DETAILED SYLLABUS FOR THE POST OF FOREMAN IN KERALA STATE WATER TRANSPORT DEPATMENT (Cat.No.: 098/2025)

(Total Marks – 100)

UNIT I

FLUID MECHANICS AND HYDRAULIC MACHINES (10 marks)

Properties of Fluid- Density- specific weight- specific volume-specific gravity – viscosity- kinematic viscosity -Newton’s law of viscosity - compressibility - surface tension - capillarity- Fluid pressure and its measurement-pressure and pressure head-absolute pressure, gauge pressure, atmosphere pressure, vacuum pressure, pressure measuring instruments and its principles- piezometer tube, pressure gaugemanometer, 'U' tube manometer, differential manometer-Pascal’s Law - Types of fluids-Ideal- Real- Newtonian and non-Newtonian

Orifice, Notches and Venture meter-types of fluid flow-steady flow, unsteady flow, uniform flow, nonuniform flow, laminar flow, turbulent flow- continuity equation-head losses, major losses, minor losses,loss of head due to friction- Darcy's and Chezy's formula- properties of hydraulic oils such as viscosity index- Oxidation stability- Demulsibility- Lubricity- Rust prevention- Pour point- Flash and fire point- Neutralisation number.

Hydraulic Machines- Different types of pumps, centrifugal pump, Reciprocating pump, -slip – efficiency-discharge- specific speed – turbines- reaction and impulse turbines – working principle and comparison

Unit II

THERMAL ENGINEERING (10 MARKS)

Laws of thermodynamics- Zeroth law, First law, Second law- Thermodynamic process- Isothermal process, isentropic process - work done equations and PV diagrams -Air cycles- assumptions- Carnot cycle-Otto cycle- Diesel cycle-Joule cycle- Dual combustion cycle.

Petrol & diesel engines (both 2 Stroke & 4 Stroke) – Working - P-V diagrams - Valve timing diagrams

I.C.Engines - Performance - testing- Indicated power- Brake Power- Frictional Power- -Mechanical Efficiency- Indicated Thermal efficiency- Brake Thermal efficiency- Relative efficiency-Total fuel consumption - Specific Fuel Consumption-Morse test for Determination of I.P. of multi-cylinder engine-Heat balance sheet

Compressors- working of compressors, use of compressors, different types of compressors, single stage compressor, multi stage compressor, single action and double action compressors, work done and efficiency

Heat Transfer- conduction, convection and radiation-Fourier's law of thermal conduction.-Thermal conductivity

UNIT III - STRENGTH OF MATERIALS (10 MARKS)

Types of stresses and strains - tensile and compressive – longitudinal stress and lateral

strain -Poisson's ratio-Stress strain diagram - behaviour of mild steel & brittle material under tension -limit of proportionality - elastic limit - yield point - ultimate stress - working stress - factor of safety - Hooks law–principle of super position- stresses in varying section -stresses in composite section - Shear stress and shear strain - volumetric strain- Young’s Modulus - Bulk Modulus and Modulus of Rigidity- relations- Thermal stress and strain-Nature and magnitude of stresses due to change in temperature-temperature stress on composite bar

Friction – types of friction – laws of friction –centre of gravity- moment of inertia- Shear force and bending moment- Types of beams and its loading conditions- shear force and bending moment diagrams and equations in different types of beams and different types of loads- point load, uniform distributed load- cantilever beam- simply supported beam.

Rivets and bolts – types of rivets- Types of riveted joints- lap joint - single riveted- double riveted – butt joint - failure of riveted joints - failure of plates - strength of rivet- strength of plate and strength of riveted joint - efficiency of a riveted joint -Types of bolts- Types of springs – spring index- deflection and stiffness of springs

Welded joints-Types of fillet and butt welds - welding terms-strength of welded joints

UNIT IV

Machine Elements, Materials and Boilers (10 marks)

Bearings –functions- types of bearings - Radial bearings - thrust bearings - sliding contact bearings – rolling contact bearing –journal bearing - bearing characteristic number- heat generated

Functions of governor - types of governors –terms –height, equilibrium speed, mean equilibrium speed, maximum & minimum equilibrium speed, sleeve fit, sensitiveness, stability and hunting of governors-Flywheels- Functions-comparison with governors – fluctuation of speed, fluctuation of energy, coefficient of fluctuation of speed- coefficient of fluctuation of energy-Energy stored in flywheels
Gears – types of gears – spur gear nomenclature- gear drive- velocity ratio- types of gear train

Boilers –types – boiler accessories- boiler mountings – steam engine – parts- working Materials – cast iron – types – application-steel- types of steel – composition and classification – heat treatment - purpose - methods –alloy steels- types and application – non-ferrous metals and alloys –applications

MODULE V - CONSTRUCTIONAL FEATURES OF ENGINE AND RELATED SYSTEMS (10 MARKS)

Constructional details of IC Engines- Cylinder block - Single cylinder and multi cylinder, materials,cylinder liners-Cylinder head - Materials, cylinder head gasket-Pistons -Type of pistons, Piston rings -Materials, Types of rings - compression ring, oil ring- Connecting rod - Function, materials used, big end and small end bearings-Crank shaft - different shapes. Types of valves- sodium vapour cooled valves. Valve operating mechanisms - side cam shaft and overhead cam shaft, Inlet and exhaust valve materials- Cam shaft - functions and drives

Fuel System- Different fuel feed systems-A.C. mechanical pump, S U Electrical pump , petrol filters and air Cleaners- Carburettors- Simple carburettors - parts, principle of working- compensation, mixture strength requirement- modern carburettors, float

system, idle and slow speed system, high speed system, Acceleration pump and choke system- Inlet Manifolds-types-variable intake system- VVT (Variable valve timing)- Continuously variable valve timing(CVVT)- Exhaust manifolds-construction-catalytic converter-working-muffler- types- Various components in Diesel fuel system - Distributor type pump, rotary type pumps, Fuel feed pump and hand priming, diesel fuel filters- Fuel injector-types – Turbo charger – types – working –Turbo lag

Lubrication and Cooling System- Types of engine lubrication- wet and dry sump lubrication, splash and pressure feed systems- Oil pumps, pressure relief valve, oil pressure indicator, Oil coolers, Oil filters, oil seals, Crank case ventilation, Air and water cooling, Thermo-syphon and Pump circulation system, Thermostat- Radiator -types, pressure cap, types of coolant, pump, antifreeze solution - cooling fan – types.

MODULE VI - CHASSIS (10 MARKS)

Chassis and frame- Chassis Constructional details, Types of frame- Frame sections, bumpers, sub frames. Materials used-Front Axle- - Types - dead & live axle, Construction - material - cross section, Stub axle - different arrangements

Suspension System- Types of front suspension for two, three & four wheeler-Rear Suspension system. Introduction to springs and Shock absorbing devices-Types, Leaf, coil springs & their arrangements, Helper spring, spring shackle, shackle pin-Telescopic type Shock absorber. Steering System- Principles of steering, Ackerman , Davis fifth wheel- Steering gear box - types, Worm & roller, worm & sector, Recirculating ball, Rack & pinion- Steering linkages - arrangement - components.- Power steering - integral - linkage type, Collapsible type steering column-Factors affecting wheel alignment.
Brake System -Types of brakes-mechanical, hydraulic, pneumatic, servo brake, Air brake. Drum and disc brake system, Internal expanding and externally contracting-Master cylinder, types ,working principle- Wheel cylinder, brake bleeding, brake shoe-Air brake- working- Servo brake – types-Working principledisc brake -working.

MODULE VII - TRANSMISSION SYSTEM AND ELECTRICAL SYSTEM (10 marks)

Transmission system -Principle of friction clutches-Constructional features and working of-Single plate dry clutch, Diaphragm clutch, Cone clutch, Centrifugal clutch, Semi centrifugal clutch, Vacuum clutch, Hydraulic clutch, Electromagnetic clutch, Multi plate clutch (dry & wet)-Fluid fly wheel, Clutch disc, Pressure plate.

Constructional features & working of - Sliding mesh gearbox, Constant mesh gearbox, Synchro mesh gearbox, Progressive type gearbox, Epicyclic gearbox, Torque converter, Gear selector and shifting mechanism- 2 Wheeler transmissions-Gear drive-Chain drive, CVT & Automatic transmission.
Propeller shaft and universal joint, Torque tube drive, Hotchkiss drive, Constant velocity joints, Front wheel drive, Differential mechanism, Rear Axles-types
Wheels - spoked wheel, disc wheel, and alloy cast wheel, composite wheel, Tyre construction (cross sectional details),Tubeless tyre, Tyre Thread patterns, Inflation pressure and its effects, Factors affecting tyre performance.

Electrical System- Constructional details of automobile dynamo- Constructional details of alternator, Charging System - necessity, Types of Regulators.

Starter switch, Starter motor - constructional features, Starter Motor Drives-Necessity, Types of starter motor drives, mechanisms of - Bendix drive (inboard & Outboard), Over running Clutch, Axial starter (sliding armature), Pre engaged type.

Types of ignition system, coil ignition, Components-Ignition coil, Contact breaker points, Cam angle, Condenser, Distributor, Spark plug - types, Spark advance & retard mechanism (centrifugal & vacuum), Magneto ignition system - Low tension & high tension, Rotating armature & rotating magnet type. Ignition system, Electronic ignition systems, Transistorized ignition, Computer controlled ignition, Distributor less ignition system.

UNIT VIII - TRANSPORTATION MANAGEMENT & MODERN TECHNOLOGIES IN AUTOMOBILES (10 MARKS)

Transportation Management- Features of M.V. Act - definition of terms -test for drivers and conductors - registration of vehicles -duties of drivers and conductors - traffic signs -M.T.0 and functional wings - organization chart. Road geometry - width of high way -gradient - cross section of road - super elevation and sight distance - road intersection. Insurance surveying - companies - classification of policies- factors involved in assessing

Fuel injection systems -Fuel injection systems in petrol and diesel engines- E.F.I-types, MPFI, Gasoline direct injection system, Throttle Body Injection, Sensors-types and construction, actuators, Common Rail Diesel Fuel System, ECM, electronic fuel injectors

Automobile pollution-sources of pollution, methods to control petrol engine and diesel engine emissions, Reduction of compression ratio, blow by control system, PCV system, After burner, catalytic converter, control of oxides of nitrogen, EGR, Evaporative emission control system-Charcoal canister, Diesel smoke and its control, emission norms

Vehicle accessories-cruise control- electric seat and mirror- intelligent wind screen wiper- automatic climatic control- adaptive noise control system- Parking distance control, Restraint systems-Seat belt -Air bag, electronic stability control- ABS-key less entry & Vehicle immobilizer- automatic traction control system – GPS

Hybrid and electric vehicles- social and environmental importance –benefits & challenges-policies related to electric and hybrid vehicles - Features of Electric Vehicle-Electric vehicle drive- components-Hybrid electric vehicle-components

II. TOPIC BASED ON DRIVING LICENCE (10 Marks)

A. Motor Vehicles (DRIVING) Regulations, 2017 (05 Marks)

B. Chapter Ii Of The Motor Vehicles Act, 1988 (LICENSING Of Drivers Of Motor Vehicles) (05 Marks)

III JOB RELATED TOPICS (10 Marks)

A. THE MOTOR VEHICLES ACT, 1988 (07 Marks)

CHAPTER- I : PRILIMINARY
Section 2(1). Adapted vehicle
Section 2(1A). Aggregator
Section 2(2). Articulated vehicle
Section 2(15). Gross vehicle weight
Section 2(16). Heavy goods vehicle
Section 2(17). Heavy passenger motor vehicle

Section 2(21). Light motor vehicle
Section 2(22). Maxi cab
Section 2(23). Medium goods vehicle
Section 2(24). Medium passenger motor vehicle
Section 2(25). Motor Cab
Section 2(26). Motor Car
Section 2(29). Omni bus
Section 2(33). Private service vehicle
Section 2(35).Public service vehicle
Section 2(47). Transport vehicle
Section 2(48). Unladen weight

CHAPTER IV: REGISTRATION OF MOTOR VEHICLES

Section 39. Necessity for registration.
Section 44. Production of vehicle at the time of registration.
Section 46. Effectiveness in India of registration.
Section 52. Alteration in motor vehicle.
Section 53. Suspension of registration.
Section 55. Cancellation of registration.
Section 56. Certificate of fitness of transport vehicles.

CHAPTER V: CONTROL OF TRANSPORT VEHICLES

Section 66. Necessity of permits

CHAPTER VI: SPECIAL PROVISIONS RELATING TO STATE TRANSPORT UNDERTAKINGS

Section 99. Preparation and publication of proposal regarding road transport Service of a State transport undertaking.

CHAPTER VII : CONSTRUCTION , EQUIPMENT AND MAINTENANCE OF MOTOR VEHICLES

Section 109. General provision regarding construction and maintenance of vehicles.
Section 110A. Recall of Motor Vehicles.
Section 110B. Type-approval certificate and testing agencies.

CHAPTER VIII : CONTROL OF TRAFFIC

Section 112. Limits of speed.
Section113. Limits of weight and limitations on use.
Section114. Power to have vehicle weighed.
Section120. Vehicles with left hand control.
Section122. Leaving vehicle in dangerous position.
Section123. Riding on running board, etc.
Section125. Obstruction of driver.
Section126. Stationary vehicles.
Section127. Removal of motor vehicles abandoned or left unattended on a public place.
Section128. Safety measures for drivers and pillion riders.
Section129. Wearing of protective headgear.
Section131. Duty of the driver to take certain precautions at unguarded railway level crossing.
Section132. Duty of driver to stop in certain cases.
Section133. Duty of owner of motor vehicle to give information.
Section134. Duty of driver in case of accident and injury to a person.

CHAPTER XI : INSURANCE OF MOTOR VEHICLES AGAINST THIRD PARTY RISKS

CHAPTER XIII : OFFENCES, PENALTIES AND PROCEDURE

CHAPTER XIV : OFFENCES, PENALTIES AND PROCEDURE

Section213. Appointment of motor vehicles officers.

B. THE KERALA MOTOR VEHICLES TAXATION ACT,1976 (03 Marks)

Section 2(e). Purchase value.
Section3. Levy of tax.
Section 3A. Levy of Green Tax.
Section 4. Payment of tax and issue of licence.
Section 5. Exemption from tax.
Section 6. Refund of tax.
Section 7. Payment of additional tax.
Section 10. Power of Officers of Police or Motor Vehicles Department to stop Motor Vehicles.
Section 11. Power to seize, detain and sell motor vehicles.
Section 12.Additional tax payable when tax is not paid.
Section 13. Amounts recoverable as arrears of land revenue.
Section 26. Escaped assessment.

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.