

## GROUP-29

### Mechanic/ Operator cum Mechanic

(Level- Matric+ ITI Diesel Mechanic/ Aircraft Mechanic etc.)

1) General awareness, Reasoning, Mathematics, Science, History including Haryana related history, current affairs, literature, Geography, Civics, Environment, Culture etc.- **(Weightage 20%)**

2) Computer terminology, Fundamentals, word software, excel software, Power point, internet, web browsing, Communication, emails, downloading and uploading data on websites etc. -

**(Weightage 10%)**

3) Subject related syllabus-

**(Weightage 70%)**

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#### **Occupational Safety & Health:**

Importance of Safety and general Precautions to be observed in the shop. Basic first aid, safety signs for Danger, Warning, caution & personal safety message. Safe handling of Fuel Spillage, Fire extinguishers used for different types of fire. Safe disposal of toxic dust, safe handling and Periodic testing of lifting equipment, Authorization of Moving & road-testing vehicles. Electrical safety tips.

#### **Hand & Power Tools:**

Marking scheme, Marking material-chalk, Prussian blue. Cleaning tools- Scraper, wire brush, Emery paper, Description, care and use of Surface plates, steel rule, measuring tape, try square. Callipers-inside and outside. Dividers, surface gauges, scribe, punches-prick punch, centre punch, pin punch, hollow punch, number and letter punch. Chisel-flat, cross-cut. Hammer- ball pein, lump, mallet. Screw drivers-blade screwdriver, Phillips screw driver, Ratchet screwdriver. Allen key, bench vice & C-clamps, Spanners, ring spanner, open end spanner & the combination spanner, universal adjustable open-end spanner. Sockets & accessories, Pliers - Combination pliers, multi grip, long nose, flat-nose, Nippers or pincer pliers, Side cutters, Tin snips, Circlips pliers, external circlips pliers. Air impact wrench, air ratchet, wrenches- Torque wrenches, pipe wrenches, car jet washers Pipe flaring & cutting tool, pullers-Gear and bearing

#### **Systems of measurement:**

Description, care & use of - Micrometres- Outside and depth micrometre, Micrometre adjustments, Vernier callipers, Telescope gauges, Dial bore gauges, Dial indicators, straightedge, feeler gauge, thread pitch gauge, vacuum gauge, tire pressure gauge.

#### **Drilling machine:**

Description and study of Bench type Drilling machine, Portable electrical Drilling machine, drill holding devices, Work Holding devices, Drill bits. Taps and Dies: Hand Taps and wrenches, Calculation of Tap drill sizes for metric and inch taps. Different type of Die and Die stock. Screw extractors. Hand Reamers, Different Type of hand reamers, Drill size for reaming, Lapping, Lapping abrasives, type of Laps.

#### **Basic electricity:**

Electricity principles, Ground connections, Ohm's law, Voltage, Current, Resistance, Power, Energy. Voltmeter, ammeter, Ohmmeter Multi-meter, Conductors & insulators, Wires, Shielding, Length vs. resistance, Resistor ratings, Fuses & circuit breakers, Ballast resistor, Stripping wire insulation, cable colour codes and sizes, Resistors in Series circuits, Parallel circuits and Series-parallel circuits, Electrostatic effects, Capacitors and its applications, Capacitors in series and parallel, Description of Chemical effects, Batteries & cells, Lead acid batteries & Sealed Maintenance Free (SMF) batteries, Magnetic effects, Heating effects, Thermo-electric energy, Thermistors, Thermo-couples, Electrochemical energy, Photo-voltaic energy, Piezoelectric energy, Electromagnetic induction, Relays, Solenoids, Primary & Secondary windings, Transformers, stator and rotor coils, Basic electronics: Description of Semiconductors, Solid state devices- Diodes, Transistors.

## **Introduction to Hydraulics & Pneumatics:**

Definition of Pascal law, pressure, Force, viscosity. Description, symbols and application in automobile of Gear pump Internal & External, single acting, double acting & Double ended cylinder; Pressure relief valve, non-return valve, Flow control valve used in automobile. Pneumatic Symbols, Description and function of air Reciprocating Compressor. Function of Air service unit (FRL-Filter, Regulator & Lubricator), Classification of vehicles on the basis of load as per central motor vehicle rule, wheels, final drive, and fuel used, axles, position of engine and steering transmission, body and load. Brief description and uses of Vehicle hoists – Two post and four post hoist, Engine hoists, Jacks, Stands

## **Introduction to Engine:**

Description of internal & external combustion engines, Classification of IC engines, Principle & working of 2&4- stroke diesel engine (Compression ignition Engine (C.I)), Principle of Spark, Ignition Engine (SI), differentiate between 2- stroke and 4 stroke, C.I engine and S.I Engine, Direct injection and Indirect injection, technical terms used in engine, Engine specification, Different type of starting and stopping method of Diesel Engine Procedure for dismantling of diesel engine from a vehicle. Petrol Engine Basics: 4-stroke spark-ignition engines, Engine cams & camshaft, Engine power transfer, Scavenging, Piston components, Intake & exhaust systems, Gasoline Fuel Systems, Stoichiometric ratio, Air density, Fuel supply system, Type of Petrol and Diesel combustion chambers, Type of valve operating mechanism, Valve- timing diagram, concept of Variable valve timing, Timing belts & chains, Description & functions of different types of pistons, piston rings and piston pins and materials, common troubles and remedy. Compression ratio, Description & function of connecting rod, Description and function of Crank shaft, camshaft, Engine bearings, Description and function of the fly wheel and vibration damper, Crank case & oil pump, gears timing mark, Chain sprockets, chain tensioner etc. Function of clutch & coupling units attached to flywheel, Description of Cylinder block, Cylinder block construction, and Different type of Cylinder sleeves (liner), Need for Cooling systems, Heat transfer method, Vehicle coolant properties, Different type of cooling systems, Need for lubrication system, Functions of oil, Viscosity and its grade as per SAE, Oil additives, Synthetic oils, The lubrication system, Splash system, Pressure system, Lubrication system components, Intake system components Description and function of Air cleaners, Different type air cleaner, Exhaust system components, Diesel Fuel Systems Description and function of Diesel fuel injection, fuel characteristics, Emission Control:- Vehicle emissions Standards- Euro and Bharat II, III, IV, V Sources of emission, Types of emissions: Characteristics and Effect of Hydrocarbons, Hydrocarbons in exhaust gases, Oxides of nitrogen, Particulates, Carbon monoxide, Carbon dioxide, Sulphur content in fuels Description of Evaporation emission control, Catalytic conversion, closed loop, Crankcase emission control, Exhaust gas recirculation (EGR) valve, Controlling air fuel ratios, Charcoal storage devices, Diesel particulate filter (DPF). Selective Catalytic Reduction (SCR), EGR VS SCR, Description. of charging circuit operation of alternators, regulator unit, ignition warning lamp troubles and remedy in charging system. Description of starter motor circuit, Constructional details of starter motor solenoid switches, common troubles and remedy in starter circuit, Troubleshooting: Causes and remedy for Engine Not starting – Mechanical & Electrical causes, High fuel consumption, Engine overheating, Low Power Generation, Excessive oil consumption, Low/High Engine Oil Pressure, Engine Noise.

## **Workshop Calculation & Science:**

Unit, Fractions Classification of unit system Fundamental and Derived units F.P.S, C.G.S, M.K.S and SI units Measurement units and conversion Factors, HCF, LCM, Applications of Pythagoras theorem and related problems Ratio and proportion Ratio and proportion - Direct and indirect proportions Percentage - Changing percentage to decimal and fraction, Mass, Weight, Volume and Density Mass, Related problems, Work, power, energy, HP, IHP, BHP and efficiency Potential energy, kinetic energy, Heat & Temperature and Pressure Concept of heat and temperature, effects of heat, difference between heat and temperature, boiling point & melting point, Scales of temperature, Celsius, Fahrenheit, kelvin and conversion between scales of temperature Heat & Temperature - Temperature measuring instruments, types of thermometer, pyrometer and transmission of heat - Conduction, convection and radiation. Mensuration Area and perimeter of square, rectangle, Triangles, circle, semi-circle, circular ring, sector of circle, volume of solids - cube, cuboid, cylinder, sphere and hollow cylinder.

## **Introduction: Study of different major components of vehicle**

Clutches & Manual Transmissions-Clutch principles, Manual transmissions Automated Manual Transmission (AMT), Final Drive & Drive Shafts - Basic layouts Front-wheel drive layout, Rear-wheel drive

layout, Four-wheel drive layout, All wheel drive layout, 4WD v/s AWD Front-wheel drive, Automatic Transmissions, Hydraulic system & controls, Steering Systems, Suspension Systems, Lubrication system, Wheels & Tyres-Wheel types, Braking systems, Importance of Diagnostic Trouble Code (DTC), Ignition principles and Faraday's laws, Charging system, Starting system, Accessories: Horn circuit, wiper circuit, power window components and circuit. Power door lock circuit, automatic door lock circuit, remote keyless entry system circuit, antitheft system, immobilizer system. Description and function of Airbags, Seatbelt, Vehicle safety systems, Crash sensors, Seat belt pretensioners, Tire pressure monitoring systems Integrated communications, Proximity sensors, Introduction to Hybrid & Electronic vehicle, Hydrogen fuel cell vehicle, Heating Ventilation Air Conditioning (HVAC) legislation, Vehicle heating, ventilation & cooling systems, Introduction to Electric Vehicle Technology, EV Terminology Comparison of Electric Vehicle with IC engine vehicle based on emissions, range, fuel type. Types of electric vehicle, BEV, HEV, PHEV and FCEV,

**Important Note: The Weightage as mentioned against the syllabus is tentative & may vary.**