Syllabus for Written Examination for Recruitment of Vocational Instructor.

Trade:- Mechanic Motor Vehicle

Syllabus:-

Engine: 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.

Diesel Engine :- Components, Description and Constructional feature of Cylinder head, Importance of Cylinder head design, Type of Diesel combustion chambers, Effect on size of Intake & exhaust passages, Head gaskets. Importance of Turbulence

- **Valves & Valve Trains**, pistons, connecting rod, Crank shaft, fly wheel, Cylinder Block
- **Cooling systems in Diesel Engine-** Heat transfer method, Boiling point & pressure, Centrifugal force, Vehicle coolant properties and recommended change of interval, Different type of cooling systems,
- **Basic 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 and its grade as per SAE , Oil additives, Synthetic oils, The lubrication system, Splash system, Pressure system, Corrosion/noise reduction in the lubrication system. Lubrication system components - Description and function of Sump, Oil collection pan, Oil tank, Pickup tube, different type of Oil pump & Oil filters Oil pressure relief valve, Spurt holes & galleries, Oil indicators, Oil cooler
- **Intake & exhaust systems Diesel Engine** – Description of Diesel induction & Exhaust systems. Description & function of air compressor, exhauster, Super charger, Intercoolers, turbo charger, variable turbo charger mechanism. Intake system components, Exhaust system components,
- **Diesel Fuel System-** Description and function of Diesel fuel injection, fuel characteristics, concept of Quiet diesel technology & Clean diesel technology. Diesel fuel system components, **Electronic Diesel control-** Electronic Diesel control systems, Common Rail Diesel Injection (CRDI) system, Hydraulically actuated electronically controlled unit injector (HEUI) diesel injection system. Sensors, actuators and ECU (Electronic Control Unit) used in Diesel Engines
- **Vehicle Emission-** Vehicle emissions Standards- Euro and Bhart 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, Charcoal storage devices, Diesel particulate filter (DPF).

Petrol Engine- 4-stroke spark-ignition engines- Basic 4stroke principles. Spark-ignition engine components- Basic engine components, Engine cams & camshaft, Engine power transfer, Scavenging, Counter weights, Piston components.

- **Intake & exhaust systems of Petrol Engine** -Carbureted systems, Electronic fuel injection systems, Exhaust systems. Intake system components, Air cleaners, Carburetor air cleaners, EFI air cleaners, Intake manifolds, Intake air heating. Gasoline Fuel Systems : Description of Gasoline fuel, Gasoline fuel characteristics, Controlling fuel burn, Stoichiometric ratio, Air density, Fuel supply system, Pressure & vacuum
- **Electronic fuel injection (EFI) fuel supply system** , Basic EFI principles, Air supply, Air volume, Multi-point injection systems (MPI/MPFI), Simultaneous injection, Efficient combustion, **EFI fuel supply system components** - Fuel pumps, Fuel filters, Tanks & lines, Fuel lines, Fuel rail, Fuel pressure regulator, Injectors, Tachometric relay, Thermotime switch, EFI sensors, Potentiometer, Auxiliary air valves, Idle speed control devices, Inertia sensors.
- **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.
- **Charging System**- Purpose of charging system, charging system components, charging system circuit, Alternator principles, Alternating current, Alternator components, Rectification, Phase winding connections, Rotor circuit, Voltage regulation, System operating voltage, High voltage charging systems, Rotor, Stator, Alternator end frames, Slip ring & brush assembly, Rectifier assembly, Alternator cooling fan.
- **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.

Clutches & Manual Transmissions-Clutch principles, Single-plate clutches, Multi-plate clutches, Dual mass flywheels, Operating mechanisms

- **Clutch components**- Pressure plate, Driven/ center plate, Throw-out bearing.
- **Manual transmissions**- Gear ratios, Compound gear trains, Gear selection, Bearings, Oil seals & gaskets, Brief about Automated Manual Transmission (AMT)

- **Gearbox layout & operation**- Gearbox layouts, Transaxle designs, 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, 4WD v/s AWD 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, Fourwheel drive differentials
- **All-wheel drive**- four wheel final drives, All-wheel drive transfer case, Transfer case differential action

Automatic Transmission- 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 (1st & 2nd) 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, Kickdown 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.

Steering Systems:- Description and function of Steering systems, 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-andpinion gearbox, Helix, Variable ratio steering, Worm gearbox, Power Assisted steering, Steering process, Flow-control valve, Electric power assisted steering, Basic electric power steering operation

- **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 & centerlines.

Suspension Systems:- 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), Adaptive air suspension operation.
- **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, Gaspressurized shock absorbers, Loadadjustable shock absorbers, Manual adjustable-rate shock absorbers, Electronic adjustable-rate shock absorbers, Automatic load-adjustable shock absorbers
- **Front suspension types & components**- Mc person 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, Rigid non-drive suspension.

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, Run flat tyres, Space-saver tyres, Tyre distortion, Center of gravity.
- **Tyre construction**-Tyre construction, Types of tyre construction, Tyre materials, Hysteresis, Tyre sizes & designations, Tyre information, Tyre tread designs, Tyre ratings for temperature & traction. Descriptions Tirewear Patterns and causes Nitrogen vs atmospheric air in tyres

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**- 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, Electro hydraulic braking (EHB), Applying brakes, Brake force, 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 calipprs, Proportioning valves, Proportioning valve operation, Brake friction materials
- **Antilock braking system & components**- ABS brake system, Antilock braking system operation, Principles of ABS braking, ABS master cylinder, Hydraulic control unit, Wheel speed sensors, ABS with EBD electronic control unit. The construction and operation of heavy vehicle Anti-Slip Regulation / Traction Control (ASR) system.