuring devices i. Vanier caliper ii. Inside and Outside micrometer including digital micrometer iii. Dial indicator gauge iv. Compressor gauge v. Vacuum gauge vi. Torque wrench	3.2.1. Using measuring and Testing Instrument to measure: a) Vanier caliper to measure depth and diameters 3.2.2. Outside and Inside diameter for measuring. Inside and Outside bore diameters 3.2.3 Compression gauge for measuring cylinder compression. Vacuum gauge for measuring inlet manifold vacuums. Torque wrench for measuring torque of bolts.	3.3. Guide students to use correct measuring instruments with demonstration

CERTIFICATE ONE - PRACTICALS

TASK		CRITICAL SKILLS	SUB-SKILLS	INSTRUCTIONAL TECHNIQUE
4.0	MATERIALS	4.1 Properties of Materials 4.1.1 Identification of materials e.g. a) Grinding Test b) Harding Test c) Ferrous d) Non-ferrous	4.2 Testing of materials a) Grinding Test b) Harding Test	4.3 Guide students to identify and select suitable materials for the Part Construction 4.3.1 Guide students to conduct the following Test: a) Grinding test b) Harding test
5.0	FASTENING DEVICES	5.1 The various locking devices	5.2 Types of locking devices. Uses of locking devices	5.3 Guide students to select the correct locking device for a particular job
6.0	CUTTING TOOLS	6.1 The various types of Cutting Tools and their uses. a) Drills, Files, Hacksaw, Scraper, Reamers etc.	6.2 Use of the various cutting tools with zero injury	6.3 Guide student to handle and use the various types of cutting tools.
7.0	WELDING (ARC AND GAS)	7.1.1 Types of welding. 7.1.2 Welding difference types of metals.	7.2 Welding torch and various types of electrodes for Arc Welding and procedure. 7.2.1 Process of cutting with the Arc and using the torch.	7.3.1 Guide students to use the torch correctly for welding. 7.3.2 Guide students to identify the various types of welding electrodes.
8.0	DISMANTLING OF AN ENGINE. CLEANING AND INSPECTION OF COMPONENT	8.1 Dismantling correct procedure. 8.1.1 Cleaning Component Parts using correct solvent.	8.2.1 Safety rules when dismantling. 8.2.2 Inspection of the various parts for any mechanical failure for corrective action.	8.3.1 Guide students to dismantle an Engine. 8.3.2 Guide students to clean, inspect mechanical parts for failure.
8.0	ASSEMBLING OF AN ENGINE	8.1.2 Assembly Engine using correct procedure	8.2.3 Torque wrench safety rules in tightening various bolts and nuts of the Engine	8.3.3 Guide students to assembly engine using Torque Wrench as a measuring tools.

CERTIFICATE ONE - PRACTICALS

TASK		CRITICAL SKILLS	SUB-SKILLS	INSTRUCTIONAL TECHNIQUE
9.0	DISMANTLING, ASSEMBLING OF TRACKS	9.1 Tracks Dismantling The Correct procedure and observing safety rules	9.2 Correct tools and equipment. Dismantle track links and shoes. Observe link and track shoe wear	9.3.0 Guide students to clean, inspect part for mechanical failure. 9.3.1 Guide students to dismantle tracks
10.0	GENERAL HYDRAULIC SYSTEM SERVICING	10.1 Dismantling hydraulic filter and draining hydraulic reservoirs	10.2 Correct tools and equipments. Dismantling filters of hydraulic system.	10.3 Guide student to carry out servicing of the hydraulic system
11.0	MEASURING WEAR ON TYPES OF ROLLERS ON TRACK MACHINE	11.1 Outside Caliper to measure wear on track rollers	11.2 Correct measuring tools e.g. Outside Caliper to measure wear on track roller.	11.3 Guide students to use correct tools to measure wear on track rollers.
12.0	MEASURING WEAR ON TYPES ON TRACK PIN	12.1 Outside caliper and micrometer to measure wear on track pins	12.2 Correct measuring tool Outside Caliper and micrometer for wear of track pins	12.3 Guide students on how to use correct tools like outside caliper and micrometer to measure wear on track pin.
13.0	TRACK FRAME ALIGNMENT	13.1 Steel rule and track gauge to measure, check Track frame alignment of a Track machine	13.2 Correct tools to check track frame Alignment of a track frame Machine.	13.3 Guide students on how to use correct tools, check track alignment. Demonstration
14.0	CHECKING CRACKS, BENDS AND BROKEN BOLTS IN TRACK FRAME OF TRACK MACHINES	14.1 The correct tools and crack detergents, check twist bends and remove broken bolt in Track frame.	14.2 The correct tools, checking, removing broken bolt in track frame	14.3 Guide student on how to use crack detectors and student to remove broken bolt in track frames

CERTIFICATE ONE - PRACTICALS

TASK		CRITICAL SKILLS	SUB-SKILLS	INSTRUCTIONAL TECHNIQUE
15.0	WHEEL MACHINES BRAKES	15.1.1 Dismantling Disc Brake at Front Wheels. 15.1.2 Dismantling Drum Brake at rear wheels.	15.2 Remove Brake Pads, Inspect, wear, and cracks on Disc. 15.2.1 Removal of drum, brakes, inspection of the shoes for wear and bell in drum. 15.2.2 Reassembling pads and shoe and brake bleeding. 15.2.3 Checking for leakage after brake bleeding of the system.	15.3 Guide students to carry out the following task. 15.2, 15.2.1, 15.2.2, 15.2.3
16.0	REVOLVING SHOVEL	16.1 Inspection: <ul style="list-style-type: none"> • Cracks on Boom • Worn out shelves and cables • Clamps 	16.2 Inspection of wear Replace worn out parts. (shelves Clamps).	16.3 Guide students to carry out the following task welding cracks, replacing worn out shelves and clamps
17.0	WORKING ATTACHMENT	17.1 Blade 17.1.1 Rippers.	17.2 Inspection for wear and replacement of blade. 17.2.1 Replacement of Rippers	17.3 Guide students in inspection wear and replacement

**LEVEL – CERTIFICATE ONE – TEST SPECIFICATION TABLE
TRADE THEORY**

NO	TOPIC	COGNITIVE KNOWLEDGE		AFFECTIVE UNDERSTANDING		PSYCHOMOTOR APPLICATION		TOTAL
		OBJ	SUB.	OBJ.	SUB.	OBJ.	SUB.	
1.	Safety Precaution	3	2	-	-			
2.	Tools and Equipment	2	1	1	1			
3.	Measuring Instrument and Gauges	2	1	-	-			
4.	Starting, moving and stopping equipments	3	1	1	1			
5.	Locking devices	2	1	-	-			
6.	Materials	2	1	1	1			
7.	Basic metal works	3	2	1	1			
8.	Engine two Stroke C.I.	3	1	1	1			
9.	Engines four stroke C.I.	3	1	1	1			
10.	Engine components	3	1	2	1			
11.	Engine types	2	1	2	-			
12.	Engine firing order	2	1	-	-			
13.	Cylinder bore	2	1	-	-			
14.	Combustion chamber design	3	1	1	1			
15.	Cylinder block	2	1	1	1			
16.	Cylinder liner	2	1	-	-			
17.	Cylinder heads	2	1	2	1			
18.	Piston and piston pin	3	2	-	-			
19.	Piston rings	3	1	1	-			
20.	Connecting rod	2	1	-	-			
21.	Engine bearing	2	1	-	-			
22.	Crankshaft	3	2	2	1			
23.	Camshaft	3	2	2	1			
24.	Valve guide	2	1	1	1			

**LEVEL – CERTIFICATE ONE – TEST SPECIFICATION TABLE
TRADE THEORY**

NO	TOPIC	COGNITIVE KNOWLEDGE		AFFECTIVE UNDERSTANDING		PSYCHOMOTOR APPLICATION		TOTAL
		OBJ.	SUB.	OBJ.	SUB.	OBJ.	SUB.	
25.	Timing gears	2	1	1	1			
26.	Gasket	1	1					
27.	Flywheel	2	1					
28.	Vibration damper	2	1	1	1			
29.	Crankcase ventilation	3	1					
30.	Cooling system	2	1	2	1			
31.	Aircooling	2	1	2	1			
32.	Liquid cooling	2	1	2	1			
33.	Lubricant	1	1	1	1			
34.	Lubrication system	2	1					
35.	Induction system	2	1					
36.	Fuel system	2	1	1	1			
37.	Fuel system filtration	2	1					
38.	Ox y-acetylene welding	2	1					
39.	Clutch	1	1					
40.	Gear box	2	1					
41.	Selector fork interlock mechanism	2	1					
42.	Hydraulic system	3	2	2				
43.	Braking system	1	1	1				
44.	Battery	1	1					
45.	Starting system	2	1					
46.	Charging system	2	1					
47.	Under carriage	2	1	1	1			
48.	Power table off P.T.O.	1	1	1	1			
49.	Winches and cable control	3	1					
50.	Basic electronic	2	1					

**LEVEL – CERTIFICATE ONE – TEST SPECIFICATION TABLE
PRACTICALS**

NO	TOPIC	COGNITIVE KNOWLEDGE	AFFECTIVE UNDERSTANDING	PSYCHOMOTOR APPLICATION	TOTAL
1.	Safety	2		2	
2.	Tools and equipment			1	
3.	Measurement		2		
4.	Test instrument	2			
5.	Materials			3	
6.	Welding (Gas/Arc)			1	
7.	Engine Dismantling		3		
8.	Engine Assembling			3	
9.	Track Dismantling			2	
10.	Hydraulic System Servicing			2	
11.	Wear Measurement on track pins			3	
12.	Tract frame alignment			2	
13.	Checking cracks and bends on track frames			2	
14.	Wheel machine brakes			2	
15.	Revolving shovel			3	
16.	Fastening devices	1	1	1	
17.	Cutting tools	2		3	

**LEVEL – CERTIFICATE ONE – TEST SPECIFICATION TABLE
TRADE SCIENCE AND CALCULATIONS**

NO	TOPIC	COGNITIVE KNOWLEDGE	AFFECTIVE UNDERSTANDING	PSYCHOMOTOR APPLICATION	TOTAL
1.	Heat and Temperature	2	1		
2.	Heat treatment of metals	2	1		
3.	Stress and strain	2	2	1	
4.	Energy	2	2	1	
5.	Work	2	2	1	
6.	Combustion and fuels	2	2		
7.	Power	2	2	1	
8.	Moment	2	2	1	
9.	Compression ratio	2	2	2	
10.	Thermostats				
11.	Principles of electricity				
12.	Machines				
13.	Density				
14.	Friction				

**LEVEL – CERTIFICATE ONE – TEST SPECIFICATION TABLE
TRADE DRAWING**

NO	TOPIC	COGNITIVE KNOWLEDGE	AFFECTIVE UNDERSTANDING	PSYCHOMOTOR APPLICATION	TOTAL
1.	Introduction to drawing	2	1		
2.	Simple sketch of solids	2	1		
3.	Geometrical construction	2	1	2	
4.	Orthographic projection	2	1	2	
5.	Polygons	2	1	2	
6.	Tolerance	2	1		
7.	Sectional views	2	2	2	
8.	Drawing of electrical components	2	1	2	
9.	Freehand sketch	2		3	