

**TAMIL NADU PUBLIC SERVICE COMMISSION**  
**SYLLABUS**  
**AUTOMOBILE AND MECHANICAL ENGINEERING**  
**(DEGREE STANDARD)**

**CODE:513**

**UNIT I: MECHANICS AND DYNAMICS (20 Questions)**

Statics of particles, equilibrium of Rigid bodies, Mechanism of Deformable Bodies, properties of surfaces and Solids, Centroid, centre of gravity, Dynamics of Particles, Elements of Rigid Body Dynamics, Basics of Mechanisms, Kinematics of mechanisms, gyroscope, Gears and Gear trains, Fly Wheels and Governors, Balancing, Rotating and Reciprocating Masses, Friction in Machine Elements, Force Analysis, Balancing, Single Degree Free Vibration, Forced Vibration, Mechanisms for vibration Control, Effect of damping, Vibration Isolation, Resonance, Critical Speed of Shaft.

**UNIT II: STRENGTH OF MATERIALS AND DESIGN(20 Questions)**

Stress, Strain and Deformation of Solids, Combined Stresses, Theories of Failures, Transverse loading on Beams, Stress in Beams, Torsion, Deflection of beams, Energy Principles, Thin cylinders and Thick cylinders, Spherical shells. Fundamentals of design for strength of stiffness of Machine Members, Design of Bearings, Flywheels, Transmission systems for Flexible Elements, Spur Gears and Helical Gears, Bevel Gears, Worm Gears and Crossed Helical Gears. Design of cam, Clutches and Brakes, Piston and connecting Rods. Constitution of alloys and phase diagrams, Heat treatment of ferrous and nonferrous metals.

**UNIT III: FLUID MECHANICS AND TURBO MACHINES (20 Questions)**

Fluid Properties, Fluid statics, manometry, buoyancy, control volume analysis of mass, momentum and energy. Fluid acceleration, differential equations of continuity and momentum, Bernoulli's equations, Viscous flow of incompressible fluids, Boundary layer, Turbulent flow through pipes, head loses in pipes. Turbomachinery: Pelton wheel, Francis and Kaplan turbines – Impulsive and reaction principles – Velocity diagrams. Pump types and its applications.

**UNIT IV: THERMODYNAMICS, HEAT AND MASS TRANSFER (20 Questions)**

Zeroth, First and second laws of Thermodynamics, Thermodynamic system and process, Thermodynamic relations, properties of pure

substances. Fuels and combustions, Rankine, Brayton cycles, Air-standard Otto, Diesel cycles. Refrigeration and Air conditioning, Heat pumps, Heat exchangers – Modes of heat transfer, Mass transfer, Diffusion Mass transfer, Convective Mass transfer, Radio-active heat transfers.

### **UNIT V: PRODUCTION TECHNOLOGY AND INDUSTRIAL ENGINEERING (20 Questions)**

Foundry technology – Patterns, Cores, Mouldings and Design of castings, Types of melting furnaces. Metal forming process – Types – Operations and Equipments, Metal joining process, Welding, Brazing, Soldering, Defects and Welding Inspections. Thermosetting and Thermoplast process, Metal cutting tools and types of machine tools. Un-conventional machining process. Metrology and quality control, Angular measurements, Interferometry types. CMM, Statistical quality control techniques and ISO standards. Fundamentals of computer graphics. Geometric modelling, Computer aided process planning, Additive manufacturing and 3D Printing. Work Study – Method Study and work measurements – Machine Loading and Scheduling, sequencing. Inventory Control -Group technology, Industrial robotics, Lean manufacturing, Industrial safety and OSHA.

### **UNIT VI: ENGINES AND EMISSIONS(20 Questions)**

Working principle and constructional details of four stroke petrol and diesel engines. Fuel supply system in SI engines – MPFI, GDI. Fuel Injection system in diesel engines – Mechanical injection, CRDI. Dual fuel engines. Engine Accessories - Cooling system – Types, construction and working principles. Lubrication system – Types, construction and working principles. Properties of lubricants and coolants. Combustion in SI and CI engines – stages of combustion – detonation in SI engine and knocking in CI engines. Combustion chambers – Turbo and super chargers. Alternative Fuels for IC engines, Desirable Properties of IC engine fuels. Advanced engine technologies - VVT, HCCI, Lean burn engines. Engine testing – Performance parameter calculations. Pollutants – sources, formation and effects on environment and human beings. Emission standards. Control techniques – EGR, SCR, LNT, Secondary air induction, Positive crankcase ventilation system, particulate trap and catalytic converters. Test cycles – Emission measuring devices - construction and working principles.

### **UNIT VII: AUTOMOTIVE CHASSIS, TRANSMISSION, SUSPENSION & BRAKING SYSTEMS(20 Questions)**

Chassis layout – Frames - Front axle – Stub axles - types and construction – Wheel geometry – Steering mechanism – Steering gear

box – Steering behaviour – Power steering – Driveline systems – Propeller shafts – joints – Final drives – Types and construction. Differential – Rear axle – Wheels and tyres – types and construction details. Suspension System - Types and Construction of Leaf Spring, Coil Spring, Torsion Bar, Rubber Suspension, Air Suspension. Front and Rear Independent Suspension, Dampers. Braking System - Types and construction. Power Assisted Braking Systems. Advanced Systems - Retarders, Anti-lock Braking System, Traction Control System, Electronic Brakeforce Distribution, Electronic Stability Program. Clutches - Types, construction details and working principles. Manual gear boxes – Types, construction details and working principles. Automated Manual Transmission – Automatic transmission – fluid coupling, torque converter, epicyclic gear box, Continuous variable Transmission, Dual Clutch Transmission – Hydrostatic transmission.

### **UNIT VIII: AUTOMOTIVE ELECTRICAL AND ELECTRONICS SYSTEM(20 Questions)**

Batteries – types, construction, working principle, rating, testing. Ignition system – types – operation. Principle and operation of starting system and charging systems. Lighting, Wiring, Auxiliary system. Engine sensors and actuators – types, principle and operation. Recent Trends - Navigation system, Advanced Driver Assistance System, Tyre pressure monitoring - Rain sensing wipers, micro-hybrid, keyless entry, antitheft technologies, V2V communication, CAN, LIN, OBD, Climate control system, Power windows and central locking system, Adaptive cruise control. Lane Departure Warning System. Adaptive Headlamps. Hybrid and electric vehicles – layout – batteries – motors and controllers – powertrain.

### **UNIT IX: VEHICLE BODY ENGINEERING & VEHICLE DYNAMICS (20 Questions)**

Vehicle Classification - Driver Visibility - Passive and Active Safety Systems construction and working. Types and Constructional Details of Car Bodies and Buses. Painting - Body repairs - Body trim items - Vehicle aerodynamics forces and moments - Testing. Vehicle vibration. Tyre forces and moments - Longitudinal and Lateral Forces - Rolling Resistance - Tractive and Cornering Properties - Tire Testing - Passive, Semi-Active, and Active Suspension - Load distribution - Vehicle resistance to motion - vehicle performance characteristics. Steady State and Transient State Handling - Direction Control - Stability under Various Conditions.

## **UNIT X:MOTOR VEHICLE ACT, MAINTENANCE & SERVICING (20 Questions)**

Motor vehicle act – registration, driving licence, insurance, pollution and control. organization and management of workshop - Scheduled and unscheduled maintenance – Workshop stores – inventory management – 5S Principles in workshops – Cost estimation for maintenance and servicing – Different forms and registers for workshop – Workshop Safety - Trouble shooting and servicing of clutch, gear box, brakes, suspension, steering systems, Wheels and Tyres. Trouble shooting and servicing of engine and its auxiliary systems – Servicing of vehicle air conditioning system – Manual, power tools and equipment required for servicing and maintenance.

Note: The medium of instruction is only in English.

Dated: 20.02.2025