

Curriculum For “Digging Operation/Technology” (Assistant Digger Operator) (Level -2)



25th to 29th October 2021



**National Vocational & Technical
Training Commission**

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Introduction

Definition/ Description of the Training Programme for *Digging Operation* /Technology

There is an increasing demand of the Digging Operation Supervisor in civil construction or mining industry. If an individual is planning to pursue a career in Digging or Excavation, this program will be helpful in targeting various industries including civil construction or mining, etc.

Purpose of the Training Programme

The purpose of this training is to develop a range of skills and techniques, personal skills and attributes essential for successful performance in civil construction or mining sector in accordance with industry requirements. Graduates of this program may find employment in local and international industries.

Overall Objectives of Training Programme

The main objective of this training program is to improve the employability of young graduates through qualifying job-related training in the Digging/Excavation sector, and to train them so that they can prove to be an asset to this sector.

Competencies to be gained after Completion of Course

- **A-** Maintain Personal Health, hygiene and safety
- **B-** Perform basic communication skills
- **C-** Operate Computer Functions (General)
- **D-** Demonstrate Basic Numeracy skills
- **E-** Identify Electrical Circuits and Measurements
- **F-** Perform Battery Service of Vehicle
- **G-** Maintain Diesel Engine Systems
- **H-** Carryout General Maintenance
- **I-** Perform Basic Technical Drawing

Possible available job opportunities available immediately and later in the future

- Junior Assistant Mechanic
- Tracer
- Semi-skilled Worker (Mechanic)

Trainee Entry Level

Middle or Equivalent (with English, Urdu and Numeracy reading and writing skills)

Minimum Qualification of Trainer

Teaching staff should have DAE with two years' experience or 2 years Certificate with five years' experience in Digging/Excavation. They should also hold or be working towards a formal teaching qualification.

Other formal qualifications in the Civil Construction or Mining would be useful in addition to the above.

Recommended Trainer: Trainee Ratio

The recommended maximum trainer: trainee ratio for this programme is 1 trainer for 25 trainees.

Medium of instruction i.e. language of instruction

Instruction will be Urdu and English.

Duration of the Course (Total Time, Theory & Practical Time)

This curriculum comprises 09 modules. The recommended delivery time is 600 hours. Delivery of the course could therefore be full time, 5 days a week. Training providers are at liberty to develop other models of delivery, including part-time and evening delivery.

The full structure of the course is as follow:

Module	Theory ¹ Days/hours	Workplace ² Days/hours	Total hours
Module 1: Maintain PersonalHealth, Hygeine and Safety	20	10	30
Module 2: Perform Basic Communication Skills	20	10	30
Module 3: Operate Computer Functions (General)	10	20	30
Module 4: Demonstrate Basic Numeracy skills	20	20	40
Module 5: Identify Electrical Circuits and Measurements	20	50	70
Module 6: Perform Battery Service of Vehicle	10	40	50
Module 7: Maintain Diesel Engine Systems	30	140	170
Module 8: Carryout General Maintenance	20	60	80
Module 9: Perform Basic Technical Drawing	30	70	100

¹ Learning Module hours in training provider premises

² Training workshop, laboratory and on-the-job workplace

Sequence of the Modules

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

The distribution table is shown below:

Mechanic - 6 Months			
Module 1: Maintain Personal Health, Hygiene and Safety 30 Hours	Module 3: Operate Computer Functions (General) 30 Hours	Module 4: Demonstrate Basic Numeracy skills 30 Hours	Module 9: Perform Basic Technical Drawing 80 Hours
Module 2: Perform Basic Communication Skills 30 Hours		Module 5: Identify Electrical Circuits and Measurements 70 Hours	
Module 8: Carryout General Maintenance 50 Hours		Module 6: Perform Battery Service of Vehicle 60 Hours	
		Module 7: Maintain Diesel Engine Systems 170 Hours	

Summary – overview of the curriculum

Module Title and Aim	Learning Units	Theory Days/hours	Workplace Days/hours	Timeframe of modules
Module 1: Maintain Personal Health, Hygiene and Safety Guidelines Aim: After successful completion of this module, the trainee is competent in maintaining personal Health, Hygiene and safety	LU1: Identify Hazards at Workplace LU2: Apply Personal Protective and Safety Equipment (PPE) LU3: Observe Occupational Safety and Health (OSH) LU4: Dispose of hazardous Waste/materials LU5: Carry out First aid	20	10	30
Module 2: Perform Basic Communication Skills Aim: After successful completion of this module, the trainee is competent in performing basic communication skills	LU1: Work in Team LU2: Follow Supervisor's instructions	20	10	30

Module Title and Aim	Learning Units	Theory Days/hours	Workplace Days/hours	Timeframe of modules
Module 3: Operate Computer Functions (General) Aim: After successful completion of this module, the trainee is competent in Operating Computer Functions (General)	LU1: Set up the computer for use LU2: Organize files in folder LU3: Shut down computer system	10	20	30
Module 4: Demonstrate Basic Numeracy Skills Aim: After successful completion of this module, the trainee is competent in Demonstrating Basic Numeracy Skills	LU1: Apply Basic Numeracy Skills LU2: Perform Measurement LU3: Calculate Area and Volume of Aggregate	20	20	40

Module Title and Aim	Learning Units	Theory Days/hours	Workplace Days/hours	Timeframe of modules
Module 5: Identify Electrical Basic Circuits and Measurements Aim: After successful completion of this module, the trainee is competent in Identifying Electrical Basic Circuits and Measurements	LU1: Prepare Basic Circuits LU2: Perform Basic Electricity Measurements	20	50	70
Module 6: Perform Battery Service of Vehicle Aim: After successful completion of this module, the trainee is competent in Performing Battery Service of Vehicle	LU1: Perform Service of battery LU2: Perform Battery replacement	10	40	50

Module Title and Aim	Learning Units	Theory Days/hours	Workplace Days/hours	Timeframe of modules
Module 7: Maintain Diesel Engine Systems Aim: After successful completion of this module, the trainee is competent in Maintaining Diesel Engine Systems	LU1: Identify basic components of diesel Engines LU2: Maintain Diesel Engine Cooling System LU3: Maintain Engine Lubrication System LU4: Maintain Engine fuel System LU5: Maintain Engine Intake System	30	140	170
Module 8: Carryout General Maintenance Aim: After successful completion of this module, the trainee is competent in carrying out general maintenance	LU1: Perform General Housekeeping & Maintenance LU2: Perform Preventive Maintenance LU3: Perform Tool Maintenance	20	60	80

Module Title and Aim	Learning Units	Theory Days/hours	Workplace Days/hours	Timeframe of modules
Module 9: Perform Basic Technical Drawing Aim: After successful completion of this module, the trainee is competent in performing basic Technical Drawing	LU1: Explore the Lettering and Lines LU2: Create a Design Using Different Geometrical Shapes LU3: Explore Orthographic views of simple shapes LU4: Explore types of dimensioning and drawing symbols	30	70	100

Modules

Module 1: Maintain Personal Health, Hygiene and Safety

Objective of the module: The aim of this module to get knowledge, skills and understanding to maintain personal health, hygiene and safety

Duration: 30hours **Theory:** 20 hours **Practical:** 10 hours

Learning Unit	Learning Outcomes	Learning Elements	Duration	Materials Required	Learning Place
LU1: Identify Hazards at Workplace	The trainee will be able to: <ol style="list-style-type: none"> 1. Interpret work processes and procedures correctly to identify risk to Health, hygiene and safety at workplace 2. Recognize processes, tools, equipment and consumable materials that have the potential to cause harm 3. Prepare Report of the identified risk to Health, hygiene and safety 	<ul style="list-style-type: none"> • Types of hazards that are most likely to cause harm to health and safety • Health and safety precautions • Techniques and methods to identify the risks of hazards at workplace • Explain different types of tools, equipment and consumable materials • Methods of Dealing with hazard to avoid any accident or injury 	Total: 07hrs Theory: 5hrs Practical: 2hrs	<div>Consumable</div> <ul style="list-style-type: none"> • Notebooks • Pencils • Erasers • Sharpeners <div>Non Consumable</div> <ul style="list-style-type: none"> • White board • Multimedia • Internet • Computer system 	<ul style="list-style-type: none"> • Class Room/ Simulated environment
LU2: Apply Personal Protective and Safety Equipment (PPE)	The trainee will be able to: <ol style="list-style-type: none"> 1. Select personal protective equipment in terms of type and quantity according to work orders. 	<ul style="list-style-type: none"> • Describe the types of Personal protective equipment (PPEs) 	Total: 7hrs Theory: 5hrs Practical: 2hrs	<div>Consumable</div> <ul style="list-style-type: none"> • Notebooks • Pencils • Erasers • Sharpeners 	<ul style="list-style-type: none"> • Class Room/ Simulated environment

	<ol style="list-style-type: none"> 2. Wear, adjust, and maintain personal protective equipment to ensure correct fit and optimum protection in compliance with company procedures. 3. Ensure personal protective equipment is cleaned and stored in proper place. 	<ul style="list-style-type: none"> • Importance of personal protective equipment • Define the Maintenance and cleaning of PPEs 		Non Consumable <ul style="list-style-type: none"> • White board • Multimedia • Internet • Computer system • PPEs (Safety glasses, Ear muffs/ear plugs, Protective Gloves, Cap, Safety shoes etc.) 	
LU3: Observe Occupational Safety and Health (OSH)	The trainee will be able to: <ol style="list-style-type: none"> 1. Maintain cleanliness and hygiene as per organizational policy 2. Comply with Health, hygiene and safety precautions before starting work 3. Follow organizational Health, hygiene and safety guidelines during work 	<ul style="list-style-type: none"> • Types of personal hygiene • Define safety reporting procedures and documentation • Importance of organizational Health, hygiene and safety guidelines 	Total: 7hrs Theory: 5hrs Practical: 2hrs	Consumable <ul style="list-style-type: none"> • Notebooks • Pencils • Erasers • Sharpeners Non Consumable <ul style="list-style-type: none"> • White board • Multimedia • Internet • Computer system 	<ul style="list-style-type: none"> • Class Room/ Simulated environment

	<ol style="list-style-type: none"> 4. Deal with resolvable problems according to prescribed procedures 5. Report resolvable problems to immediate supervisor 6. Place the tools equipment etc at their prescribed place after completion of work 	<ul style="list-style-type: none"> • Explain resolvable problems at workplace • Importance of housekeeping at workplace 		<ul style="list-style-type: none"> • Safety manuals 	
LU4: Dispose of hazardous Waste/materials	<p>The trainee will be able to:</p> <ol style="list-style-type: none"> 1. Identify hazardous waste/ drug materials which needs to be disposed off 2. Collect hazardous or non-hazardous waste carefully from the designated area as per approved procedure 3. Use proper disposal hazardous containers for dispose-off hazardous waste as per procedure 4. Take necessary precautions like putting masks and gloves while disposing hazardous 	<ul style="list-style-type: none"> • Types of hazardous waste/ drug materials • Types of non-hazardous waste • Explain the difference between non-hazardous and hazardous waste • Explain the hazardous or non-hazardous waste collection procedures • Define the hazardous or non-hazardous waste disposal procedures 	<p>Total: 9hrs Theory: 5hrs Practical: 4hrs</p>	<p>Consumable</p> <ul style="list-style-type: none"> • Notebooks • Pencils • Erasers • Sharpeners <p>Non Consumable</p> <ul style="list-style-type: none"> • White board • Multimedia • Internet • Computer system 	<ul style="list-style-type: none"> • Class Room/ Simulated environment

	waste/ materials as per standard operating procedure				
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Module 2: Perform Basic Communication Skills

Objective of the module: The aim of this module to get knowledge, skills and understanding to perform basic communication.

Duration: 30 hours **Theory:** 20 hours **Practical:** 10hours

Learning Unit	Learning Outcomes	Learning Elements	Duration	Materials Required	Learning Place
LU1: Work in Team	<p>The trainee will be able to:</p> <ol style="list-style-type: none"> 1. Treat team members with respect and maintain positive relationships to achieve common organizational goals 2. Listen to instructions carefully & comply with those instructions 3. Provide work related information to team members and identify interrelated work activities to avoid confusion 4. Adopt communication skills, appropriate to work activities and organizational/medical procedures 5. Identify problems and resolve them through 	<ul style="list-style-type: none"> • Importance and application of Work ethics • Explain the importance of Good communication skills (7Cs of effective communication) • Define Workplace dress code • Describe the role of team members and functionality of the teams • Describe team dynamics and stages of team development • Describe Conflict resolution strategies 	<p>Total: 8hrs</p> <p>Theory: 6hrs</p> <p>Practical: 2hrs</p>	<p>Consumable</p> <ul style="list-style-type: none"> • Notebooks • Pen <p>Non Consumable</p> <ul style="list-style-type: none"> • White board • Multimedia • Internet • Computer system 	<ul style="list-style-type: none"> • Class Room

	discussion and mutual agreement				
LU2: Follow Supervisor's instructions	The trainee will be able to: <ol style="list-style-type: none"> 1. Carefully listen and note down the instructions of Supervisor 2. Carry out the instructions of the supervisor 3. Report to the supervisor as per organizational SOPs 	<ul style="list-style-type: none"> • Define Reporting techniques 	Total: 8hrs Theory: 6hrs Practical: 2hrs	Consumable <ul style="list-style-type: none"> • Notebooks • Pen Non Consumable <ul style="list-style-type: none"> • White board • Multimedia • Internet • Computer system 	<ul style="list-style-type: none"> • Class Room
LU3: Demonstrate Basic IT Skills	The trainee will be able to: <ol style="list-style-type: none"> 1. Create folders and files and learn major commands of operating system/windows 2. Type text and use major commands such as printing, editing, creating tables and graphs etc 3. Generate office reports using appropriate computer applications 4. Use internet for sending/receiving emails 	<ul style="list-style-type: none"> • Explain the importance of Basic computer skills • Different Types of computer applications for office reports • Types of internet browser • Enlist different types of social media • Explain Internet and E-mailing 	Total: 14hrs Theory: 6hrs Practical: 8hrs	Consumable <ul style="list-style-type: none"> • Notebooks • Pen Non Consumable <ul style="list-style-type: none"> • White board • Multimedia • Internet • Computer system 	<ul style="list-style-type: none"> • Class Room

	and connecting through social or other media				
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Module 3: Operate Computer Functions (General)

Objective of the module: The aim of this module to get knowledge, skills and understanding to Operate Computer Functions (General).

Duration: 30 hours **Theory:** 10 hours **Practical:** 20 hours

Learning Unit	Learning Outcomes	Learning Elements	Duration	Materials Required	Learning Place
LU1: Set up the computer for use	The trainee will be able to: <ol style="list-style-type: none"> 1. Identify physical components of computer 2. Identify peripheral devices of the computer 3. Connect all components of computer 4. Follow procedures to turn on the computer system 	<ul style="list-style-type: none"> • Basic parts of a computer • Definition of computer • Definition of Drives • Computer component 	Total: 14hrs Theory: 6hrs Practical: 8hrs	Consumable <ul style="list-style-type: none"> • Notebooks • Pencils • Erasers • Sharpeners Non Consumable <ul style="list-style-type: none"> • White board • Multimedia • Internet • Computer system 	Class Room/ Simulated environment
LU2: Organise files in folder	The trainee will be able to: <ol style="list-style-type: none"> 1. Create folders/subfolders with suitable names 2. Save files in relevant folders. 3. Rename and move folders in different drives. 	<ul style="list-style-type: none"> • Importance of organising files and folders on suitable locations • Procedure to save the files 	Total: 8hrs Theory: 2hrs Practical: 6hrs	Consumable <ul style="list-style-type: none"> • Notebooks • Pencils • Erasers • Sharpeners Non Consumable <ul style="list-style-type: none"> • White board • Multimedia • Internet 	Class Room/ Simulated environment

	<ol style="list-style-type: none"> 4. Move folders and files using drag and drop techniques 5. Save folders and files on different media 6. Search for folders/subfolders and files using appropriate tool bars 7. Delete Folder files 8. Restore deleted folder files 	<ul style="list-style-type: none"> • Procedure to restore deleted folder and files 		<ul style="list-style-type: none"> • Computer system • PPEs (Safety glasses, Ear muffs/ear plugs, Protective Gloves, Cap, Safety shoes etc.) 	
LU3: Shut down computer system	The trainee will be able to: <ol style="list-style-type: none"> 1. Save any work to be retained 2. Close open application programs correctly 3. Shut down computer 4. Switch off any unused peripheral devices 5. Ensure computer safety 	<ul style="list-style-type: none"> • Peripheral devices • Shutting down computer system to ensure computer safety 	Total: 8hrs Theory: 2hrs Practical: 6hrs	Consumable <ul style="list-style-type: none"> • Notebooks • Pencils • Erasers • Sharpeners Non Consumable <ul style="list-style-type: none"> • White board • Multimedia • Internet • Computer system • Safety manuals 	Class Room/ Simulated environment

Module 3: Demonstrate Basic Numeracy Skills

Objective of the module: The aim of this module to get knowledge, skills and understanding to Demonstrate Basic Numeracy Skills

Duration: 40 hours

Theory: 20 hours

Practical: 20 hours

Learning Unit	Learning Outcomes	Learning Elements	Duration	Materials Required	Learning Place
LU1: Apply Basic Numeracy Skills	The trainee will be able to: <ol style="list-style-type: none"> 1. Perform addition 2. Perform subtraction 3. Perform multiplication 4. Perform division 5. Calculate percentage 	<ul style="list-style-type: none"> • Basic principles of addition, subtraction, multiplication and division • Define the rules of percentage calculation 	Total: 10hrs Theory: 05hrs Practical: 05hrs	Consumable <ul style="list-style-type: none"> • Notebooks • Pencils • Erasers • Sharpeners • White Board Marker 	Class Room
		Practical Activity: <ol style="list-style-type: none"> 1. Solve various basic mathematical expressions/equations 2. Solve various questions to calculate percentage 		Non Consumable <ul style="list-style-type: none"> • White board • Multimedia • Internet • Computer system • Pen • Calculator 	

LU2: Perform Measurement	The trainee will be able to: <ol style="list-style-type: none"> 1. Collect appropriate measuring tools 2. Identify inch foot and yard 3. Identify millimeter, centimeter and meter 4. Perform inter conversion of Measuring units 	<ul style="list-style-type: none"> • Measuring tools • Basic measuring units and its inter conversion • Knowledge of British and Metric system Practical Activity: <ol style="list-style-type: none"> 1. Using appropriate tool and measure the parameters of given plot in British system and convert it into Metric system, 	Total: 10hrs Theory: 05hrs Practical: 05hrs	<div>Consumable</div> <ul style="list-style-type: none"> • Notebooks • Pencils • Erasers • Sharpeners • White Board Marker <div>Non Consumable</div> <ul style="list-style-type: none"> • White board • Multimedia • Internet • Computer system • Calculator • Measuring Tape 	<ul style="list-style-type: none"> • Class Room
U3: Calculate Area and Volume of Regular Shapes	The trainee will be able to: <ol style="list-style-type: none"> 1. Calculate Area and Volume of basic shapes 2. Calculate surface area 3. Calculate volume of materials 4. Calculate quantities of materials (stacks/pile, 	<ul style="list-style-type: none"> • Knowledge of Geometrical Shapes • Calculation of area and volume of basic shapes and materials and describe their units 	Total: 20hrs Theory: 10hrs Practical: 10hrs	<div>Consumable</div> <ul style="list-style-type: none"> • Notebooks • Pencils • Erasers • Sharpeners • White Board Marker <div>Non Consumable</div>	<ul style="list-style-type: none"> • Class Room/Site Area

	<p>earth material and sand)</p> <p>by incorporating time saving practices</p>	<p>Practical Activity:</p> <p>1. Measure the size of given geometrical shapes</p>		<ul style="list-style-type: none"> • White board • Multimedia • Internet • Computer system • Calculator • Measuring Tape 	
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Module 5: Identify Electrical Basic Circuits and Measurements

Objective of the module: The aim of this module to get knowledge, skills and understanding to Identify Electrical Basic Circuits and Measurements

Duration: 70 hours

Theory: 20 hours

Practical: 50 hours

Learning Unit	Learning Outcomes	Learning Elements	Duration	Materials Required	Learning Place
LU1: Prepare Basic Circuits	<p>The trainee will be able to:</p> <ol style="list-style-type: none"> 1. Prepare series circuit on work bench using appropriate tools. 2. Prepare parallel circuit on work bench using appropriate tools. 3. Prepare combination circuit (series parallel circuit) on work bench using appropriate tools. 	<ul style="list-style-type: none"> • Basics of Electricity generation • Types of current (AC/DC) • Types of circuits (series, parallel, etc.), etc. • Switches, relay, fuses, circuit breaker, LEDs, bulbs, etc. • Resistors/colour coding. <p>Practical Activity:</p> <ol style="list-style-type: none"> 1. Prepare combination circuit (series parallel circuit) on work bench using appropriate tools. 	<p>Total: 48hrs Theory: 12hrs Practical: 36hrs</p>	<p>Consumable</p> <ul style="list-style-type: none"> • Notebooks • Pencils • Erasers • Sharpeners • Board Markers • Electrical Wires • Switches • Relay • Fuses • LEDs • Bulbs • Resistor • Circuit breaker, etc. <p>Non Consumable</p> <ul style="list-style-type: none"> • White board • Multimedia 	<ul style="list-style-type: none"> • Class Room/Lab

				<ul style="list-style-type: none"> • Internet • Computer system • Pen • Series and Parallel circuit boards 	
LU2: Perform Basic Electricity Measurements	The trainee will be able to: <ol style="list-style-type: none"> 1. Measure/ record voltage by using appropriate equipment 2. Measure/ record current by using appropriate equipment Measure/ record resistance by using appropriate equipment 3. Measure/ record continuity by using appropriate equipment 	<ul style="list-style-type: none"> • Electrical measuring units (Volts, Watts, Amperes, etc.) • Motors (DC/AC), • Generator (DC/AC) • Electricity Measuring tools and equipment 	Total: 22hrs Theory: 8hrs Practical: 14hrs	<div>Consumable</div> <ul style="list-style-type: none"> • Notebooks • Pencils • Erasers • Sharpeners <div>Non Consumable</div> <ul style="list-style-type: none"> • White board • Multimedia • Internet • Computer system • Motors (DC/AC), • Generator (DC/AC) • Multimeter • Clamp Meter 	<ul style="list-style-type: none"> • Class Room/Lab

Module 6: Perform Battery Service of Vehicle

Objective of the module: The aim of this module to get knowledge, skills and understanding to Perform Battery Service of Vehicle

Duration: 50 hours

Theory: 10 hours

Practical: 40 hours

Learning Unit	Learning Outcomes	Learning Elements	Duration	Materials Required	Learning Place
LU1: Perform Service of battery	The trainee will be able to: <ol style="list-style-type: none"> 1. Perform the battery test using appropriate tools according to the standards. 2. Perform cleaning of terminal holder according to the standard. 3. Perform replacement of terminal holder according to requirement. 4. Assess the battery performance using appropriate tool. 	<ul style="list-style-type: none"> • Types of Lead Acid battery and its internal components: Material, acid and water ratio, plates, cells, ampere hour rating, voltage drop, corroded/ lose terminals • Maintenance free batteries/Dry Batteries • Chemical activities in Lead Acid Battery while charging and discharging. 	Total: 25hrs Theory: 05hrs Practical: 20hrs	<div>Consumable</div> <ul style="list-style-type: none"> • Notebooks • Pencils • Erasers • Sharpeners <div>Non Consumable</div> <ul style="list-style-type: none"> • White board • Multimedia • Internet • Computer system • Pen • Lead Acid battery • Battery tester • Hydro meter 	<ul style="list-style-type: none"> • Class Room/Lab
		Practical Activity: <ol style="list-style-type: none"> 1. Perform the battery test using battery tester according to the standards. 2. Perform replacement of terminal holder according to requirement. 			

LU2: Perform Battery replacement	The trainee will be able to: <ol style="list-style-type: none"> 1. Perform Safe removal of Battery from the vehicle. 2. Install Battery in the vehicle. 3. Test the battery performance according to the set procedure. 	<ul style="list-style-type: none"> • Procedure of safe removal and placement of battery • Testing of battery performance using appropriate equipment <hr/> Practical Activity: <ol style="list-style-type: none"> 1. Perform safe removal of battery using appropriate tools and equipment. 2. Perform installation of battery using appropriate tools and equipment. 	Total: 25hrs Theory: 05hrs Practical: 20hrs	<div>Consumable</div> <ul style="list-style-type: none"> • Notebooks • Pencils • Erasers • Sharpeners <div>Non Consumable</div> <ul style="list-style-type: none"> • White board • Multimedia • Internet • Computer system • Pen • Lead Acid battery • Battery tester • Hydro meter • Spanner Set • Screw driver set 	<ul style="list-style-type: none"> • Class Room/Lab
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Module 7: Maintain Diesel Engine Systems

Objective of the module: The aim of this module to get knowledge, skills and understanding to Maintain Diesel Engine Systems

Duration: 170 hours

Theory: 30 hours

Practical: 140 hours

Learning Unit	Learning Outcomes	Learning Elements	Duration	Materials Required	Learning Place
LU1: Identify basic components of Diesel Engines	The trainee will be able to: <ol style="list-style-type: none"> 1. Identify the main components of Diesel Engine 2. Locate fuel injectors and its function 3. Identify high pressure fuel pump and its functions 4. Identify heater plug and its function 5. Identify the Common rail fuel system 6. Identify HEUI fuel system 7. Identify Cooling system in the vehicle 	<ul style="list-style-type: none"> • Main Components of Diesel Engine • Fuel injectors and its function • High pressure fuel pump and its functions • Heater plug and its functions • Common rail fuel system • HEUI fuel system • Cooling system in the vehicle Practical Activity: <ol style="list-style-type: none"> 1. Identify the main components of Diesel Engine and label the diagrams given by trainer. 	Total: 26hrs Theory: 06hrs Practical: 20hrs	Consumable <ul style="list-style-type: none"> • Notebooks • Pencils • Erasers • Sharpeners • Whiteboard Marker Non Consumable <ul style="list-style-type: none"> • White board • Multimedia • Internet • Computer system • Diesel Engine • Diesel Engine Accessories (Fuel Pump, Fuel Injector, etc.) 	<ul style="list-style-type: none"> • Class Room/Lab

LU2: Maintain Diesel Engine Cooling System	The trainee will be able to: <ol style="list-style-type: none"> 1. Identify the antifreeze and its compositions 2. Check coolant level 3. Identify the rust and corrosion in the engine and preventions 4. Perform Flushing of Cooling system 	<ul style="list-style-type: none"> • Operating principles and terminologies of cooling system (Air cooled engine, liquid cooled engine, operating temperature, thermal efficiency, pressurized system, heat exchange method (conduction, radiation, and convection), corrosion, and inhibitors/antifreeze) • Functions and purpose of engine cooling system components (Electrical motor operated fan with water temperature sensor, belt operated fan, temperature controlled/viscous coupling fan, pressure cap, water body/pump, drive belt, thermostat, radiator, core plug, hoses/clamps, and gasket/ seals (Petrol four 	Total: 36hrs Theory: 06hrs Practical: 30hrs	<div>Consumable</div> <ul style="list-style-type: none"> • Notebooks • Pencils • Erasers • Sharpeners • Coolants <div>Non Consumable</div> <ul style="list-style-type: none"> • White board • Multimedia • Internet • Computer system • Diesel Engine with accessories • Radiator with cooling fan • Hose Pipe • Thermostat • Pressure Cap • Clamps • Gasket • Drive Belts 	<ul style="list-style-type: none"> • Class Room/Lab
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		stroke, diesel four stroke, and rotary/Wankel).			
		Practical Activity: <ol style="list-style-type: none"> Label the diagram of Diesel Engine Cooling System. Perform Flushing of Cooling system as per procedure. 			
LU3: Maintain Engine Lubrication System	The trainee will be able to: <ol style="list-style-type: none"> Identify the main components of engine lubrication system. Replace Oil filter Check engine oil level Change engine oil Check engine oil leakage 	<ul style="list-style-type: none"> The functions/operating principle and main components of engine lubrication system as following: <ul style="list-style-type: none"> Wet sump, dry sump, total loss, Oil pumps and its types, pressure relief valves, oil filter, oil cooler, ventilation/ Pressure Control Valve (PCV), hoses, and oil level indicators. Lubricant (oils viscosity, oil classifications, cooling effect, cleaning effect, 	Total: 36hrs Theory: 06hrs Practical: 30hrs	Consumable <ul style="list-style-type: none"> Notebooks Pencils Erasers Sharpeners Engine Oil Engine Oil Filter Non Consumable <ul style="list-style-type: none"> White board Multimedia Internet Computer system 	<ul style="list-style-type: none"> Class Room

		<p>corrosion resistance, and noise reduction).</p> <ul style="list-style-type: none"> • Explain flow of oil in Lubrication system diagram with and without Exhaust Gas Recirculation (EGR). • Define Micron rating of Oil Filters. • Define Oil Grades 		<ul style="list-style-type: none"> • Diesel Engine with accessories 	
		<p>Practical Activity:</p> <ol style="list-style-type: none"> 1. Label the diagram of Diesel Engine Lubrication System. 2. Check and change engine Oil and oil filter 			
LU4: Maintain Diesel Engine fuel System	<p>The trainee will be able to:</p> <ol style="list-style-type: none"> 1. Identify the main components of engine fuel system. 2. Replace fuel filter. 3. Drain water from water separator. 	<ul style="list-style-type: none"> • The main components of engine fuel system • The functions/operating principle of Diesel engine fuel system 	<p>Total: 36hrs</p> <p>Theory: 06hrs</p> <p>Practical: 30hrs</p>	<p>Consumable</p> <ul style="list-style-type: none"> • Notebooks • Pencils • Erasers • Sharpeners • Engine Fuel 	<ul style="list-style-type: none"> • Class Room/Lab

		Practical Activity: <ol style="list-style-type: none"> 1. Label the diagram of Diesel Engine Fuel System. 2. Check and change engine Fuel filter 		<ul style="list-style-type: none"> • Engine Fuel Filter <div>Non Consumable</div> <ul style="list-style-type: none"> • White board • Multimedia • Internet • Computer system • Diesel Engine with accessories • Filter Wrench 	
LU5: Maintain Engine Intake System	The trainee will be able to: <ol style="list-style-type: none"> 1. Identify the main components of engine Intake system. 2. Check dust indicator 3. Clean the air filter 4. Replace the air filter 	<ul style="list-style-type: none"> • The main components of engine Intake system (Air filters, dust indicator, air manifold, etc.) • The Operating principle of Diesel engine Intake system 	Total: 36hrs Theory: 06hrs Practical: 30hrs	<div>Consumable</div> <ul style="list-style-type: none"> • Notebooks • Pencils • Erasers • Sharpeners • Air Filter 	<ul style="list-style-type: none"> • Class Room/Lab

		Practical Activity: <ol style="list-style-type: none"> 1. Label the diagram of Diesel Engine Intake System. 2. Check and clean engine Air filter 		<div>Non Consumable</div> <ul style="list-style-type: none"> • White board • Multimedia • Internet • Computer system • Diesel Engine 	
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Module 8: Carryout General Maintenance

Objective of the module: The aim of this module to get knowledge, skills and understanding to carry out general maintenance

Duration: 80 hours

Theory: 20 hours

Practical: 60 hours

Learning Unit	Learning Outcomes	Learning Elements	Duration	Materials Required	Learning Place
LU1: Perform General Housekeeping & Maintenance	The trainee will be able to: <ol style="list-style-type: none"> 1. Apply appropriate methods and techniques for cleanliness and maintenance of machines & tools 2. Clean and maintain all workplace tools & machines as per housekeeping checklists or given instructions 3. Prepare checklist for daily cleanliness of the workplace 4. Respond appropriately to safety hazards on all 	<ul style="list-style-type: none"> • Explain the methods for cleanliness machines & tools • Define the techniques for cleanliness and maintenance of machines & tools • Explain housekeeping check list • Enlist safety hazards on all bench-work tools and machines • Explain the importance of maintenance and housekeeping of machines and tools 	Total: 16hrs Theory: 06hrs Practical: 10hrs	Consumable <ul style="list-style-type: none"> • Notebooks • Pencils • Erasers • Sharpeners Non Consumable <ul style="list-style-type: none"> • White board • Multimedia • Internet • Computer system • Pen • Tool kit 	<ul style="list-style-type: none"> • Class Room/Lab

	bench-work tools and machines 5. Place all the tools & material in proper place to ensure safe work 6. Prepare specific guidelines and checklists to conduct maintenance and housekeeping of machines & tools	Practical Activity: 1. Place all the tools & material in proper place 2. Prepare specific guidelines and checklists to conduct maintenance and housekeeping of machines & tools			
LU2: Perform Preventive Maintenance	The trainee will be able to: 1. Read and interpret maintenance schedule carefully 2. Prepare oiling and greasing chart (daily, weekly as per machine requirement) 3. Prepare machine history record - date of installation, condition, oiling and maintenance 4. Inspect and assess the general condition of an assigned machine on regular basis	<ul style="list-style-type: none"> • Explain the importance of maintenance schedule • Explain oiling and greasing chart • Define machine history record • Procedure of Inspection and assessment the general condition of machine on regular basis 	Total: 38hrs Theory: 08hrs Practical: 30hrs	Consumable <ul style="list-style-type: none"> • Notebooks • Pencils • Erasers • Sharpeners • White board Marker Non Consumable <ul style="list-style-type: none"> • White board • Multimedia • Internet • Computer system • Maintenance Tool kit 	<ul style="list-style-type: none"> • Class Room/Lab

	<p>5. Observe problems and carry out routine maintenance as per given instructions and schedules</p> <p>6. Identify faulty/damaged/ worn out parts and take appropriate steps to replace them</p> <p>7. Report faults and problems of the machines to the person concerned, if not controllable.</p>	<ul style="list-style-type: none"> • Enlist the common problems in machines • Enlist faulty/damaged/ worn out parts <p>Practical Activity:</p> <ol style="list-style-type: none"> 1. Prepare oiling and greasing chart (daily, weekly as per machine requirement). 2. Prepare machine history record like: date of installation, condition, oiling and maintenance. Also report the issues to the concerned person. 			
LU3: Perform Maintenance of Tooling	<p>The trainee will be able to:</p> <ol style="list-style-type: none"> 1. Clean and maintain all bench-work tools and machines as per housekeeping checklists or instructions provided 2. Prepare checklist for daily cleanliness of the workplace 	<ul style="list-style-type: none"> • Explain the basic procedures of Cleaning and maintaining all bench-work tools and machines • Types of checklist 	<p>Total: 26hrs Theory: 06hrs Practical: 20hrs</p>	<p>Consumable</p> <ul style="list-style-type: none"> • Notebooks • Pencils • Erasers • Sharpeners • White board Marker <p>Non Consumable</p>	<ul style="list-style-type: none"> • Class Room/Lab

	<ol style="list-style-type: none"> 3. Respond appropriately to safety hazards on all bench-work tools & machines 4. Identify all the tools and material in proper place to ensure safe work 5. Adopt methods and techniques for cleanliness and maintenance of tools 	Practical Activity: <ol style="list-style-type: none"> 1. Prepare checklist for daily cleanliness of the tooling and workstation. 2. Clean and maintain all bench-work tools and machines as per housekeeping checklists 		<ul style="list-style-type: none"> • White board • Multimedia • Internet • Computer system • Maintenance Tool kit 	
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Module 9: Perform Basic Technical Drawing

Objective of the module: The aim of this module to get knowledge, skills and understanding to perform basic engineering drawing.

Duration: 80 hours **Theory:** 20 hours **Practical:** 60 hours

Learning Unit	Learning Outcomes	Learning Elements	Duration	Materials Required	Learning Place
LU1: Explore the Lettering and Lines	The trainee will be able to: <ol style="list-style-type: none"> 1. Draw different types of lettering 2. Draw different types of lines 3. Draw upper and lower lines for lettering on distance of 3mm 	<ul style="list-style-type: none"> • Describe lettering and its types and importance in Drawing • Explain line and its Types • Describe application of lines • Lettering Styles like: Gothic, Roman and free hand lettering 	Total: 24hrs Theory: 04hrs Practical: 20hrs	<div>Consumable</div> <ul style="list-style-type: none"> • Notebooks • Pen • Drawing Pencils • Geometry box • Thumb Pin/ Scotch Tape • Drawing Sheets <div>Non Consumable</div> <ul style="list-style-type: none"> • White board • Multimedia • Internet 	Classroom/ Drawing Hall

	4. Write Vertical Lettering with different style like Gothic, Roman and free hand lettering	Practical Activity: 1. Draw a different Geometrical Shapes using prescribed lines and label the shapes with lettering.		<ul style="list-style-type: none"> • Computer system • Drawing Board • T-Square • Set Square • Flexible Curve • Stencils 	
LU2: Create a Design Using Different Geometrical Shapes	The trainee will be able to: 1. Draw different shapes through lines including: <ul style="list-style-type: none"> • Circle • Triangle • Square • Rectangle • Curves 	<ul style="list-style-type: none"> • Describe Geometry shapes and its types • Describe geometrical construction methods of Circle, Triangle, Squares, Polygons and Curves • Explain the use of T-Square and Set Squares 	Total: 14hrs Theory: 04hrs Practical: 10hrs	Consumable <ul style="list-style-type: none"> • Notebooks • Pen • Drawing Pencils • Geometry box • Thumb Pin/ Scotch Tape • Drawing Sheets Non Consumable <ul style="list-style-type: none"> • White board • Multimedia 	Classroom/ Drawing Hall

	<p>2. Use T-Square and Set Squares for drawing horizontal, vertical and inclined lines</p> <p>3. Create a design using different shapes</p>	<ul style="list-style-type: none"> Describe construction of Circumscribed and Inscribed geometrical shapes <p>Activity:</p> <ol style="list-style-type: none"> Create a single V Block. Draw a Circle and divide it into 6 parts. 		<ul style="list-style-type: none"> Internet Computer system Drawing Board T-Square Set Square Flexible Curve 	
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LU3: Explore Orthographic views of simple shapes	The trainee will be able to: <ol style="list-style-type: none"> 1. Draw first angle projection 2. Draw third angle projection 3. Draw missing views 4. Draw different section views 5. Draw Plane geometry angles and triangles 6. Sketch Plane Geometry 	<ul style="list-style-type: none"> • Describe Projection and its types • Explain Difference between 1st Angle & 3rd Angle Projection • Explain sections and its types • Explain Hatching of different materials • Describe application of section views 	Total: 28hrs Theory: 08hrs Practical: 20hrs	<div>Consumable</div> <ul style="list-style-type: none"> • Notebooks • Pen • Drawing Pencils • Geometry box • Thumb Pin/ Scotch Tape • Drawing Sheets <div>Non Consumable</div> <ul style="list-style-type: none"> • White board • Multimedia • Internet • Computer system 	Classroom/ Drawing Hall
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	quadrilateral, square, rhombus and parallelogram 7. Draw Plane Geometry parallel- lines, perpendicular, bisect line and angle 8. Sketch Plane geometry equal division of line with the help of compass and set square	Practical Activity: <ol style="list-style-type: none"> 1. Draw missing views of different objects 2. Draw an Ellipse and divide it into 6 parts. 		<ul style="list-style-type: none"> • Drawing Board • T-Square • Set Square • Flexible Curve • Stencils 	
LU4: Explore types of dimensioning and drawing symbols	The trainee will be able to: <ol style="list-style-type: none"> 1. Draw different types of dimensions 2. Draw different drawing symbols 3. Draw geometrical tolerance 	<ul style="list-style-type: none"> • Explain general rules and principles of dimensioning • Describe geometric dimensioning • Explain symbols used in engineering drawing and manufacturing • Describe application of tolerances, type of fits and allowances used in manufacturing drawings 	Total: 14hrs Theory: 04hrs Practical: 10hrs	Consumable <ul style="list-style-type: none"> • Notebooks • Pen • Drawing Pencils • Geometry box • Thumb Pin/ Scotch Tape • Drawing Sheets Non Consumable <ul style="list-style-type: none"> • White board • Multimedia 	Classroom/ Drawing Hall

		Practical Activity: <ol style="list-style-type: none"> 1. Draw different drawing symbols and label each symbol 2. Draw any object and mark internal and external dimensions 		<ul style="list-style-type: none"> • Internet • Computer system • Drawing Board • T-Square • Set Square • Flexible Curve • Stencils 	
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General assessment guidance for *Digging Operation/Technology*

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

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

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

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

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

Methods of Assessment

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

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

Examples for direct assessment of a Digging Operation Supervisor include:

- Work performances, for example perform basic communication, maintain personal health, hygiene and safety and perform basic computer operations
- Demonstrations, for example Identifying Electrical Circuits and Measurements
- Direct questioning, where the assessor would ask the student how to perform personal safety at work place, how they can communicate work place policy and procedures, how they can create electrical circuits and how they can measure these circuits

- Paper-based tests, such as multiple choice or short answer questions on communication at work place policy and procedures, Electrical Circuits and Measurements
- Indirect assessment is the method used where the performance could not be watched and evidence is gained indirectly.

Examples for indirect assessment of a Digging Operation Supervisor include:

- Work products, such as preparing and handling documents, perform some procedures of Milling

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

Principles of Assessment

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

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

Validity means that a valid assessment assesses what it claims to assess. For example, if documentation or identifying Electrical Circuits and Measurements are to be assessed and certificated, the assessment should involve performance criteria that are directly related to that documentation activity. An interview about the identifying Electrical Circuits and Measurements would not meet the performance criteria.

Reliability means that the assessment is consistent and reproducible. For example, if the work performance of preparing documents in words has been assessed, another assessor (e.g. the future employer) should be able to see the same work performance and witness the same level of achievement.

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

Assessment strategy for *Digging Operation*

This curriculum consists of 9 modules:

- **Module 1:** Maintain Personal Health, Hygiene and Safety
- **Module 2:** Perform Basic Communication Skills
- **Module 3:** Operate Computer Functions (General)
- **Module 4:** Demonstrate Basic Numeracy skills
- **Module 5:** Identify Electrical Circuits and Measurements
- **Module 6:** Perform Battery Service of Vehicle
- **Module 7:** Maintain Diesel Engine Systems
- **Module 8:** Carryout General Maintenance
- **Module 9:** Perform Basic Technical Drawing

Sessional Assessment

The sessional assessment for all modules shall be in two parts: theoretical assessment and practical assessment. The sessional marks shall contribute to the final qualification.

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

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

Final Assessment

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

The Assessment Team

The number of assessors must meet the needs of the students and the training provider. For example, where two assessors are conducting the assessment, there must be a maximum of five students per assessor. In this example, a group of 25 students shall therefore require assessments to be carried out over a four-day period. For a group of only 10 to 15 students, assessments would be carried out over a two-day period only.

Planning For Assessment

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

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

Complete List of Tools and Equipment

Sr#	Description	Quantity
1.	Computer Systems	26
2.	Scanner	1
3.	Printer	1
4.	Hardness Testers	1
5.	Universal testing machine(UTM)	1
6.	Impact Testing Machines	1
7.	Steel Rulers	10
8.	Tri Square	10
9.	Inside Vernier Caliper	10
10.	Odd leg Vernier Caliper	10
11.	Trammel Vernier Caliper	10
12.	Outside Vernier Caliper	10
13.	Vernier Depth gauge	5
14.	Vernier Bevel protractor	5
15.	Thread gauges	5
16.	Screw pitch gauges	5
17.	Fillet gauges	5

18.	Feeler gauges	5
19.	Vernier Height gauge	5
20.	Dial indicators with magnetic stand	5
21.	Vernier Micrometer	5
22.	Inside Micrometer	5
23.	Outside Micrometer	10
24.	Depth Micrometer	5
25.	Snap Gauge set	2
26.	Dial Bore Gauge	5
27.	Set of Adjustable Wrench	5
28.	Set of Spanners (Open end, Ring)	5 each
29.	Pipe wrench	2
30.	L-key sets	5
31.	Nose pliers	5
32.	Grip pliers	5
33.	Crawler Excavator	5
34.	Wheel Excavator	5
35.	Wrenches	5
36.	Pliers	5
37.	Screw driver (Positive and negative)	5
38.	Hammer	5

39.	Vice grip	5
40.	Grease gun	5 each
41.	Paint brush	10
42.	Steel brush	25
43.	Crawler Excavator	10
44.	Measuring tape	10
45.	High pressure washer	5
46.	Air compressor	5
47.	Rigid and articulated dump truck (Off road)	5
48.	Dump truck (On road)	10 set
49.	Hopper	10
50.	Conveyor	10
51.	Vernier caliper (out, inside)	5
52.	Torque gauge	5
53.	Steel rule	5
54.	Multi-meter	5
55.	Thermometers	5
56.	Spanner set	10 packs
57.	Socket set	1
58.	ST(special service Tool)	1
59.	Drilling Machines	1

60.	Location Determining Devices	1
61.	Digging slant determining devices	1
62.	Communication Devices	10
63.	Sample Boxes	10
64.	Exploration and Scanning Devices	2
65.	Drawing board	25

List of consumable supplies

Sr no	Material	Quantity
1.	Note book	25
2.	Pencil	25
3.	White sheets	25
4.	Eraser	25
5.	Sharpener	25
6.	Pen	25
7.	Clutch pencils	25
8.	Sticky Notes	25
9.	Card sheets	100
10.	Cleaning brush	25
11.	Cotton rags	1KG

12.	PPE's	25
13.	Lubricants	In Litters
14.	Drawing Board	25
15.	Drawing Sheets	25 Books

Credit values

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

The credit values are as follows:

Competency Standard	Estimate of hours	Credit
A. Maintain Personal Health, Hygiene and Safety	30	3
B. Perform Basic Communication Skills	30	3
C. Operate Computer Functions (General)	30	3
D. Demonstrate Basic Numeracy skills	40	4
E. Identify Electrical Circuits and Measurements	70	7
F. Perform Battery Service of Vehicle	50	5
G. Maintain Diesel Engine Systems	170	17
H. Carryout General Maintenance	80	8
I. Perform Basic Technical Drawing	100	10