SYLLABUS FOR INSTRUCTOR

(MECHANIC TRACTOR)

Mechanic Tractor

1. **Measurements and Metrology:**
Systems of measurement; Micrometers, Outside and depth micrometer,Micrometer adjustments, Vernier calipers, Telescope gauges, Dial bore gauges, Dial indicators, straightedge, feeler gauge, thread pitch gauge, vacuum gauge, tire pressure gauge, Surface plates, steel rule, measuring tape, try square. Calipers-inside and outside. Dividers, surface gauges, scriber, punches prick punch, center punch, pin punch, hollow punch, number and letter punch-Description, care & use; Chisel-flat, crosscut; Hammer; Screw drivers,bench vice & C-clamps, Spanners, Sockets & accessories, Pliers, wrenches, pullers – classification, properties, care and its applications.
Hand & Power Tools - Marking scheme, Marking material; Cleaning tools; Scraper, wire brush, Emery paper.
Fasteners; screws; nuts; studs, bolts, locking devices- types, care and its applications; Function of Gaskets, Selection of materials for gaskets and packing, oil seals.
2. **Basic Electrical &Electronics:**
Basic electricity; Ground connections; 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 and parallel; Description of Batteries & cells, Lead acid batteries & Stay Maintenance Free (SMF) batteries;Thermisters, Thermo couples, Relays, Solenoids, Charging system circuit.
Basic electronics: Description of Semiconductors, Solid state devices- Diodes, Transistors,Thyristors, Uni Junction Transistors (UJT), Metal Oxide Field Effect Transistors (MOSFETs), Logic gates-OR, AND & NOT and Logic gates using switches; Tractor Electrical Maintenance- Lighting arrangement in tractors; Description of charging circuit; alternator, regulator unit; ignition warning lamp troubles and remedy in charging system. Fault finding in electrical system; starter motor circuit-common troubles and remedy; lighting circuit. Charging & discharging of lead acid battery.
3. **Manufacturing Technology:**
Cutting tools - type of cutting tools like Hacksaw, File Definition, parts of a file, specification, Grade, shape, different type of cut and uses., OFF-hand grinding with sander, bench and pedestal grinders, safety precautions while grinding.
Limits, Fits & Tolerances.
Drilling machine –type of Drilling machine, Portable electrical Drilling machine, drill holding devices, Drill bits; Drill size for reaming, Taps and Dies: Hand Taps and wrenches, Calculation of Tap drill sizes; Different type of Die and Die stock. Screw extractors; Hand Reamers - Different Type of hand reamers; Lapping, Lapping abrasives, type of Laps.
Work Holding devices.
4. **Fluid Mechanics:**
Pascal law, pressure, Force, viscosity. Description, symbols and application in automobile of Gear Pump-Internal & External, single acting, double acting & Double ended cylinder; Introduction to Hydraulics & Pneumatics; Directional control valves; Flow control valve used in automobile.
5. **Vehicle Mechanics:**
Auto Industry - History, leading manufacturers, development in automobile industry, trends, new product: Brief about Ministry of Road transport &Highways; 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.
Tractor Industry in India – leading manufacturers, development in Tractor industry, trends, new product. Study of tractors, Different type of Tractor starting method and stopping.
Clutch- types, construction and function; Components of clutch -driver & driven plates, torsion spring, cushion springs, operating fingers, clutch shaft, Slave cylinder & oil seal; Clutch release bearing & linkages; Manual transmissions Function, description, types and their application; Gearbox layout: Components of tractor gear box; Principle of epicyclical gear box; Necessity of torque convertor, need of 4 x 4-wheel drive / Front wheel drive, Low & high gear ratio, universal joint and propeller shaft, Final Drive & Drive Shafts Differential carriers double reduction gearing, differential lock, crown wheel and pinion

adjustments, function and types of power take off (PTO) mechanism; Types of front & rear axles. Common trouble and their remedies, care and maintenance.

Steering Systems-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. their movement and adjustment; Description and mechanism of foot steerage pedal as incorporated in tractors; Description, working and principle of hydraulic steering system. Different parts such as pump, distributor valves, pipe line and hoses etc. Development of mechanical framing. Use of Power tiller, Tractor & Bulldozer, Chassis frame of tractor.

Wheels & Tyres Description, construction and function of Wheel.; Rim sizes; Types & sizes of tyres. Solid, pneumatic & Radial; Ply rating. Tyre materials, Tyre information, Tyre tread designs, Tyre ratings for temperature & traction.; Repair and maintenance of tyres and tubes; Storage of tyres; Tire wear Patterns Braking Systems - Braking fundamentals Principles of braking, Drum & disc brakes, Lever/mechanical advantage, Hydraulic pressure & force, Brake fade. Braking systems - Brake type used on tractor. Braking system components, Park brake system, Brake pedal, Brake lines, Brake fluid, Bleeding, Master cylinder, Divided systems, Tandem master cylinder, Power booster or brake unit, Hydraulic brake booster, Applying brakes, Brake force, Brake light switch Drum brakes & components -Drum brake system, Drum brake operation, Brake linings& shoes, Backing plate, Wheel cylinders Disc brakes & components-Disc brake system, Disc brake operation, Disc brake rotors, Disc brake pads, Disc brake calipers, Proportioning valves,, Brake friction materials.

power tiller- working principle& use of (two-wheel tractor) power unit. Method of power transmission to wheel from engine. Main clutch assembling working procedure steering Clutch/brakes mechanism method of power transmission to implement (Rotation). Hitching of M.B. Plough, trailer disc harrow

Tractor equipment: - Description, function of harrows, cultivators, seed drills & tractor trailer. Hitching of equipment. Danger in overloading & incorrect field operation. Average life of Agriculture implements: Description and function of tractor accessories; Setting of drawbar to correct height; Use of Hydraulic lift.

6. IC Engine:

Engine Basics: Classification of engines, Principle & working of 2 & 4- Stroke diesel engine (CI and SI); Direct injection and Indirect injection; common rail diesel injection engine.

Engine Parameters; Engine Components -- working principle & construction of cylinder heads, types of combustion chambers; Function of Engine Valves, different types. materials. Type of valve operating mechanism; Valve-timing diagram.

Intake & exhaust systems - Description of Diesel induction & Exhaust systems. Description & function of air compressor, Supercharger, Intercoolers, turbocharger, variable turbo charger mechanism; Air cleaners; Description of Intake manifolds and material. Exhaust system components-Description and function of Exhaust manifold, Exhaust pipe, Mufflers- Reactive, absorptive, Combination, Electronic mufflers, Catalytic converters, Backpressure, Diesel particulate filter, Exhaust Gas Recirculation (EGR).

Diesel fuel characteristics, concept of Quiet diesel technology & Clean diesel technology, Fuel feed system used in Tractor's description and layout. Diesel fuel system components, Description and function of Diesel fuel injection system, types of fuel injection pumps, type of drive, injectors-types and function. Governor and their types. Distributor-type injection pump, Glow plugs, Cummins & Detroit Diesel injection. Diesel electronic control- Diesel electronic control systems (DEC). Common rail diesel injection System. Method of bleeding fuel supply system.

Description of Cylinder block, Cylinder block construction, types of cylinder blocks &cylinder liners: Description & functions of different types of pistons, piston rings and piston pins and materials: Description & function of connecting rod; Shells piston pins and locking methods of piston pins cylinder liners & rings. Bearing failure & its causes-care & maintenance.

Description of crankshaft & Camshafts. Types of their drives; Description of Overhead camshaft and Cam lobes. Crankcase ventilation (PCV). Camshaft; Crank-shaft balancing; Firing order of the engine. Description and function of the fly wheel and vibration damper, Timing mark.

Cooling systems: - Coolant properties, preparation and recommended change of interval, use of anti-freezer. Cooling system components, water pump, function of thermostat, pressure cap, Recovery system & Thermo-switch. Function & types of Radiators.

Lubrication system; type of lubricants; Oil pump, Oil filters & oil cooler;

7. **ENGINEERING DRAWING:**

Introduction to Engineering Drawing and Drawing Instruments – Conventions, Sizes and layout of drawing sheets; Drawing Instrument Lines- Types and applications; Free hand drawing of – Geometrical figures and blocks with dimension, hand tools and measuring tools; Drawing of Geometrical figures-Angle, Triangle, Circle, Rectangle, Square, Parallelogram; Lettering & Numbering; Single Stroke. Dimensioning Types of arrowhead Leader line with text Position of dimensioning (Unidirectional, Align Concept of axes plane and quadrant, Orthographic and Isometric projections; angle and third angle projections; Symbolic representation – Different symbols used in the related trades of Mechanic Auto Body Repair / Electrical and Electronics / Diesel / Tractor / Two and Three-wheeler. Reading of Job drawing related to Mechanic Auto Body Repair / Electrical and Electronics / Diesel / Tractor / Two and Three-wheeler trades.

8. **Basic Science & Mathematics:**

Fractions; unit system; HCF, LCM and problems Fractions - Addition, subtraction, multiplication & division; Decimal fractions - Addition, subtraction, multiplication; Ratio and Proportions, Percentage; Square and square root; Applications of Pythagoras theorem; Mensuration Area and perimeter of common geometrical plane; volume of solids of common geometrical plane; ; Trigonometry Measurement of angles;Trigonometrical ratios; Trigonometrical tables.

Levers and Simple machines - Effort and load, mechanical advantage, velocity ratio, efficiency of machine, relationship between efficiency, velocity ratio and mechanical advantage

Related problems for mass, volume, density, weight and specific gravity, Speed and Velocity, Work, Power and Energy Work, power, energy, HP, IHP, BHP and efficiency Heat & Temperature; boiling point & melting point of different metals and non-metals; Concept of pressure;

Basic Electricity Introduction and uses of electricity, molecule, atom; electric current AC,DC their comparison, voltage, resistance and their units;

Friction - Advantages and disadvantages, Laws of friction, coefficient of friction, angle of friction; Centre of Gravity- practical application Area of cut out regular surfaces and area of irregular surfaces; Area of cut out regular surfaces and application; Elasticity- Elastic, plastic materials, stress, strain and their units and young's modulus Elasticity - Ultimate stress and working stress.