Preface to Latest (NSQF Level-3.5 Compliant) Edition

Directorate General of Training (DGT) under the Ministry of Skill Development and Entrepreneurship (MSDE) is the apex body in the country as regards planning, formulating and prescribing norms, standards, procedures and guidelines in respect of various vocational training schemes of which Craftsmen Training Scheme (CTS) implemented in ITI's is the most important. Prescribing well designed curriculum and putting in place appropriate assessment and certification procedure are among the vital aspects of vocational training.

Mechanic Diesel (Sector: Automotive) is one among the top few popular ITI designated trades and is of one-year duration. DGT issued latest revised version (version 2.0) of the syllabus. The main significant change has been that NSQF level for this trade has been revised from 3 to 3.5. In view of the fact that training in ITI's is primarily practical-oriented, major part of training time (70%) is devoted to practical. In consideration of this important part of training, 150 hours has now been set aside for on-the-job training (OJT) / group project.

This book fully covers the professional skill (trade practical) part of the latest syllabus. Besides incorporating relevant skill information, each practical exercise comprises of necessary information relating to objective, material, tools, equipment and instruments required, the job sequence etc. Besides practical exercises relating to all aspects of Diesel Engine per se, adequate number of exercises concerning allied topics like Marking & Measuring, Fastening & Fitting Operations, Electric &Electronic Circuits, Arc & Gas Welding, Hydraulic & Pneumatic Circuits etc. have also been included as prescribed in the syllabus.

An added feature is that a set of 32 most important practical jobs, as often appeared in All India Trade Tests, has been compiled for the benefit of trainees to familiarise themselves with and practice such jobs and thus prepare well for the final trade test.

We sincerely hope that trainees will find this book very much helpful to adjust with the latest changes in syllabus related to Mechanic Diesel Trade Practical. We would welcome suggestions for further improvement of this book in its subsequent editions.

— Author

Contents

Chapter **Page No.**

NSQF (Level-3.5) Compliant Competency based Curriculum Mechanic Diesel Trade Practical (Latest Syllabus) ..... (ix–xii)

Chapter 1: Tools, Equipment and Machinery 3–52

Chapter 2: Safe Working Practices 53–57

Exercise 1: Identifying Safety Gear / Personal Protective Equipment 53
Exercise 2: Using Fire Extinguisher 55
Exercise 3: Applying Energy Saving Tips In Electricity Usage In The ITI 57

Chapter 3: Marking and Measuring 58–93

Exercise 1: Using Marking Aids For Marking 58
Exercise 2: Measuring Wheelbase of A Vehicle 62
Exercise 3: Measuring Valve Spring Tension Using Spring Tension Tester .....
Exercise 4: Removing Wheel Lug Nuts Using Air Impact Wrench 67
Exercise 5: Measuring Cam Height, Crankshaft Journal And Crank Pin Diameter, Valve Stem Diameter, Piston Diameter, Piston Pin Diameter 69
Exercise 6: Measuring Height of Rotor of An Oil Pump With Depth Gauge 72
Exercise 7: Measuring Valve Spring Free Length 75
Exercise 8: Measuring Cylinder Bore 77
Exercise 9: Measuring Connecting Rod Bore 78
Exercise 10: Measuring Crankshaft End Play 83
Exercise 11: Measuring Crankshaft Run-out 84
Exercise 12: Measuring Inside Diameter of Valve Guide 85
Exercise 13: Checking Flatness of Cylinder Head 86
Exercise 14: Checking End Gap of Piston Ring 88
Exercise 15: Measuring Piston-to-cylinder Gap 89
Exercise 16: Checking Engine Manifold Vacuum 91
Exercise 17: Checking Air Pressure In Vehicle Tyre 92

Chapter 4: Fastening and Fitting Operations 94–143

Exercise 1: Checking Nuts And Bolts of Connecting Rod 94
Exercise 2: Removing Stud / Bolt From Blind Hole 95
Exercise 3: Using A Hacksaw 97
Exercise 4: Using A Chisel 99
Exercise 5: Sharpening A Chisel 102
Exercise 6: Sharpening Centre Punch And Scriber 104
Exercise 7: Hacksawing And Filing 106
Exercise 8: Performing Soldering 108
Exercise 9: Performing Brazing 110
Exercise 10: Making A Gasket 112
Exercise 11: Drilling Clear and Blind Holes 114
Exercise 12: Observing Safety Precautions While Using A Drilling Machine 118
Exercise 13: Re-sharpening A Twist Drill 119
Exercise 14: Tapping Clear And Blind Holes 122
Exercise 15: Cutting Threads on A Bolt / Stud 126
Exercise 16: Reaming A Hole 127
Exercise 17: Scraping A Surface 130
Exercise 18: Making Rectangular Tray 133

Exercise 19: Bending A Pipe By Hot Method 135
Exercise 20: Bending A Pipe By Cold Method 137
Exercise 21: Soldering Copper Pipes 140
Exercise 22: Brazing The Pipes 142

Chapter 5: Electrical and Electronic Circuits 144–187

Exercise 1: Joining The Wires Using Soldering Iron 144
Exercise 2: Measuring Voltage, Current And Reistance With Multimeter 146
Exercise 3: Making Continuity Test For Fuses And Jumper Wires 150
Exercise 4: Verifying Ohm's Law 153
Exercise 5: Performing Voltage Drop Test 156
Exercise 6: Cleaning Lead Acid Battery Terminals 161
Exercise 7: Topping Up Lead Acid Battery 163
Exercise 8: Testing Battery With Hydrometer 165
Exercise 9: Charging The Battery 168
Exercise 10: Constant Current Method 170
Exercise 11: Constant Voltage Method 171
Exercise 12: Parasitic Battery Drain 172
Exercise 13: Jump Starting 173
Exercise 14: Checking Solenoid Switch 174
Exercise 15: Checking Relay In Horn Circuit 175
Exercise 16: Identify Different Types Of Diodes 177
Exercise 17: Identify Pnp And Npn Transistors 182
Exercise 18: Constructing 'Or' Logic Gate Circuit 184
Exercise 19: Constructing 'And' Logic Gate Circuit 186
Exercise 20: Constructing 'Not' Logic Gate Circuit 187

Chapter 6: Arc and Gas Welding 188–205

Exercise 1: Making Straight Beads, Butt Joint, Lap Joint, T-joint By
Exercise 2: Setting Up Oxy-acetylene Welding Plant 196
Exercise 3: Depositing Fusion Run By Gas Welding Process Without Using Filler Wire In Flat Position 202
Exercise 4: Depositing Fusion Run By Gas Welding Process Using Filler Wire In Flat Position 203
Exercise 5: Welding Closed Square Butt Weld By Oxy-acetylene Gas Welding 204

Chapter 7: Hydraulics and Pneumatic Circuits 206–218

Exercise 1: Performing Liquid Penetrant Test 206
Exercise 2: Performing Magnetic Particle Test 209
Exercise 3: Identifying Clutch Components On A Vehicle 212
Exercise 4: Tracing Hydraulic Power Steering System 214
Exercise 5: Tracing Hydraulic Brake System 215
Exercise 6: Identifying Components In Air Brake System 218

Chapter 8: Vehicle Specifications 219–227

Exercise 1: Identifying Different Types Of Vehicles 219
Exercise 2: Demonstration Of Vehicle Specification Data 222
Exercise 3: Identifying Vehicle Information Number (Vin) 226

Chapter 9: Service Station Equipment 228–230

Exercise 1: Identifying Garage, Service Station Equipment 228

Chapter 10: Dismantling and Assembling Diesel Engine 231–246

Exercise 1: Identifying Parts Of Internal Combustion Engine 233

Exercise 2: Starting And Stopping Of Diesel Engine 237
Exercise 3: Dismantling And Assembling Diesel Engine 240

Chapter 11: Overhauling Engine Parts 247–295

Exercise 1: Overhauling Cylinder Head Assembly 247
Exercise 2: Overhauling Rocker Arm Assembly 252
Exercise 3: Removing Valves From Cylinder Head 254
Exercise 4: Checking Cylinder Head For Warpage 256
Exercise 5: Adjusting Valve Tappet Clearance (4-cyinder / 6-cylinder Engine) 258
Exercise 6: Overhauling Piston And Connecting Rod Assembly 261
Exercise 7: Removing And Installing Oil Pan 267
Exercise 8: Overhauling An Oil Pump 269
Exercise 9: Removing And Installing Connecting Rod Bush 272
Exercise 10: Removing And Installing Piston Rings 274
Exercise 11: Overhauling Crankshaft 276
Exercise 12: Removing Harmonic Balancer / Damper 282
Exercise 13: Measuring Crankshaft Journal For Wear, Taper And Ovality 283
Exercise 14: Removing And Checking Camshaft Assembly 285
Exercise 15: Overhauling Cylinder Block 288
Exercise 16: Checking Cylinder Bore 290
Exercise 17: Measuring Compression Pressure 292

Chapter 12: Testing Cooling and Lubrication Systems 296–313

Exercise 1: Checking And Topping Up Coolant 296
Exercise 2: Testing Cooling System Pressure 299
Exercise 3: Servicing Radiator 300
Exercise 4: Testing The Thermostat Valve 304
Exercise 5: Overhauling Water Pump And Refitting 306
Exercise 6: Changing Engine Oil 308
Exercise 7: Servicing of Air Cleaner (Dry Type) 310
Exercise 8: Servicing of Air Cleaner (Wet Type) 311

Chapter 13: Testing Intake and Exhaust Systems 314–320

Exercise 1: Overhauling Turbocharger 314
Exercise 2: Servicing Inlet Manifold, Exhaust Manifold, Silencer And Tail Pipe 318

Chapter 14: Servicing Fuel System 321–330

Exercise 1: Servicing Fuel Tank And Fuel Lines 321
Exercise 2: Servicing Fuel Filter 323
Exercise 3: Overhauling of Mechanical Fuel Pump 324
Exercise 4: Bleeding Fuel System 326
Exercise 5: Cleaning And Testing of Fuel Injector Nozzles 327
Exercise 6: Setting The Fuel Injection Pump Timing 329

Chapter 15: Overhauling Stationary Engine 331–332

Exercise 1: Starting The Engine And Adjusting Idling Speed With Pneumatic Governor 331

Chapter 16: Monitoring Emission 333–344

Exercise 1: Using Engine Exhaust Analyser 333
Exercise 2: Using Diesel Smoke Meter 335
Exercise 3: Checking The Evap Canister 337
Exercise 4: Checking Tank Pressure Control Valve 338
Exercise 5: Inspecting Evaporative (Evap) Canister Purge System With Use of Scan Tool 339
Exercise 6: Checking And Cleaning Positive Crankcase Ventilation (PCV) Valve 342
Exercise 7: Inspecting And Cleaning Egr Valve 344

Chapter 17: Overhauling Alternator and Starter Motor 345–348

Exercise 1: Overhauling And Testing Alternator 345

Exercise 2: Servicing The Starter Motor 347

Chapter 18: Troubleshooting 349–351

Exercise 1: Troubleshooting 350

Chapter 19: Project Work 352–355

Trade Practical Jobs 356