SYLLABUS FOR Drilling Assistant Ground Water

(Cat.No:314/2021)

MODULE 1. MEASURING AND FITTING (10 marks)

Cleaning tools- Scraper, wire brush, Emery paper,
Measuring tools - Surface plates, steel rule, measuring tape, try square. Callipers-inside, outside & jenny. Dividers,
Precision instruments- Micrometers- Outside and depth micrometer, Micrometer adjustments, Vernier callipers, Telescope gauges, Dial bore gauges, Dial indicators, straightedge, feeler gauge, thread pitch gauge, vacuum gauge, tire pressure gauge.
Marking tools- surface gauges, scriber. - Punches- prick, centre punch, pin punch, hollow punch, number and letter punch.
Fitting tools- Chisel-flat, cross-cut, diamond point, web chisel. Hammer- peen types, lump, mallet.
Work holding devices- bench vice, tool maker,s vice, pin vice, C-clamps,
Screw drivers-blade screwdriver, Phillips screw driver, Ratchet screwdriver. Allen key,
Spanners- ring spanner, open end spanner & the combination spanner, universal adjustable open end spanner. Sockets & accessories, Allen key
Pliers - Combination pliers, multi grip, long nose, flat-nose, Nippers or pincer pliers, Side cutters, Tin snips, Circlips pliers, external circlips pliers.
Wrenches- Air impact wrench, air ratchet, wrenches- Torque wrenches, pipe wrenches, Pipe flaring & cutting tool, pullers-Gear and bearing.
Drilling machine - Bench type Drilling machine, Portable electrical Drilling machine, drill holding devices, Work Holding devices, Drill bits.
Taps and Dies: Hand Taps and wrenches, Die and Die stock. Screw extractors. Hand Reamers –Drill size for reaming, Lapping, Lapping abrasives, type of Laps

MODULE 2. AUTO ELECTRICAL AND ELECTRONICS (10 marks)

Electricity principles, Ground connections, Ohm's law, Voltage, Current, Resistance, Power, Energy. Voltmeter, ammeter, Ohmmeter Mulitmeter, Conductors & insulators, Wires, Shielding, Resistor ratings
Fuses & circuit breakers,Ballast resistor, cable colour codes and sizes, Resistors in Series circuits Parallel circuits and Series-parallel circuits, Capacitors and its applications, Capacitors in Series circuits, Parallel circuits and Series-parallel circuits
Effects Of Electricity - Electrostatic effects, Chemical effects of electricity, Magnetic effects, Heating effects, Thermo-electric energy, Thermisters, Thermocouples, Electrochemical energy, Photo-voltaic energy, Piezo-electric energy, Electromagnetic induction,Relays,Solenoids, Primary & Secondary windings, Transformers, stator and rotor coils. Batteries & cells, Lead acid batteries
Basic electronics: Description of Semi-conductors, Solid state devices- Diodes, Transistors,
Charging system- The purpose of Charging system, charging system components, charging system circuit, Alternator principles, Alternating current,

Alternator components, Rectification, Voltage regulation- System operating voltage, High voltage

Starting system- purpose of starting system, Staring system components, Starter motor principles, study of starter control circuits. Starter motor construction, Starter magnet types, Starter motor engagement, Commutation, Switching, solenoid construction

Spark Ignition System- Ignition principles and Faraday's laws, Primary and secondary winding of transformer, Ignition components, Spark plugs, Spark plug components, Vacuum & centrifugal units, Plug firing voltage, Induction, Inductive system operation, Induction wiring, Hall effect sensors, Hall effect operation, Optical type sensors Distributor less ignition systems, Insulated coils, Distributor less ignition system timing.

Auxillery Electrical Systems- 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. Airbags, Seatbelt, Vehicle safety systems, Crash sensors, Seat belt pre-tensioners, Integrated communications, Proximity sensors, Introduction to Hybrid & Electronic vehicle, Hydrogen fuel cell vehicle.

VEHICLE AIR –CONDITIONING - Heating Ventilation Air Conditioning (HVAC) Vehicle heating, ventilation & cooling systems, Basic air-conditioning principles, Refrigerants, Pressure switches, Heating elements**,** Air-conditioning ECU, Ambient air temperature sensor, Servo motors, Automatic climate control sensors, Evaporator temperature sensor, Blower speed control, Ventilation systems

MODULE 3. MOTOR VEHICLE S ACT & ELECTRIC VEHICLES (06 marks)

Classification of vehicles on the basis of load, wheels, final drive, and fuel used, axles, position of engine and steering transmission, body and load, Traffic rules, Signals & controls. Locating vehicle information, Traffic Regulations and maintenance of good road conduct

Electric Vehicle Technology, EV Terminology, Comparison of Electric Vehicle with IC engine

Types of electric vehicle, BEV, HEV, PHEV and FCEV.

working principle of fully electric vehicle, Major component, Basics of Motors, Selection, sizing and characteristic of Motor, calculation for motor effort, electric transmission Principle, working and operation of propulsion system,

DC Motor - Drives Armature Voltage, chopper circuit, step up, Step down chopper, control strategy, chopper amplifier.

Brushless DC Motor – principle working, features, speed control system of brushless DC motor, efficiency, calculation.

Battery management system

MODULE 4. INTERNAL COMBUSTION ENGINES (14 marks)

Introduction to Engine:

internal & external combustion engines, Classification of IC engines, Principle & working of 2&4-stroke diesel engine , Principle of Spark Ignition Engine(SI), Technical terms used in engine, Engine specification. Speedometer, Tachometer, Odometer and Fuel gauge, and Indicators such as gearshift position, Seat belt

warning light, Parking-brake-engagement warning light -Different type of starting and stopping method of Diesel Engine

Engine Components: Cylinder head, Head gaskets, Valves & Valve Trains-materials, Type of valve operating mechanism, Valve stem oil seals, Valve-timing diagram, Variable valve timing. Camshafts & drives , DOHC-SOHC, Timing belts & chains, Timing belt tensioners.

Pistons, piston rings and piston pins and materials. Compression ratio.

Connecting rod, Materials used for connecting rod's big end & main bearings Shells,

Crank shaft, Crank-shaft balancing, Firing order of the engine,

Engine bearings- classification and location – materials used & composition of bearing materials- Shell bearing and their advantages-

Fly wheel and vibration damper- Cylinder block construction, and type of Cylinder sleeves

MODULE 5. COOLING SYSTEMS, LUBRICATION SYSTEM, (12 marks)

Cooling systems- Heat transfer method, Boiling point & pressure, Centrifugal force, Vehicle coolant properties -Different type of cooling systems, - cooling system components- Radiator, Coolant hoses, Water pump, Cooling system thermostat, Cooling fans, Temperature indicators, Radiator pressure cap, Recovery system, Thermo-switch.

Lubrication System, Functions of oil, Viscosity GRADES , Oil additives, Synthetic oils, The types of lubrication system,- Splash system, -Pressure system, - Lubrication system components - Oil Sump, Pickup tube, different type of Oil pump & Oil filters Oil pressure relief valve, Spurt holes & galleries, Oil indicators, Oil cooler

MODULE 6. INTAKE & EXHAUST SYSTEM (10 marks)

Intake system components- Air cleaners- types Intake manifolds and material, super charger & turbo charger

Exhaust system components- Exhaust manifold, Exhaust pipe, Extractors, Mufflers- Reactive, absorptive, Combination., Catalytic converters, Flexible connections, Ceramic coatings, Back-pressure, Electronic mufflers

Emission Control:- Vehicle emissions Standards- Euro and Bharat II, III, IV, V Sources of emission, Combustion, Combustion chamber design.

Types of emissions: Characteristics and Effect of Hydrocarbons, Hydrocarbons in exhaust gases, Oxides of nitrogen, Particulates, Carbon monoxide, Carbon dioxide, Sulphur content in fuels 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),

MODULE 7. FUEL SYSTEM (14 marks)

Diesel Fuel Systems- Description and function of Diesel fuel injection, fuel characteristics, Diesel fuel system components – Diesel tanks & lines, Diesel fuel filters, water separator, Lift pump, Plunger pump, Priming pump,
Electronic Diesel control systems, Common Rail Diesel Injection (CRDI) system, Sensors, actuators and ECU (Electronic Control Unit) used in Diesel Engines
Electronic fuel injection, Idle speed control systems, Feedback & looping, Cold start systems, Air measurement, Air-flow monitoring, Variable intake manifold system, Electrical functions, EFI wiring diagram EFI sensors- Intake Temperature sensor, Mass airflow sensor, Manifold absolute pressure sensor, Air vortex sensor, Fuel system sensor, Throttle position sensor, Exhaust gas oxygen sensor, Crank angle sensor, Hall effect voltage sensor
Electronic control unit (ECU) - EFI system ECU, Electronic control unit settings, Engine speed limiting, Malfunction indicator lamp.
Importance of Diagnostic Trouble Code (DTC) & its general format..
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.

MODULE 8. TRANSMISSION SYSTEM (08 marks)

Clutches -Clutch principles, Single-plate clutches, Multi-plate clutches, Dual mass flywheels, Operating mechanisms Clutch components- Pressure plate, Driven/ centre plate, Throw-out bearing.
Manual transmissions- Gear ratios, Compound gear trains, Gear selection, Bearings, Oil seals & gaskets, Automated Manual Transmission (AMT)
Gearbox layouts, Gearbox operation, Baulk-ring synchromesh unit, Transaxle synchromesh unit Gear shift mechanism
Final Drive & Drive Shafts - Basic layouts
Front-wheel drive layout, Rear-wheel drive layout, Four-wheel drive layout, All-wheel drive layout,
Front-wheel drive, Front-wheel drive shafts, Front-wheel final drives, Front-wheel differentials
Rear-wheel drive- Propeller shaft, Type of Universal joints, Type of Constant velocity Joints, Rear-wheel final drives, Salisbury axles, Rear-wheel drive differentials, Limited slip differentials.
Four-wheel drive- Four-wheel drive shafts, Four-wheel final drive, Four-wheel drive transfer case, Freewheeling hubs, Four-wheel drive differentials All-wheel drive- four wheel final drives,
All-wheel drive transfer case, Transfer case differential action.
Automatic Transmissions - Torque converters, Torque converter principles, drive plate, Converter operation, Torque multiplication, Fluid flow, Heat exchanger, Lock-up converters, clutches.
Planetary gearing- Planetary gears, Simple planetary gear sets, Compound planetary gear sets, Automatic transmission brake bands, Multi-disc clutches, Electronic control transmission -Electronic control Unit, Fully hydraulically controlled transmission, Electronic shift programs, Manual selection.
Layout & operation for P,R,N&D (First & Second) Selector positions, Planetary gear set, High range power flow, Low range power flow Servos & clutches-Rear

servo, Front servo, One way clutch, Multi-plate front clutch, Clutch pack, Rear clutch.
Hydraulic system & controls-Hydraulic system components, Spool valves, Regulating or flow control valves, Control valves, Orifices
Valve types & functions- Basic valve action, Regulator & control valves, Shift & governor valves
Pressure regulation- The primary regulating valve, Line pressure variation, Modulator valve pressure, The governor, Governor pressure, Kick down pressure.
Flow control- Gear position 1, 1-2 shift valve, 2-3 shift valve assembly, The servo orifice control valve, 3-2 kick down
Continuously variable transmission (C.V.T.) - Continuously variable transmission, Drive or reverse, The steel belt, Secondary pulley shaft

MODULE 9. CONTROL SYSTEM (08 marks)

Steering Systems: - Principles of steering- Steering systems, Rack-and-pinion -Recirculation ball & nut steering , Four-wheel steering systems, collapsible steering system.
Steering boxes & columns - Steering columns, Helix, Variable ratio steering, Worm gearbox, Power Assisted steering, Flow-control valve, Electric power assisted steering, Steering arms & components- Forward control vehicle steering, Steering linkages, Joints, Bushes/bushings
Wheel alignment fundamentals:- Basic principles of wheel alignment, wheel base, wheel track, king pin inclination, Caster, Camber, Scrub radius, Toe-in & toe out, Toe-out on turns, Turning radius, Thrust angle &centrelines.
Suspension Systems:-Principles of suspension, Suspension force, Unsprung weight, Types of suspension- Types of springs - Coil springs, Leaf springs, Torsion bars, Rubber springs. Shock absorber types- Hydraulic shock absorbers, - Mc pherson Strut suspension, Short/long arm suspension, Torsion bar suspension, Rigid axle leaf spring suspension, rigid axle coil spring suspension,
Wheels & Tyres-Wheel types & sizes, Rim sizes & designations, Tyres, Radial ply tyres, Radial ply tyre sidewalls, Tyre pressure monitoring systems, Tyre distortion, Center of gravity. Tyre construction, Tyre materials, Hysteresis, Tyre sizes, designations & information, Tyre tread designs, Tyre ratings for temperature & traction. Tire wear Patterns and causes Nitrogen v/s atmospheric air in tyres
Hydraulics & Pneumatics:- Pascal law, pressure, Force, viscosity. 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, air Reciprocating Compressor. Function of Filter, Regulator & Lubricator unit
Braking Systems - Principles of braking, Drum & disc brakes, Lever/mechanical advantage, Hydraulic pressure & force, Brake pad, Regenerative braking. Brake type - principles, Air brakes, Exhaust brakes, Electric brakes, Parking brakes, Engine brakes, Regenerative braking Braking system components- Brake pedal, Brake lines, Brake fluid, Bleeding, Master cylinder, Divided systems, Tandem master cylinder, Power booster or brake unit, Hydraulic brake booster, Electro hydraulic braking (EHB), Applying brakes, Brake force, Brake light switch
Drum brake system, operation, Brake linings & shoes, Back plate, Wheel cylinders

Disc brake system, operation, Disc brake rotors, Disc brake pads, Disc brake callipers, proportioning valves, Proportioning valve operation, Brake friction materials
ABS brake system, operation, Principles of ABS braking, ABS master cylinder, Hydraulic control unit, Wheel speed sensors, ABS with EBD electronic control unit. Electromagnetic retarder brake (EMR) and Engine exhaust brake

MODULE 10. WORKSHOP CALCULATION & SCIENCE (08 marks):

Classification of unit system-F.P.S, C.G.S, M.K.S and SI units
Measurement units and conversion, Factors, HCF, LCM and problems
Fractions - Addition, substraction, multiplication &division
Decimal fractions - Addition, subtraction, multiplication& division
Proportions, Percentage, Square and square root
Pythagoras theorem, Ratio and proportion - Direct and indirect proportions
Percentage - Changing percentage to decimal and fraction
Material Science
Types metals, ferrous and non-ferrous metals, Physical and mechanical properties of metals
Iron and cast iron, Difference between iron & steel, alloy steel and carbon steel
Mass, volume, density, weight and specific gravity, Work, Power and Energy
Speed and velocity - Rest, motion, speed, velocity, Speed and velocity - Related problems on speed & velocity, Work, power, energy, HP, IHP, BHP and efficiency, Potential energy, kinetic energy
Concept of heat and temperature, effects of heat, difference between heat and temperature, boiling point & melting point of different metals and non-metals
Concept of pressure - Units of pressure, atmospheric pressure, absolute pressure, gauge pressure and gauges used for measuring pressure
Surface area and volume of solids - cube, cuboid, cylinder, sphere and hollow cylinder
Levers and Simple machines
Friction- Advantages and disadvantages, Laws of friction, co-efficient of friction, angle of friction.

NOTE: - It may be noted that apart from the topics detailed above, questions from other topics prescribed for the educational qualification of the post may also appear in the question paper. There is no undertaking that all the topics above may be covered in the question paper.