

**DETAILED SYLLABUS FOR THE POST OF
MECHANIC IN AGRICULTURE DEVELOPMENT AND FARMERS
WELFARE - DIRECT RECRUITMENT**

(CAT.NO: 449/2022)

MECHANIC TRACTOR

Module – 1 [4 marks]

Tractor Industry in India – leading manufacturers, development in Tractor industry, trends, new product.

Describe tractor and its parts, Tractor specification.

Different type of Tractor starting method and stopping.

Method of power transmission to wheel from engine.

Types of shift system in tractor transmission, Hydraulically controlled clutches, Gear train arrangements, Drive arrangements

Module – 2 [4 marks]

Lay out of power transmission in tractor

Differential carriers double reduction gearing, Differential lock, types and its advantage, crown wheel and pinion adjustments.

Function and types of power take off (PTO) mechanism, working of PTO,

Rear driving axles for tractor, Row crop tractor, Crawler tractor, and General purpose wheeled tractor.

Method of power transmission to implement (Rotation).

Tractor steering – Tractor moving in straight line, Tractor moving in left/right.

Description and mechanism of foot steering pedal as incorporated in tractors

Module – 3 [5 marks]

Drawbar, hitches and power applications, Purpose of hitching, Types of Hitching, Hitching of equipment. Danger in overloading & incorrect field operation. Average life of Agriculture implements.

Development of mechanical framing. Working and Use of Power tiller(two-wheel tractor), Tractor & Bulldozer, Chassis frame of tractor.

Purpose and construction of disc plough.

Description, function of harrows, cultivators, seed drills & tractor trailer.

Description and function of tractor accessories such as Draw bar, top link & Belly Pulley.
Setting of draw bar to correct height. Use of Hydraulic lift. Maintenance of tractor accessories.

Types and uses of seed metering devices.

Types and uses of Furrow openers.

Construction of hand seed drill, seed drill cum fertilizer drill, Calibration and adjustments of seed drill.

Module – 4 [4 marks]

Clutch principles, Single-plate clutches, Multi-plate clutches, Dual mass flywheels, Operating mechanisms, Clutch components- Pressure plate, Driven/ centre plate, Throw-out bearing.

Gearbox function and types, constant mesh, sliding mesh, synchromesh Gearbox operation, Gear shift mechanism. Gear ratios. Types of gear box.

Module- 5 [4 marks]

Wheels & Tyres-Wheel types & sizes Wheels, Rim sizes & designations, Types of wheels

Tyre types & characteristics- Tyres, Radial ply tyres, Radial ply tyre sidewalls, Tyre pressure monitoring systems.

Tyre construction, Types of tyre construction, Tyre materials, Hysteresis, Tyre sizes & designations, Tyre information, Tyre tread designs, Tyre ratings for temperature & traction. Descriptions Tyre wear patterns and causes.

Nitrogen v/s atmospheric air in tyres

Module – 6 [4 marks]

Basic Knowledge about DC Generator & AC Generator.

Constructional details of Alternator

Description of charging circuit, working 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

Batteries & cells, Lead acid batteries & Sealed Maintenance Free (SMF) batteries.

Lead acid battery parts and its materials

LAB chemical reaction

Ohm's law, Voltage, Current, Resistance, Power, Energy.

Voltmeter, ammeter, Ohmmeter Multimeter.

Conductors & insulators

Fuses & circuit breakers,

Cable colour codes and sizes

MECHANIC MOTOR VEHICLE

Module – 1 [5 marks]

Definition: - 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.

Final Drive & Drive Shafts - Basic layouts

Front-wheel drive layout, Rear-wheel drive layout, Four-wheel drive layout, All-wheel drive layout.

Rear-wheel drive- Propeller shaft, Type of Universal joints, Type of Constant velocity Joints, Rear-wheel final drives, Salisbury axles, Rear-wheel drive differentials.

Automatic Transmissions - Torque converters, Torque converter principles.

Module – 2 [5 marks]

Function and types of steering system. Description, construction and function of mechanical steering system steering wheel, steering gear box, tie-rod, arms link, ball and socket joints etc.

Principles of steering, Rack-and-pinion steering system, Recirculation ball & nut steering system, Four-wheel steering systems, collapsible steering system.

Steering boxes & columns - Description and function of Steering columns, Rack-and-pinion gearbox, Worm gearbox, steering gear ratio

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 & centre lines.

Module – 3 [5 marks]

Principles of suspension, Suspension force, Unsprung weight, Wheel unit location, Dampening. Types of suspension-Suspension systems, Solid axle, Dead axle, Description, function and advantages of non independent suspension Independent suspension, Rear independent suspension, Rear-wheel drive independent suspension, Electronically controlled air suspension (ECAS)

Types of springs - Description and function of Coil springs, Leaf springs, Torsion bars, Rubber springs.

Shock absorber types- Description and function of Hydraulic shock absorbers, Gas-pressurized shock absorbers, Load-adjustable shock absorbers, Manual adjustable-rate shock absorbers, Electronic adjustable-rate shock absorbers, Automatic load-adjustable shock absorbers

Front suspension types & components- MacPherson Strut suspension, Short/long arm suspension, Torsion bar suspension

Rear suspension types & components-Rigid axle leaf spring suspension, Rigid axle coil spring suspension, Independent type suspension.

Module – 4 [5 marks]

Principles of braking, Drum & disc brakes, Lever/mechanical advantage, Hydraulic pressure & force, Brake pad.

Braking systems - Brake type - 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), Brake light switch.

Drum brakes & components -Drum brake system, Drum brake operation, Brake linings & shoes, Back plate, Wheel cylinders

Disc brakes & components -Disc brake system, Disc brake operation, Disc brake rotors, Disc brake pads, Disc brake callipers, proportioning valves, Proportioning valve operation, Brake friction materials.

Antilock braking system & components-ABS brake system.

Module – 5 [5 marks]

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.

Distributor and Distributor less ignition systems, Insulated coils, Distributor less ignition system timing.

Importance of Diagnostic Trouble Code (DTC) & its general format. Use of scan tool and retrievals of codes.

FITTER

MODULE-1 [Marks- 4]

Personal Protective Equipment (PPE), First-aid, Guidelines for good shop floor maintenance, Importance of housekeeping, Disposal of waste material, Occupational health and safety, Safety Sign, Safety practice, Response to emergencies-Power failure, System failure & Fire, Fire extinguishers -Types of fire extinguishers, working on fire extinguishers, Basic understanding on hot work, Confined space work and material handling equipment, Lifting and handling loads, Moving heavy equipment.

MODULE-2 [Marks -4]

Linear measurement, Scribes, Dividers, Datum, Calipers, Jenny caliper, Try square

File- Elements, Cut , Specifications, Grades, Types of file, Needle files, Special files, Convexity

Measurements of angles- Angular measuring instruments, Combination set

Surface gauges, Cold Chisel, Angles of chisels, Ordinary depth gauge

Marking media, Surface plates, Angle plates, Parallel blocks

Power hacksaw, Metal-cutting saws

Outside micrometer- Reading dimensions, Constructional features

Inside micrometer, Digital Vernier caliper -Reading, constructional features Vernier height gauge, Vernier bevel protractor- Graduations & Reading . Dial caliper, Digital calliper, Vernier micrometer, screw thread micrometer- graduation & reading, Dial test indicator, comparators, digital dial indicator

MODULE -3 [Marks- 2]

Welding - Safety, Welding hand tools, Setting up parameter for arc welding machine, Safety precautions in handling gas cutting plant

MODULE -4 [Marks-3]

Screw thread and elements, Tap wrenches, removal of broken tap, studs Dies and die stock

Drilling processes, Drilling Machines .Drill troubles - Causes and remedy,

Grinding wheel-Standard marking system, construction

MODULE-5[Marks-3]

Necessity of Interchangeability in engineering field,

Physical and mechanical properties of metals, Pig iron, Wrought iron, plain carbon steel

Heat treatment of plain carbon steels, Heating and quenching steel, Hardening of carbon steel

Tempering hardened steel, Annealing of steel, Normalising Aluminium and its alloys,
Copper and its alloys

MODULE -6[Marks-4]

Types of screws, Screw drivers, Spanners, Power tools, Locking devices-Types of locknut,
Various types of keys

Template and gauges, Screw pitch gauge, Simple and standard workshop gauges , types of
gauges,

Sine bar- principle, application and specification

Lapping-Lap materials and lapping compounds, Lap external and internal cylindrical surfaces

Surface finish importance, Surface texture measuring instruments, Surface quality, Honing,
frosting, Simple scrapers and scraping

MODULE-7[Marks -3]

Types of belts and fasteners, Belts tension, Vee belts and their advantages and disadvantages,
'V' belts creep, slip.

Pulleys - types - solid - split and 'V' belt pulleys.

Types of gears , Repair broken gear tooth(Dovetail blank method)

MODULE-8[Marks -2]

Application of Pneumatics, Introduction of Hydraulic system, Air compressor- parts and
function

FRL unit (Filter, regulator, lubricator), Applications of pneumatics

MECHANIC DIESEL

Module 1 [4 marks]

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 (S.I), differentiate between 2-stroke and 4 stroke, C.I engine and S.I Engine

Technical terms used in engine, Engine specification. Study of various gauges/instrument on a dash board of a vehicle- Speedometer, Tachometer, Odometer and Fuel gauge, and Indicators

Module -2 [6 marks]

Engine Components: Constructional feature of Cylinder head, Cylinder block, Oil sump, Cylinder head gasket.

Type of combustion chambers, Effect on size of Intake & exhaust passages

Different type of Cylinder sleeves (liner), material. Recommended clearances for the cylinder liners & rings

Description and Function of Engine Valves, different types, materials, size of Intake valves. Type of valve operating mechanism. Valve timing diagram,

Description of Camshafts & drives, Timing belts & chains, Timing belts & tensioners.

Description & functions of different types of pistons, piston rings and piston pins and materials.

Compression ratio. Piston clearance , piston ring clearance

Description & function of connecting rod, Materials used for connecting rods big end & main bearings. Piston pins and locking methods of piston pins.

Description and function of Crank shaft, Camshaft and Engine bearings, classification and materials used, composition of bearing materials- Shell bearing and their advantages.

Crank-shaft balancing, firing order of the engine.

Description and function of the fly wheel and vibration damper

Engine assembly procedure with aid of special tools, Torque wrench, feeler gauge, piston ring compressor, piston ring expander, valve spring compressor

Module -3 [4 marks]

Heat transfer method, Boiling point & pressure relationship

Different type of cooling systems, Basic cooling system components and types of Radiator, Coolant hoses, Water pump, thermostat, Cooling fans, Temperature indicators, Radiator pressure cap

Function of lubrication system, oil and its property, Viscosity and its grade as per SAE

Types of lubrication system- splash system, pressure system, dry sump system

Description, function and types of oil pump, oil filter, Oil level indicators, Oil cooler, oil pressure gauge, pressure relief valve

Probable reasons for low / high oil pressure, high oil consumption and their remedies.

Module- 4 [3 marks]

Description and function of Air cleaners, Different type air cleaner, Description of Intake manifolds and material,

Description and function of Exhaust manifold, Exhaust pipe, Mufflers

Description & function of air compressor, exhauster, Super charger, Intercoolers, turbo charger

Module – 5 [5 marks]

Fuel Feed System in IC Engine (Petrol & Diesel)

Diesel fuel characteristics, quality

Gravity feed system, Forced feed system, Main parts, Fuel Pumps- Mechanical & Electrical Fuel feed pump.

Knowledge about the function, working & types of Carburetor.

Diesel fuel system components, function of Diesel tanks, fuel lines, Diesel fuel filters, water separator, priming pump

Inline injection pump, Distributor-type injection pump, types Diesel injectors.

Governor and their types.

Method of bleeding of Diesel fuel supply system

Electronic Diesel control systems, Common Rail Diesel Injection (CRDI) system, Sensors, actuators and ECU (Electronic Control Unit) used in Diesel Engines.

Calibration of FIP and testing of injectors

Module – 6 [3 marks]

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.

Description of Evaporation emission control, Catalytic conversion, Closed loop, Crankcase emission control.

Exhaust gas recirculation (EGR) valve, controlling air- fuel ratios, Diesel particulate filter (DPF). Selective Catalytic, Reduction (SCR).

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