Skill India
कौशल भारत - कुशल भारत

Directorate General of Training

सत्यमेव जयते

GOVERNMENT OF INDIA
MINISTRY OF SKILL DEVELOPMENT & ENTREPRENEURSHIP
DIRECTORATE GENERAL OF TRAINING

COMPETENCY BASED CURRICULUM

CERTIFICATE COURSE ON

DIESEL ENGINE ELECTRONICS DIAGNOSTIC TECHNICIAN

NSQF LEVEL- 5

SECTOR : AUTOMOTIVE

DIESEL ENGINE ELECTRONICS DIAGNOSTIC TECHNICIAN

Duration: 240 Hours

NSQF LEVEL - 5

(Version: 1.0)

Designed in 2020

Developed By

Ministry of Skill Development and Entrepreneurship

Directorate General of Training

Sectoral Trade Course Committee of Automotive Sector

&

CENTRAL STAFF TRAINING AND RESEARCH INSTITUTE

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1. COURSE INFORMATION

1.1 GENERAL

During the six weeks duration "Diesel Engine Electronics Diagnostic Technician" trade, a candidate is trained on subjects - Professional Skill, Professional Knowledge. The practical skills are imparted in simple to complex manner & simultaneously theory subject is taught in the same fashion to apply cognitive knowledge while executing task. The broad components covered under Professional Skill subject are as below:

In this course, Trainee will learn about the emerging new trends in engine repair, including advanced engine diagnostics, repair methods, hardware used in the automotive engine diagnosis and fuel delivery systems. This is a hands-on intensive course, which covers the diagnostic tools and equipment to repair the automotive diesel engine. Trainees will learn skills to diagnosis, repair, rebuild, and install parts to repair the engine utilizing the knowledge and competencies learned in the previous Training.

1.2 PROGRESSION PATHWAYS

- Progression for this up-skilling programme will remain same as that of base trades for which this course is designed.
- Can join industry as Technician and will progress further as Senior Technician, Supervisor and can rise up to the level of Manager.
- Can become Entrepreneur in the related field.

1.3 COURSE STRUCTURE

Table below depicts the distribution of training hours across various course elements during a period of 6 weeks: -

S No.	Course Element	Notional Training Hours
1.	Professional Skill (Trade Practical)	180
2.	Professional Knowledge (Trade Theory)	60
	Total	**240**

1.3 ASSESSMENT & CERTIFICATION

The trainee will be tested for his skill, knowledge and attitude during the period of course through formative assessment and at the end of the training programme through summative assessment as notified by the DGT from time to time.

a) The Continuous Assessment (Internal) during the period of training will be done by Formative Assessment Method by testing for assessment criteria listed against learning outcomes. The training institute has to maintain an individual trainee portfolio as detailed in assessment guideline.

b) The pattern and marking structure is being notified by DGT from time to time. The learning outcome and assessment criteria will be the basis for setting question papers for final assessment.

c) Assessment will be evidence based comprising the following:

- Job carried out in labs/workshop/Field
- Answer sheet of assessment
- Viva-voce
- Participation and punctuality

Evidences of internal assessments are to be preserved until forthcoming Block examination for audit and verification by examining body.

d) The minimum pass percentage for skill test is 60%.

2. JOB ROLE

Brief description of Job roles:

This course is designed for Trainees who interested in vehicle diagnosing field. As on today modern vehicles are equipped with so many electronic control components which are connected to the vehicle computer.

This course enables Trainee to understand in depth about the functioning of all sensors, control modules and actuators. This ADD ON Courses includes inspecting and repairing of sensors, control modules, actuators with latest scan tool and other diagnosing equipment. After the completion of course Trainees becomes an Automobile Diesel Engine electronics diagnostic specialist.

3. GENERAL INFORMATION

Name of the Trade	**DIESEL ENGINE ELECTRONICS DIAGNOSTIC TECHNICIAN**
Trade Code	DGT/8009
Reference NCO - 2015	7233.0400 –Mechanic, Diesel Engine
NSQF Level	Level 5
Duration of Craftsmen Training	240 Hours
Entry Qualification	Passed 10th Class Examination with CTS course in MMV & MD trade.
Unit Strength (No. of Student)	16
Space Norms	56 Sq. m (Including Parking)
Power Norms	4.5 KW
Instructors Qualification	Degree in Automobile/ Mechanical Engineering from recognized Engineering College/ university with one-year experience in the relevant field. **OR** Diploma in Automobile/ Mechanical Engineering from recognized board of technical education with two-year experience in the relevant field. **OR** NTC/NAC passed in the Trade of "Mechanic Motor Vehicle"/Mechanic Diesel with three years post qualification experience in the relevant field.
List of Tools and Equipment	As per Annexure – I

Distribution of training on hourly basis: (Indicative only)

Total hours/ Week	Trade practical	Trade theory
40	30	10

4. LEARNING OUTCOME

Learning outcomes are a reflection of total competencies of a trainee and assessment will be carried out as per the assessment criteria.

4.1 LEARNING OUTCOMES

1. Observe Safety precautions while Working on engine
2. Comply with environment regulation and housekeeping
3. Generate Diagnostic report using appropriate tools and equipment while observing related safety precautions.
4. Analyze electronic components and study of digital instrument cluster of vehicle
5. Diagnose and Rectify errors of CRDi system
6. Perform on board, diagnosis using scan tool, Testing of sensors & Testing of actuators

SYLLABUS – DIESEL ENGINE ELECTRONICS DIAGNOSTIC TECHNICIAN			
Duration: 240 Hours			
Duration Weeks	**Reference Learning outcome**	**Professional Skills (Trade Practical)**	**Professional Knowledge (Trade Theory)**
Professional skills-30 Hrs Professional Knowledge-10 Hrs	Generate Diagnostic report using appropriate tools and equipment while observing related safety precautions.	1. Demonstration on use of fire extinguisher 2. Identification of Read customer complaint job card, Interpreted service manual data, circuit diagram and Laying out results in the standard format 3. Perform stripping of wires and joining wires using soldering Iron 4. Construction of simple electrical circuits 5. Checking of a electrical Circuit, Voltage drop, Current, Resistance, continuity test for open and short circuit using Multimeter. 6. Identify and location of fuse box, Checking of fuses, jumper wires, fusible links, and circuit breakers. 7. Check electrical circuit with a test lamp. 8. checking of Battery Performance 9. Use of Oscilloscope and interpretation of Waves	• Safety precautions is to be followed while Working on engine. • Fire safety and types of fire extinguisher used. • Electrical safety. Safe working practices. Proper customer relation procedures. • Diagnostic terminologies-Fault, symptom, Diagnostics, logical procedure and report. Preparation of report. • Use the three Cs (concern, cause, and correction) to diagnose the vehicle problem. • Types of data necessary for diagnostic Tools and equipments used for engine diagnostics-Hand tools, Multimeter, Oscilloscope, Scanners/fault code readers, Exhaust gas analyser. • Review of Electrical, Principles, OHM's Law-Power, Voltage, Current, resistance, Serious and

		forms 10. Connect the scan tool with vehicle data link connector and study the scan tool operations.	Parallel circuit Reading of Electrical wiring circuits and symbols, Stripping wire insulation • Generic Electrical testing procedure, Battery testing, Fuse rating and types of Fuse, wiring harness- Voltage drop test, short circuits, Open circuit, Continuity test, conductor Resistance, Ballast resistor, Relays and Switches, On and OFF load tests-checking of current and voltage of circuits, • Safety precaution to be followed during Electrical checking. • Wiring colour codes and sizes related to engine wiring couplers. • Resistors in Series circuits, Parallel circuits and Series-parallel circuits, Capacitors and its applications. Capacitors in series and parallel. • Use of service manual wiring diagram for troubleshooting.
Professional skills-30 Hrs Professional Knowledge-10 Hrs	Analyze electronic components and study of digital instrument cluster of vehicle	11. Test power and signal connectors for continuity 12. Test different type of Diodes 13. Carryout NPN & PNP Transistors for its	• Basic electronics: Description of Semiconductors, Solid state devices- Diodes, Transistors, Thyristors, Uni Junction Transistors (

		functionality 14. Construct and test simple logic circuits OR, AND & NOT and Logic gates using switches. 15. Start engine and Check the warning lights of Instrument cluster.	UJT), Metal Oxide Field Effect Transistors (MOSFETs), Integrated circuits • Logic gates-OR, AND & NOT and Logic gates using switches. • Brief description of microprocessor • Study of various gauges/instrument on a dash board of a vehicle-Speedometer, Tachometer, Odometer and Fuel gauge, and Indicators such as oil pressure warning light, coolant low level warning light water on fuel warning light, vehicle service warning light, immobilizer warning light and an Engine-malfunction light.
Professional skills-30Hrs Professional Knowledge-10 Hrs	Diagnose and Rectify errors of CRDi system	16. Identify and locate the components of CRDI System 17. Trace out the Engine control system electrical circuit 18. Carryout removal and installation of Engine Control Module (ECM) (follow the Exercise of procedure for registration of ignition key)	• Latest development on Diesel Engines. Vehicle emissions. Emission control norms - Bharat stage I to VI and Euro I to VII . • Electronic diesel control-Electronic Diesel control systems, Common Rail Direct Injection (CRDI) system- • Layout of CRDI Diesel Engine, Components of

		19. Register for ECM replacement procedure 20. Register for Fuel Injector Diesel vehicle	CRDI Diesel Engine and its working-High pressure pump, low pressure pump, common rail, Fuel injectors-solenoid and Piezo-crystal hydraulically actuated electronically controlled unit injector (HEUI) diesel injection system. • Glow plugs, Turbo charger and Variable geometric Turbo charger. Engine control system electrical circuit diagram
Professional skills-30Hrs Professional Knowledge-10 Hrs	Perform onboard, diagnosis using scan tool, Testing of sensors	21. Identify the terminal arrangement of ECM connector 22. Perform On board diagnosis using scan tool -Connecting of scan tool with data link connector, Reading of diagnostic trouble code, Reviewing of Engine freezing data and live data's, Deletion of error code memory 23. Inspect On-Vehicle for Crankshaft Position sensor (CKP) performance, Removal and Installation of Crank position sensor(CKP) and test the circuit. 24. Inspect On-Vehicle for Cam Position sensor (CMP) performance,	• On board Diagnostics system (OBD),OBD-II and EOBD,OBD Cycles, Malfunction indication lamp • Diagnostics trouble codes (DTC-P Codes, B Codes, C Codes,) • Data link connector and its pin configuration • Input and output of electronic control unit with respect to engine and emission control systems. • Electronic control Module (ECM) coupler pin configuration. • Engine problems and symptoms related to the engine electronics. • Scan tool data

		Removal and Installation of Cam position sensor(CMP) and test the circuit. 25. Inspect On-Vehicle for Mass Air Flow sensor (MAF) performance, Removal and Installation of Mass Air Flow sensor(MAF)and test the circuit. 26. Inspect On-Vehicle for Coolant Temperature Sensor (CTS) performance, Removal and Installation of Coolant Temperature sensor(CTS) and test the circuit 27. Inspect On-Vehicle for Throttle Position sensor (TPS) performance, Removal and Installation of Throttle body assembly and test the circuit 28. Inspect On-Vehicle for Accelerator Pedal Position sensor (APP) performance, Removal and Installation of Accelerator pedal position sensor(APP) and test the circuit 29. Inspect On-Vehicle for Knock sensor performance, Removal and Installation of Knock	description and standard reference values on engine normal running condition • Working Principles of Sensors - Crank position sensor(CKP), - Cam position sensor(CMP), - Coolant Temperature sensor(CTS), - Throttle Position Sensor(TPS), - Accelerator pedal position sensor(APP), - Knock sensor, - Inlet air temperature sensor(IAT), - Mass air flow sensor(MAF), - Boost pressure sensor, - Fuel temperature sensor, - Rail pressure sensor, - Water on fuel sensor, - NOx sensor, - Exhaust gas temperature sensors, - Differential pressure sensor

		sensor and test the circuit 30. Inspect On-Vehicle for Inlet Air Temperature sensor (IAT) performance, Removal and Installation of Inlet air temperature sensor(IAT) and test the circuit 31. Inspect On-Vehicle for Boost pressure sensor (BPP) performance, Removal and Installation of Boost Pressure sensor(BPP) and test the circuit 32. Inspect On-Vehicle for Fuel Temperature sensor (FTS) performance, Removal and Installation of Fuel temperature sensor and test the circuit 33. Inspect On-Vehicle for Fuel Pressure sensor (FPS) performance ,Removal and Installation of Fuel Pressure sensor and test the circuit 34. Inspect On-Vehicle for Water on Fuel sensor performance, Removal and Installation of Water on Fuel sensor and test the circuit 35. Inspect On-Vehicle for NOx sensor	

		performance, Removal and Installation of NOx sensor and test the circuit 36. Inspect On-Vehicle for Exhaust gasPre Temperature sensor performance, Removal and Installation of exhaust gasPre temperature sensor and test the circuit 37. Inspect On-Vehicle for Exhaust gas post Temperature sensors performance, Removal and Installation of Exhaust gas post temperature sensor and test the circuit 38. Inspect On-Vehicle for Differential Pressure sensor performance, Removal and Installation of differential pressure sensor and test the circuit	
Professional skills-30Hrs Professional Knowledge-10 Hrs	Perform on board, diagnosis using scan tool, Testing of sensors & Testing of actuators	39. inspect fuel pump relay, starting motor control relay, main relay and fuel heater relay 40. Trace and test of Fuel metering unit 41. Trace and test of Fuel injectors circuit 42. Trace and test of Fuel pressure regulator circuit 43. Carryout removal and	• Working principles of Actuators • Exhaust gas re-circulation solenoid valve(EGR), • SCR doser unit, • Fuel injectors, • Fuel metering unit, • Fuel pressure regulator, • Air control valve,

		installation of Glow plug control module 44. Trace and test of SCR doser circuit 45. Trace and test of EGR valve circuit 46. Trace and test of Radiator cooling fan circuit 47. Trace and test of Engine oil pressure circuit	• VGT control solenoid, • Glow plug relay • Main relay and Fuel pump relay. • Emission control system-EGR system • Selective catalytic reduction system(SCR), • Diesel Oxidation catalytic(DOC), • Diesel particulate filter(DPF) • Radiator cooling fan control system. • Engine Oil pressure circuit
Examination			

7. ASSESSMENT CRITERIA

LEARNING OUTCOME	ASSESSMENT CRITERIA
1. Observe Safety precautions while Working on engine	Follow and maintain procedures to achieve a safe working environment in line with occupational health and safety regulations and requirements, and according to policy.
	Recognize and report all unsafe situations according to policy.
	Identify and take necessary precautions on fire and safety hazards and report according to work policy and procedures.
	Identify, handle and store/ dispose-off dangerous goods and substances according to policy and procedures following safety regulations and requirements.
	Identify and observe policies and procedures with regard to illness or accident.
	Identify safety alarms accurately.
	Report supervisor/ competent of authority in the event of accident or sickness of any staff and record accident details correctly according to accident/injury procedures.
	Identify and observe evacuation procedures according to site policy.
	Identify Personal Productive Equipment (PPE) and use the same as per related working environment.
	Identify basic first-aid and use them under different circumstances.
	Identify different fire extinguisher and use the same as per requirement.
2. Comply with environment regulation and housekeeping	Identify environmental pollution & contribute to the avoidance of instances of environmental pollution.
	Deploy environmental protection legislation & regulations.
	Take opportunities to use energy and materials in an environmentally friendly manner.
	Avoid waste and dispose waste as per procedure.
	Their applications will be assessed during execution of assessable outcome.
3. Generate Diagnostic report using appropriate tools and	Plan work in compliance with standard safety norms.
	Ascertain and select tools and materials for the job and make

equipment while observing related safety precautions.	this available for use in a timely manner.
	Identify the different vehicle engine specification data and information.
	Identify and location of fuse box, Checking of fuses, jumper wires, fusible links, and circuit breakers
	Demonstrate of Oscilloscope and interpretation of Waves forms
4. Analyze electronic components and study of digital instrument cluster of vehicle	Test different type of Diodes
	Carryout NPN & PNP Transistors for its functionality
	Demonstrate of logic gates using switches
	Identify & Check the function of Mal Indication Lamp (MIL), Oil pressure warning light, charge indication light, Temperature warning light/gauge, Seat belt warning light, ABS warning light, Parking light, fuel level gauge.
5. Diagnose and Rectify errors of CRDi system	Identify and locate the components of CRDi System
	Trace out the Engine control system electrical circuit
	Carryout removal and installation of Engine Control Module (ECM)
	Register for ECM replacement procedure
	Register for Fuel Injector Diesel vehicle
6. Perform on board, diagnosis using scan tool, Testing of sensors & Testing of actuators	Work in compliance with standard Norms
	Carry out their Removal and replacement Activities by reviewing • Vehicle technical data • Removal and Replacement procedure legal requirement
	Use of technical information to support over hauling of CRDi engine
	Select Material tools and equipment for the job and make this available for use in timely manner
	Perform all overhauling of CRDi as per standard specification and tolerance
	Manufacture's approved overhauling method

	Use testing method that comply with manufactured required
	Identify the terminal arrangement of connector
	Perform on board diagnosis
	Connect and read of scan tool
	Inspecting of all sensor
	Inspecting of all actuator
	Rectifying the trouble as per the standard norms

ANNEXURE-I

LIST OF TOOLS & EQUIPMENT			
DIESEL ENGINE ELECTRONICS DIAGNOSTIC TECHNICIAN			
S No.	**Name of the Tools and Equipment**	**Specification**	**Quantity**
A. TRAINEES TOOL KIT			
1.	Allen Key set of 12 pieces	2mm to 14mm	5+1 Nos
2.	Caliper inside with spring	15 cm	5+1 Nos
3.	Calipers outside with spring	15 cm	5+1 Nos
4.	Center Punch.	10 mm. Dia. x 100 mm	5+1 Nos
5.	Dividers with spring	15 cm	5+1 Nos
6.	Electrician Screw Driver	250mm	5+1 Nos
7.	Hammer ball peen with handle	0.5 kg	5+1 Nos
8.	Hands file for Second cut flat	20 cm.	5+1 Nos
9.	Philips Screw Driver set of 5 pieces	Philips Screw Driver set of 5 pieces	5+1 Nos
10.	Pliers combination	20 cm.	5+1 Nos
11.	Screw driver Blade	20cm.X 9mm	5+1 Nos
12.	Screw driver Blade	30 cm. X 9 mm.	5+1 Nos
13.	Scriber	15 cm	5+1 Nos
14.	Spanner D.E. set of 12 pieces	6mm to 32mm	5+1 Nos
15.	Spanner, ring set of 12	6 to 32 mm. (metric)	5+1 Nos
16.	Spanners socket with speed handle, T-bar, ratchet and universal set of 28 pieces with box	up to 32 mm	5+1 Nos
17.	Steel rule	30 cm inch and metric	5+1 Nos
18.	Wire cutter & Stripper		5+1 Nos
19.	Multimeters		5+1 Nos

B.SHOP OUTFIT & MEASURING INSTRUMENTS			
1.	Adjustable spanner (pipe wrench)	350 mm	4 nos.
2.	Chain Pulley Block capacity with tripod stand	3 ton	1 no.
3.	Cleaning tray	45x30 cm.	2 nos.
4.	Grease Gun	-	2 nos.
5.	Hacksaw frame	adjustable 20-30 cm	10 nos.
6.	Hammer Ball Peen	0.75 Kg	2 nos.
7.	Hammer Mallet	-	4 nos.
8.	Hammer Plastic	-	4 nos.
9.	Hand vice	Up to 37 mm	2 nos.
10.	Oil can	0.5/0.25 liter capacity	4 nos.
11.	Pliers flat nose	15 cm	4 nos.
12.	Circlip plier Internal & External	150 mm &200 mm(Two each)	8 nos
13.	Steel measuring tape in a case	10 meter	2 nos.
14.	Torque wrenches	5-35 Nm, 12-68 Nm & 50-225 Nm	1 each
15.	Glow plug tester		1no
16.	Test lamps for continuity test	-	4 nos.
17.	Electric soldering Iron	25 watts,60 watts	2 nos each
18.	Battery Charger		1 no
19.	Battery Tester (load tester)		1 no
GENERAL INSTALLAION AND MACHINERIES			
20.	Air conditioned CRDI Vehicle in running condition -LMV	New vehicle with CRDI engine, 04 strokes, 04 cylinders, BS-IV, fitted with air condition.	1 no.
21.	Multi Scan Tool To scan Engine, ABS & EBD, AT, SRS, Body Control and immobilizer	Should perform automotive sensor simulation test specially designed to diagnose and simulate vehicle sensor faults for sensors like MAP sensor,	1 no
22.	Oscilloscope with Test leads	100 MHZ with CAN BUS Inbuilt	1 no

NOTE: If Above Tools, Equipments and general machineries are available with MMV Trade running on the ITI the same may be utilized.

ANNEXURE-II

The DGT sincerely acknowledges contributions of the Industries, State Directorates, Trade Experts, Domain Experts and all others who contributed in designing/ revising the curriculum. Special acknowledgement is extended by DGT to the following expert members who had contributed immensely in this curriculum.

List of Expert Members contributed/ participated for finalizing the course curriculum of DIESEL ENGINE ELECTRONICS DIAGNOSTIC TECHNICIAN .

S No.	Name & Designation Shri/Mr./Ms	Organization	Remarks
1.	Sh. K. Srinivasa Rao, Director,	RDSDE Tamil Nadu	STCC Convener
2.	Sh. C. S. Murthy, JD,	CSTARI, Kolkata	Member
3.	Sh. Nirmalya Nath, DD,	NIMI, Chennai	Member
4.	Sh. Sankar R- Head Service Training	Ashok Leyland	Expert
5.	Sh. Anurag Saxena - Training Delivery Manager(Service Training)	Ashok Leyland	Expert
6.	Sh. Suresh Babu- Head DTI	Ashok Leyland Driver Training Institute, Namakkal	Expert
7.	Sh. P Mohammed Ali- Training Head	Ashok Leyland Driver Training Institute, Namakkal	Expert
8.	Sh.V.Krishna Shankar	Retd.DGM-CSR, Ashok Leyland	Expert
9.	Sh.C.Prakash	Retd.GM-Product Development, Ashok Leyland	Expert
10.	Sh.Ajay Dhuri	Divisional Manager, Tata Motors Limited	Expert
11.	Sh.Sathish	South Head Servicing, HYUNDAI MOTOR INDIA	Expert
12.	Sh.Abhijit Mandal	Dy. Director Technical, NATRIP	Expert
13.	Sh.Arun Lakshman	Industry expert (Road Transportation), ASDC	Expert
14.	Sh.Dharmendra Sharma	Head – Industry Alliance and World skills, ASDC	Expert
15.	Sh.Venkat raman	Manager Ramkay TVS, Adyar	Expert
16.	Sh.karthik Johan	Country head auto electrical, Mahindra electric	Expert

17.	Sh.Sathish	Senior Manager-Customer care, Mahindra Electric	Expert
18.	Sh.Sankar	GM, BMW India	Expert
19.	Sh.P. Thangapazham	DGM Training, DAIMLER INDIA COMMERCIAL VEHICLE PVT. LTD.	Expert
20.	Sh.Awadhut Vedpathak	Service head, Piaggio Vehicles Pvt. Ltd.	Expert
21.	Sh. Rajan	Managing Director, Cuuro motors	Expert
22.	Sh. Shekhar Malani	MD, Devise Electronics Pvt Ltd	Expert
23.	Sh.Khurana	MARURI SUZUKI INDIA LTD.	Expert
24.	Sh..Viswanathan.D	Training Head, Lanson Toyota	Expert
25.	Sh.Arulmozhivarman	Technical Head,Lanson Toyota	Expert
26.	Sh. C. Yuvaraj, DD,	NSTI, Howrah	Member
27.	Sh. G. Venkatesh, DD,	RDSDE, Bangalore	Member
28.	Sh. Aman Kumar, AD,	RDSDE Tamil Nadu	Member
29.	Sh. R. Rajesh kanna, TO,	NSTI, Chennai	Member
30.	Sh. N. Ramesh Kumar, TO,	NSTI Chennai	Member
31.	Sh. S. Shankar, TO,	NSTI Chennai	Member
32.	Sh. Mane,V.I	NSTI Mumbai	Member
33.	Sh,A. Duraiswamy, ATO	Govt ITI, Coonor	Member
34.	Sh.K. Maharajan,JTO,	Govt ITI Radhapuram	Member
35.	Sh.A. Muthuvel,ATO,	Govt.ITI, Nagapattinam	Member