



Co-funded by the European Union



Norwegian Embassy
Islamabad



GENERATOR MECHANIC



© TVET SSP

CBT Curriculum

National Vocational Certificate Level 3

Version 1 - November, 2019



Implemented by
giz Deutsche Gesellschaft
für Internationale
Zusammenarbeit (GIZ) GmbH

Published by

National Vocational and Technical Training Commission
Government of Pakistan

Headquarter

Plot 38, Kirthar Road, Sector H-9/4, Islamabad, Pakistan
www.navttc.org

Responsible

Director General Skills Standard and Curricula, National Vocational and Technical Training Commission
National Deputy Head, TVET Sector Support Programme, Deutsche Gesellschaft für Internationale Zusammenarbeit (GIZ) GmbH

Layout & design

SAP Communications

Photo Credits

TVET Sector Support Programme

URL links

Responsibility for the content of external websites linked in this publication always lies with their respective publishers. TVET Sector Support Programme expressly dissociates itself from such content.

This document has been produced with the technical assistance of the TVET Sector Support Programme, which is funded by the European Union, the Federal Republic of Germany and the Royal Norwegian Embassy and has been commissioned by the German Federal Ministry for Economic Cooperation and Development (BMZ). The Deutsche Gesellschaft für Internationale Zusammenarbeit (GIZ) GmbH in close collaboration with the National Vocational and Technical Training Commission (NAVTTTC) as well as provincial Technical Education and Vocational Training Authorities (TEVTAs), Punjab Vocational Training Council (PVTC), Qualification Awarding Bodies (QABs)s and private sector organizations.

Document Version

November, 2019

Islamabad, Pakistan

GENERATOR MECHANIC



© TVET SSP

CBT Curriculum

National Vocational Certificate Level 3

Version 1 - November, 2019

Contents

Introduction	3
Purpose of the Training Programme	3
Overall objectives of the course	4
Competencies to be gained after completion of course.....	4
Job opportunities available immediately and in the future	5
Trainee Entry Level:	5
Minimum Qualification of Trainer.....	5
Recommended Trainer: Trainee ratio.....	5
Medium of Instruction:	5
Duration of course (total time, Theory & Practical)	6
Overview of the Curriculum for Generator Mechanic (Level 3).....	7
Module 6: Carryout Basic Electrical Installation (Alternating Current-AC)	11
Module 7: Repair/Replace Mechanical Components.....	13
Module 8: Repair/Replace Electrical Components	18
Module 9: Install new Generator	21
List of Tools and Equipment.....	23

Introduction

Generators are machines that transform mechanical energy into electrical energy; they can be used to run a variety of electrical appliances for home or commercial use. There are numerous types of generators; some rely on natural gas, diesel or petrol as energy sources. This generator mechanic course is provided to train the unskilled trainees to service/repair/install engines and generators for home or industrial use. This course is aimed at introducing and developing the basic skills with an understanding of different energy sources, power quality and its influences on standby generator sets, different loads, startup and running of a standby generator. Set, size and select the most appropriated standby generator set of the application and provide the trainees with electrical and electronic principles to enable effective fault finding of the standby generators and associated systems alongside the installation of different types of generators. The trainees are encouraged to experiment with a focus on acquiring a wide range of new skills. They are also exposed to the commercial market and taught how to deal with clients and their demands.

In order to improve the quality of training and to ensure relevance, National Vocational & Technical Training Commission (NAVTTTC) through Qualification Development Committee (QDC) developed National Competency Standards for generator mechanic. The learning outcomes provided in this curriculum form the basis of this instruction, which are in accordance with the approved National Competency Standards for generator mechanic. The curriculum can be implemented in a variety of pathways and provides flexible learning opportunities.

Purpose of the Training Programme

In this training program trainee will learn and acquire specialized knowledge and particle skills required to function as a generator mechanic both at public and private levels. The specific objectives of developing these qualifications are as under:

- Improve the overall quality of training delivery and setting national benchmarks for training of generator mechanic in the country
- Provide flexible pathways and progressions to learners enabling them to receive relevant, up-to-date and current skills

- Provide basis for competency-based assessment which is recognized and accepted by employers
- Establish a standardized and sustainable system of training for generator mechanic in the country.

Overall objectives of the course

The prime objective of this one-year certificate in Generator mechanic is to provide the trainee with a comprehensive introduction and skill oriented practical work of generator at workplace. It develops trainee's abilities, interests and offers an outstanding opportunity for an intense engagement with various stages of installation, overhauling, maintenance work of generator. It encourages individual creativity while giving a solid ground in terms of identification of faults, maintenance of faulty parts, overhauling, earthing and installation alongside the skill to perform winding, work plan, documentation and develop professionalism by using appropriate technology. Part of the task is to help the trainees realize their commercial viability as an independent generator mechanic or an employee in a commercial setup. They are also made aware of the ever changing and evolving demands and challenges of market trends. This course is open to students of all levels and experiences under following main objectives.

Competencies to be gained after completion of course

The detail of the competency standards included in this qualification are given below:

National Vocational Certificate level 3, in "Generator Mechanic"

1. Apply Work Health and Safety Practices (WHS)
2. Identify and Implement Workplace Policy and Procedures
3. Communicate at Workplace
4. Perform Computer Application Skills
5. Manage Personal Finances
6. Carryout Basic Electrical AC
7. Repair/Replace Mechanical Components
8. Repair/Replace Electrical Components
9. Install New Generator

Job opportunities available immediately and in the future

The Pass outs of this course may find job / employment opportunities in the following areas:

- Work as Generator Mechanic (Level 3)

Trainee Entry Level:

The entry for National Vocational Certificate level 3, Generator Mechanic is given below:

Title	Entry requirements
National Vocational Certificate level 3, in Generator Mechanic	Entry for assessment for this qualification is open. However, entry into formal training institute for this qualification is person holding National Vocational Certificate level 2, “Generator Mechanic” in (Mechanical Sector)

Minimum Qualification of Trainer

- 2 years of teaching/ professional experience after Diploma/Bachelors
- 1 year of teaching/ professional experience after B-Tech
- Trainers or technical staff should have the ability to communicate and impart technical and conceptual skills
- Academic qualification should be DAE or B-Tech

Recommended Trainer: Trainee ratio

The recommended trainer and trainee ratio are 1:24 per class

Medium of Instruction:

Urdu, English or Local Language

Duration of course (total time, Theory & Practical)

The proposed curriculum is composed of **09** modules that will be covered in **670** hrs. It is proposed that the course may be delivered in a **Six months** period. The distribution of contact hours is given below:

- **Theory:** (18.36%) **Practical** (81.64%)
- **Theory: 123 hours**
- **Practical: 547 hours**
- **Total: 670**

11. Sequence of the modules

Following is the structure of the course:

NVQF Level	Module #	Title	Category	Theory (hours)	Practical (hours)	Total (hour)	Credits hours	Total Credit Hours
3	1	Apply Work Health and Safety Practices (WHS)	Generic	04	16	20	2	67
	2	Identify and Implement Workplace Policy and Procedures	Generic	02	08	10	1	
	3	Communicate at Workplace	Generic	02	08	10	1	
	4	Perform Computer Application Skills	Generic	02	08	10	1	
	5	Manage Personal Finances	Generic	02	08	10	1	
	6	Carryout Basic Electrical AC Installer	Technical	20	80	100	10	
	7	Repair/Replace Mechanical Components	Technical	40	230	270	27	
	8	Repair/Replace Electrical Components	Technical	34	136	170	17	
	9	Install New Generator	Technical	17	53	70	07	
TOTAL				123	547	670	67	
Percentage.				18.36%	81.64%			

Overview of the Curriculum for Generator Mechanic (Level 3)

Module Title and Aim	Learning Units	Theory Days/hours	Workplace Days/hours	Timeframe of Modules
Module 1: Apply Work Health and Safety Practices (WHS) Aim: This unit describes the skills to work with safety and participate in hazard assessment activities, follow emergency procedures and participate OHS practices in process	LU1. Implement safe work practices at work place LU2. Participate in hazard assessment activities at a work place LU3. Follow emergency procedures at workplace LU4. Participate in OHS consultative processes	04	16	20
Module 2: Identify and Implement Workplace Policy and Procedures Aim: This unit describes the skills and knowledge required to develop and implement a workplace policy & procedures and to modify the policy to suit changed circumstances. It applies to individuals with managerial responsibilities who undertake work developing approaches to create, monitor and improve strategies and policies within workplaces and engage with a range of relevant stakeholders and specialists.	LU1. Identify workplace policy & procedures LU2. Implement workplace policy & procedures LU3. Communicate workplace policy & procedures LU4. Review the implementation of workplace policy & procedures	02	08	10
Module 3: Communicate at Workplace Aim: This unit describes the performance outcomes, skills and knowledge required to	LU-1: Communicate within the organization LU-2: Communicate outside the organization LU-3: Communicate effectively in workgroup	02	08	10

develop communication skills in the workplace. It covers gathering, conveying and receiving information, along with completing assigned written information under direct supervision.	LU-4: Communicate in writing			
Module 4: Perform Computer Application Skills Aim: This unit describes the skills and knowledge required to use spreadsheet applications, prepare in page documents, develops familiarity with Word, Excel, Access, PowerPoint, email, and computer graphics basics. It applies to individuals who perform a range of routine tasks in the workplace using a fundamental knowledge of spreadsheets, Microsoft office and computer graphics in under direct supervision or with limited responsibility.	LU1. Prepare In-page documents as per required information LU2. Prepare Spreadsheets as per required information LU3. Use MS Office as per required information LU4. Perform computer graphics in basic applications LU5. Create Email account for communications	02	08	10
Module 5: Manage Personal Finances Aim: This unit of competency describes the outcomes required to manage develop, implement and monitor a personal budget in order to plan regular savings and manage debt effectively.	LU1. Develop a personal budget LU2. Develop long term personal budget LU3. Identify ways to maximize future finances	02	08	10
Module 6: Carryout Basic Electrical Alternate Current (AC) Installation Aim: After completing this learning module, the learner will be able to lay cables, perform single	LU1. Lay cables LU2. Perform single-phase Connection LU3. Perform three phase Connection	20	80	100

& three phase connections, basic electric wiring and wiring test for carrying out basic electrical alternating current (AC) installation.	LU4. Perform Basic Electrical wiring LU5. Conduct wiring Test			
Module 7: Repair/Replace Mechanical Components Aim: After completing this learning module, the learner will be able to replace fuel pump, oil pump, fan belt, radiator, oil filter and change cam shaft, crank shaft, valve train components, timing belt and change injector for generator maintenance & repair	LU1. Replace fuel / Injection pump LU2. Replace oil pump LU3. Replace fan belt LU4. Replace Radiator LU5. Change oil filter LU6. Change air filter LU7. Change Connecting Rod LU8. Change cam shaft LU9. Change crank shaft LU10. Change valve train Components LU11. Change Timing Belt / Timing Gear LU12. Change Injector/automizer LU13. Change/repair cylinder head LU14. Change/repair cylinder block	40	230	270

Module 8: Repair/Replace Electrical Components Aim: After completing this learning module, the learner will be able to repair self- starter, replace faulty parts, replace governor, replace cooling fan motor and inspect warning system.	LU1. Repair Self-Starter LU2. Replace faulty parts of main alternator LU3. Change gauges on display panel LU4. Repair/ replace governor LU5. Replace warning sensors LU6. Replace main alternator bearings LU7. Change Spark plugs	34	136	170
Module 9: Install new Generator Aim: After completing this learning module, the learner will be able to maintain supply in accordance with the requirements of industry regulations and established procedures. It encompasses the operation, connection and disconnection as well as assessing load assuring the appropriateness of all generators for the required outcome.	LU1. Adopt manufacture procedure LU2. Interpret foundation drawing LU3. Hoist generator LU4. Level generator LU5. Distribute electrical load LU6. Install change over switch LU7. Connect earthing	17	53	70
TOTAL		123	547	670

GENERATOR MECHANIC



© TVET SSP

Module-6

CBT Curriculum

National Vocational Certificate Level 3

Version 1 - November, 2019

Module 6: Carryout Basic Electrical (Alternating Current-AC) Installation

Objectives: After completing this learning module, the learner will be able to lay cables, perform single & three phase connections, basic electric wiring and wiring test for carrying out basic electrical alternating current (AC) installation.

Duration:	Total hours	100	Theory	20	Practical	80
------------------	--------------------	------------	---------------	-----------	------------------	-----------

Learning Unit	Learning Outcomes	Learning Elements	Duration	Materials (Tools & Equipment) Required	Learning Place
LU1. Lay cables	• Interpret electrical drawing / document • Identify cables • Lay cables • Perform earthing	• Knowledge about electrical drawing/documents • Describe types of cables • Describe size of cables • Knowledge about earthing	4 hours Theory 16 hours Practical	• Cables of different sizes • Micro meter • Electrical drawing • Earthing materials (coal, salt, copper plates, GI pipe, earth continuity conductor, copper nut bolts etc) • Electrical tool kit	Class Room and workplace
LU2. Perform single-phase Connection	• Select cable gauge • Select cables colors • Connect cables • Insulate Joints	• Describe gauges of cables • Describe single phase connection • Knowledge about color of cables • Describe types and techniques of joints • Describe importance of insulation	4 hours Theory 16 hours Practical	• Cable different sizes • Electrical tool kit • Micro meter • Insulating materials	Class Room and workplace

LU3. Perform three phase Connection	• Select cable Gauge • Select cables colors • Connect cables • Insulate Joints	• Describe three phase connection • Knowledge about color/sequence of cables • Describe various types of core insulation (single, two, three & four core cable)	4 hours Theory 16 hours Practical	• Cable sizes different • Electrical tool kit • Micro meter • Insulating materials	Class Room and workplace
LU4. Perform Basic Electrical wiring	• Measure cables as per requirement • Connect cables • Perform joints • Insulate Joints	• Define conductor and insulator • Describe types of wiring • Describe various wiring procedure	4 hours Theory 16 hours Practical	• Cable sizes different • Electrical tool kit • Micro meter • Insulating materials • Wiring materials	Class Room and workplace
LU5. Conduct wiring Test	• Operate multi-meter for voltage and current • Perform continuity test • Perform polarity test • Perform earthing test • Perform insulation test • Record test results	• Describe various wiring test • knowledge about uses of multi meter • Knowledge about series test lamp • Describe testing procedures for continuity and polarity test • Describe functions of Megger/earthing tester • Describe testing procedure for earthing and insulation test by Megger/earthing tester	4 hours Theory 16 hours Practical	• Multi mater • Megger • Insulation tester • Series test lamp	Class Room and workplace

GENERATOR MECHANIC



© TVET SSP

Module-7

CBT Curriculum

National Vocational Certificate Level 3

Version 1 - November, 2019

Module 7: Repair/Replace Mechanical Components

Objectives: After completing this learning module, the learner will be able to replace fuel pump, oil pump, fan belt, radiator, oil filter and change cam shaft, crank shaft, valve train components, timing belt and change injector for generator maintenance & repair

Duration	Total hours	270 hours	Theory	40 hours	Practical	230 hours
Learning Unit	Learning Outcomes	Learning Elements	Duration	Materials (Tools & Equipment) Required	Learning Place	
LU1. Replace fuel Injection pump	• Select tools and equipment • Replace fuel pipes • Replace fuel filter • Replace the fuel injunction pump • Calibrate injection pump • Reinstall calibrated injection pump	• Describe different types of injection pump • Define phasing and calibration	4 hours Theory 20 hours Practical	• Fuel injection pump • Fuel pipe • Fuel filter • Socket box • Ring spanner set	Class Room and workplace	
LU2. Replace oil pump	• Select Tools and equipment • Remove oil pump • Repair / Replace faulty components of oil pump	• Describe different types of oil pump	2 hours Theory 16 hours Practical	• Oil pump • Tool kit	Class Room and workplace	

LU3. Replace fan belt	• Collect tools and equipment • Identify size of fan belt • Replace fan belt • Adjust fan belt	• Define Fan belt • Describe different type of fan belts	2 hours Theory 8 hours Practical	• Fan belt • Ring spanner set • Adjustment lever	Class Room and workplace
LU4. Replace Radiator	• Arrange tools and equipment • Uninstall the radiator • Clean and flush radiator • Repair radiator • Reinstall radiator	• Describe various radiators (single & double tubes) • Describe servicing techniques of radiator • Define different chemicals for internal cleaning/flushing	3 hours Theory 16 hours Practical	• Radiator • Flushing materials • Radiator pressure cap • Radiator bottle • Tool box	Class Room and workplace
LU5. Change oil filter	• Collect tools and equipment • Select proper size of oil filter • Remove oil filter • Install oil filter	• Describe different types of oil filter and its functions • Describe procedure for replacing oil filter	2 hours Theory 12 hours Practical	• Oil filter • Filter chain	Class Room and workplace

LU6. Change air filter	• Collect tools and equipment • Select proper size of air filter • Remove air filter • Install air filter	• Describe sizes of air filter and its functions • Describe procedure of replacing air filter	2 hours Theory 10 hours Practical	• Air filter	Class Room and workplace
LU7. Change Connecting Rod	• Select tools and equipment • Remove engine from main alternator • Dismantle engine • Remove connecting rod • Repair /replace connecting rod	• Describe connecting rod and its functions • Describe importance of connecting rod components • Describe dismantling procedure of engine	4 hours Theory 24 hours Practical	• Generator engine • Connecting rod with its accessories • Toolkit	Class Room and workplace
LU8. Change cam shaft	• Identify tools and equipment • Remove tappet cover • Remove cam shaft • Repair and replace cam shaft	• Describe cam shaft and its functions • Describe dismantling procedure of cam shaft	3 hours Theory 18 hours Practical	• Generator engine • Cam shaft with its accessories • Toolkit	Class Room and workplace
LU9. Change crank shaft	• Identify tools and equipment • Remove fly wheel • Open main big end	• Describe crank shaft and its functions • Describe dismantling procedure of crank shaft	3 hours Theory 18 hours Practical	• Generator engine • Crank shaft • Toolkit	Class Room and workplace

	• Remove Timing plate and timing gear / Pulley • Remove hosing • Remove main oil seal plate • Remove crank shaft • Repair and replace Crank shaft	• Describe functions of flywheel • Describe dismantling procedure of flywheel,			
LU10. Change valve train components	• Identify tools and equipment • Remove tappet cover, atomizer pipe timing belt, rocker and head bolt • Dress/ Polish valve and valve seats • Replace head gas kit • Reinstall valve train component	• Define valve train • Describe grinding /polishing of valve and valve seat • Describe head gas kit	3 hours Theory 18 hours Practical	• Valve train with accessories • Head gas kit • Head assembly • Valve lapping stick and paste • Tool kit	Class Room and workplace
LU11. Change Timing Belt / Timing Gear	• Identify tools and equipment • Identify timing marks • Loose the adjustment bolt • Remove the timing belt/gear	• Describe timing belt/timing plate/timing gear • Describe dismantling procedure of timing belts, timing gear and pulley • Describe mounting techniques	3 hours Theory 18 hours Practical	• Timing belt • Timing gear • Timing chain • Tool Box	Class Room and workplace

	• Reinstall the timing belt / gear	of timing belts/gear			
LU12. Change Injector/automizer	• Identify the tools and equipment • Remove the injection pipe • Remove the mounting bolt of injector • Remove the injector • Calibrate the injectors • Install the injectors	• Define injector/automizer • Describe functions of injector/automizer • Describe dismantling procedure of injector/automizer • Describe calibration techniques of injector/automizer	3 hours Theory 18hours Practical	• Injector/automizer • Injector pressure tester • Tool kit	Class Room and workplace
LU13. Change/repair cylinder head	• Identify tools and equipment • Repair Valve seat • Perform Top overhaul • Perform head tightening sequence	• Define cylinder head • Define components in cylinder head • Describe facing and decarburizing techniques of cylinder head • Describe installation techniques of cylinder head	3 hours Theory 18 hours Practical	• Cylinder head • Tool Kit • Torque wrench	Class Room and workplace

LU14. Change/repair cylinder block	• Identify tools and equipment • Perform major overhaul • Change sleeve • Perform Honing • Replace piston and piston rings	• Define cylinder block • Define components in cylinder block • Describe piston and piston rings. • Describe installation techniques of piston and piston rings.	3 hours Theory 16 hours Practical	• Cylinder block • Sleeves • Piston & piston rings • Honing machine • Toolkit	Class Room and workplace
---	--	---	--	---	--------------------------------

GENERATOR MECHANIC



© TVET SSP

Module-8

CBT Curriculum

National Vocational Certificate Level 3

Version 1 - November, 2019

Module 8: Repair/Replace Electrical Components

Objectives of the module: After completing this learning module, the learner will be able to repair self- starter, replace faulty parts, replace governor, replace cooling fan motor and inspect warning system.

Duration:	Total hours	170	Theory	34	Practical	136
------------------	--------------------	------------	---------------	-----------	------------------	------------

Learning Unit	Learning Outcomes	Learning Elements	Duration	Materials (Tools & Equipment) Required	Learning Place
LU1. Repair Self-Starter	• Identify tools and equipment • Check the self-starter relay • Check self- starter switch contacts (cut-out) • Check starter loose connections • Check self- starter armature • Check starter field coil for short circuit	• Describe functions of self-starter and its components	4 hours Theory 20 hours Practical	• Self-starter • Multi meter • Tool kit	Class Room and workplace

	• Check drive system of self-gear • Check self- starter bushes				
LU2. Replace faulty parts of main alternator	• Select tools and equipment • Replace carbon-bushes • Replace of self-excitation system • Replace Automatic Voltage Regulator (AVR) • Replace alternator terminal block (connection plate)	• Describe various types of main alternator (statically and dynamically induced EMF) • Describe function Automatic Voltage Regulator (AVR) • Describe functions of various main alternator parts	6 hours Theory 24 hours Practical	• Main alternator • Carbon brushes • Diodes • AVR • Tool kit	Class Room and workplace
LU3. Change gauges on display panel	• Identify tools and equipment • Replace temperature gauge • Replace oil pressure gauge • Replace AC Ampere meter • Replace DC charging gauge • Replace revolution per minute (RPM) meter • Replace AC volt meter • Replace frequency meter • Replace hour meter	• Describe replacement techniques of various gauges on display panel	4hours Theory 20 hours Practical	• Temperature gauge • Oil pressure gauge • AC Ampere meter • DC charging gauge • Revolution per minute (RPM) meter • AC volt meter • Frequency meter	Class Room and workplace

				• Hour meter • Tool kit	
LU4. Repair/replace Governor	• Identify tools and equipment • Remove fuel pipe lines • Remove timing plate • Remove fuel injection pump gear • Repair Governor • Install Governor	• Describe repair/replacement techniques of Governor components	6 hours Theory 24 hours Practical	• Governor • Tool kit	Class Room and workplace
LU5. Replace warning sensors	• Select tools and equipment • Remove and replace temperature sensors • Remove and replace oil pressure sensors • Remove and replace fuel sensors	• Describe replacement techniques of various warning sensors	6 hours Theory 16 hours Practical	• Tool kit	Class Room and workplace
LU6. Replace main alternator bearings	• Arrange tools and equipment • Dismantle main alternator • Pull out the bearings	• Describe replacement techniques of main alternator bearings	4 hours Theory 18 hours Practical	• Main alternator • Bearing Puller • Bearing	Class Room and workplace

		• Install bearings			• Tool kit	
LU7. Change plugs	Spark	• Arrange tools and equipment • Remove the spark plug cables • Remove spark plugs • Install spark plugs	• Describe replacement techniques of change spark plugs	4 hours Theory 14 hours Practical	• Spark plugs • Spark plug spanner	Class Room and workplace

GENERATOR MECHANIC



© TVET SSP

Module-9

CBT Curriculum

National Vocational Certificate Level 3

Version 1 - November, 2019

Module 9: Install new Generator

Objectives: After completing this learning module, the learner will be able to maintain supply in accordance with the requirements of industry regulations and established procedures. It encompasses the operation, connection and disconnection as well as assessing load assuring the appropriateness of all generators for the required outcome.

Duration:	Total hours	70	Theory	17	Practical	53
Learning Unit	Learning Outcomes	Learning Elements	Duration	Materials (Tools & Equipment) Required	Learning Place	
LU1. Adopt manufacture procedure	• Identify Gross weight of the generator • Identify foundation holes of generator as per Manufacturer • Ensure holes in concrete base	• Knowledge about generator installation manual	2 hours Theory 8 hours Practical	• Generator • Multi meter	Class Room and workplace	
LU2. Interpret foundation drawing	• Measure distance between foundation holes • Measure diameters of foundation holes • Compare diameters of foundation bolts as per specification	• Understand foundation drawing • Knowledge about the measurement of holes and round bolts	3 hours Theory 8 hours Practical	• Foundation drawing • Foundation Generator	Class Room and workplace	

LU3. Hoist generator	• Locate loading hooks of generator • Secure ropes and balance generator • Place generator on concrete foundation with chain pulley	• Knowledge about the steel ropes/cotton ropes • Describe lifting techniques of generator	3 hours Theory 8 hours Practical	• Chain pulley • Tool kit	Class Room and workplace
LU4. Level generator	• Put foundation bolts in foundation holes • Level generator length and width wise • Fill holes in base with concrete	• Knowledge about the leveling techniques • Knowledge about mixing of concrete ratio	3 hours Theory 8 hours Practical	• Chain pulley • Level meter • Tool box	Class Room and workplace
LU5. Distribute electrical load	• Estimate total electrical load	• Knowledge about the load calculation including conversion of	3 hours Theory	• Clamp on Meter	Class Room and workplace

	• Distribute load on each phase equally	KW to KVA and neutral balancing	8 hours Practical	• Multi meter • Electrical tool kit	
LU6. Install change over switch	• Mount change over switch/ATS on wall • Connect load side with changeover switch • Connect generator output with changeover switch • Connect external power source with changeover switch	• Describe types and functions of change over switch/ Automatic Transfer Switch (ATS) • Describe installation procedure of change over switch/ Automatic Transfer Switch (ATS)	2 hours Theory 8 hours Practical	• Change over switch/ATS • Rawal bolts • Electrical tool kit	Class Room and workplace
LU7. Connect Earthing	• Arrange tools and equipment • Ensure Earthing as per standards • Connect Earth Cable with Generator Body	• Know about the Earthing Materials • Describe Procedure of Earthing, Construction and Installation.	1 hour Theory 5 hour Practical	• 1. Earthing rod/ plates • 2. Earthing lead • 3. Earth continuity conductor • 4. Earthing mixture	Class Room and workplace

List of Tools and Equipment

Sr. No	A. Testing instruments	Quantity,24-25 students
1.	Volt meter	10
2.	Clamp on mater	10
3.	Phase sequence meter	10
4.	Pressure gauge (oil)	10
5.	vacuum gauge	10
6.	PH meter	10

7.	Growler	10
8.	Bench power supply (variable DC)	5
9.	Megger/insulation tester,	10
10.	Frequency meter	10
11.	Temperature mater	10
12.	Tachometer	10
13.	Watt meter	10
14.	Multimètre	10
15.	Power factor meter	10
Tools and Equipment		
1.	Timing light	5
2.	Engine analyzer	5 set
3.	Electronic Fuel Injection (EFI) engine diagnostic scanner	2
4.	Compression gauge	10
5.	Cylinder leakage tester	10
6.	Fuel injection test device	5
7.	Fuel injector pressure tester	5
8.	Glow plug analyzer	10
9.	Smoke diagnostic tool kit	10
10.	Heat gun	10
11.	Torque wrench	15
12.	Open end spanner set	15
13.	Combination spanner set	15
14.	Ring spanner set	15
15.	Socket box	15
16.	Adjustable screw wrench set	15
17.	Vice grip pliers	15
18.	Universal pliers	15
19.	Nose pliers	15
20.	Combination pliers	15
21.	Inside circlip pliers	15
22.	Outside circlip pliers	15
23.	Bearing puller inside	15
24.	Bearing puller outside	15

25.	Ring installer	15
26.	Ring remover	15
27.	Ridge remover	15
28.	C clamp	15
29.	Ring compressor	15
30.	Hammer set(steel)	15
31.	Hammer set (plastic/rubber)	15
32.	Allen key set	15
33.	Screw driver set (star, flat)	15
34.	Feeler gauge	15
35.	Micrometer	15
36.	Vernier caliper	15
37.	Winding machine	10
38.	Hydrometer	15
39.	Bench vise	10
40.	Hand hacksaw frame	25
41.	Scriber	25
42.	Scraper (triangular & flat)	25 set
43.	Surface gauge	10
44.	Surface plate	10
45.	Air blower	10
46.	Hand drill machine	10
47.	Oil cane	15
48.	valve re-facer machine	2
49.	Filter chain	25
50.	Oil drain plug spanner	25
51.	Spark plug spanner	25
52.	Hand grinder machine	5
53.	Tap and die set (inch & millimeter)	25 set
54.	Nipple forming set	25
55.	Tri square	25
56.	Hand file set	25
57.	Needle file set	25
58.	Cross cut chisel	25
59.	Flat chisel	25

60.	Round chisel	25
61.	Centre punch	25
62.	Pin punch set	25
63.	Insulation remover	25
64.	Thimble press	25
65.	Funnel	25
66.	Pipe wrench set	10
67.	Portable petrol and diesel generator	5
68.	Label maker (wire, tape, plastic)	10 Dozen
69.	Soldering iron (25W & 100 W)	15
70.	Lifts (scissor, Paper cutter)	25
71.	Air compressor with full accessoires	2
72.	Personale Protective Equipment	25
73.	High voltage gloves, (rubber and leather)	25
74.	Materials safety Data Sheets (MSDS)	25
75.	Temperature sensor	25
76.	Tool box (23 pieces)	25
77.	Tool belt (13 pieces)	25
78.	Silicone gun	25
79.	Heat sensor	25
80.	Oil pressure sensor	25
81.	RPM sensor/magnetic pickup	25
82.	Mallet	25
	Rawhide mallet	25
83.	Battery (200 Ah) and battery charger	2 each
84.	Hydraulic jack (portable, 200kg)	5
85.	AVR	10
86.	Fuel solenoid switch	10
87.	Tool trolley	5
LIST OF CONSUMABLE SUPPLIES		
1.	Spark plug	10 Dozen
2.	Atomizer nozzle	24

3.	Filter (air, oil, fuel, water)	10
4.	Lubricants	5 *4
5.	Overhauling kit	5
6.	Belts different sizes	50
7.	Bearings different sizes	50
8.	Radiator hose pipes	15
9.	Engine alternator foundation	15
10.	Bridge set/diode plates	25
11.	Enamel copper wire different SWG	5 KG each
12.	Insulation paper with different SWG	10 KG each
13.	Varnish	10 liters
14.	Wire sleeves different sizes	100 No. each
15.	Valve lapping stick	25
16.	Emery pastes	10 tin
17.	Emery paper different sizes	25 No. each
18.	Slip rings	10
19.	Carbon brushes different sizes	15 set each
20.	Insulation taps	200.No
21.	Cables (3/29, 7/29, 7/36, 4)	300 meter each
22.	Cables (7/44, 1/7/52, 7/64) etc.	300 meter each
23.	Flexible cable different sizes	200 meter each
24.	Multi core cables different sizes	100meter each
25.	Cotton tap	100 No.
26.	Flexible pipes	10
27.	Circuit breaker different rating	50
28.	Relays	25
29.	Selector switch	25
30.	Bulbs	50
31.	Fuses different rating	50 No. each
32.	Magnetic contactor different rating	5 No. each
33.	Penal box	5
34.	High tension lead	15 set
35.	High tension tap	15 set
36.	Soap	25 No

37.	Detergent etc.	25 No
38.	Cotton waste	10 Dozen

