

## **SYLLABUS FOR WRITTEN TEST**

### **POST NAME: TECHNICAL ASSISTANT (AUTOMOBILE)**

Qualification: 3 Year Diploma in Automobile Engineering

#### **TECHNICAL MATHEMATICS:**

Matrices, Determinants, Trigonometric functions, Properties of trigonometric functions, Properties of triangles, Solution of triangles, Functions, Limits & Continuity, Differentiation, Integration.

#### **PHYSICS:**

Units, Scalar and Vector representation, Circular motion, Friction, Laws of motion, force and momentum, impulse, work, power & energy, Simple Harmonic Motion, Optics : Lenses and types, power of lens, total internal reflection, optical fibre, Electromagnetism, Semi conductors: conductors, insulators, p-n junction, diodes, transistors, solar cell, Laser and applications.

#### **ENGINEERING GRAPHICS :**

Drawing instruments, scale in dimensioning, Projection of points and straight lines, Orthographic projection, isometric projection, 1<sup>st</sup> angle, 3<sup>rd</sup> angle projection.

#### **MECHANICS :**

Statics and dynamics, fundamental and derived units, resultant of forces, resolution of force, moment of force, free body diagram, Moment of Inertia, Centroid and centre of gravity, radius of gyration, Stress, Strain, Types of stress and strain, Hook's law.

#### **BASIC AUTOMOBILE ENGINEERING :**

IC engines, wheel base, overhangs, wheel track, ground clearance, kerb weight, gross weight, payload, Indicated power, brake power, frictional power, types of engine, IC engine parts-functions, firing order, SOHC, DOHC, valve clearance.

#### **FLUID MECHANICS :**

Fluid properties, density, specific gravity, specific weight, viscosity and types, surface tension, capillarity, Pressure; absolute and gauge pressure, vacuum pressure, vapour pressure, manometers, Fluid flow; steady, laminar, uniform flows, Bernaulli's principle, venturimeter, orifice meter, pitot tube, coefficient of discharge, losses in fluid flow, Pumps; types of pumps and working, types of casing and impellers, priming in centrifugal pumps, slip, negative slip and cavitation in pumps, fluid control valves, pressure control valves, direction control valves, pneumatic system and parts, air compressor, accumulator and intensifier, hydro-pneumatic systems.

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## **MANUFACTURING TECHNOLOGY:**

Casting, pattern making and types. Pattern allowance: shrinkage, draft, distortion, shake allowances. Moulding items: cope drag, runner, riser, green sand, dry sand, die casting, centrifugal casting, casting defects. Powder metallurgy. Metals used in sheet metal work: SM operations; shearing parting, blanking, punching, lancing, bending, drawing and squeezing. Welding: fusion welding and solid state welding, Arc welding types: TIG, MIG and submerged arc welding; Oxy-acetylene welding and types of flames, resistance welding, soldering and brazing.

Lathe: Parts, constructional features, lathe operations; boring facing, reaming, thread turning, centering, Shaper: Parts and constructional features, quick return mechanism. Drilling, reaming, milling, CNC machines, hot working, cold working, extrusion, hydro forming, shot peening, additive manufacturing.

## **AUTO ELECTRICAL/ELECTRONICS:**

Lead acid Battery: types, parts, specific gravity, battery ratings, Ah rating, cold rating, battery charging, battery troubles, Li-ion battery, jump starting. Alternators: components, stator, rotor, rectifier unit, Starter motor- parts and operation, types; series, shunt and compound wound, gear reduction starters, bendix drive, axial drive. Ignition system-parts, CB points, distributor type ignition. system, distributor less ignition. System, ignition coil and construction, spark plug construction, ignition timing and its importance. Head lights: sealed beam head lights, HID lamps, LED lamps, Head light aiming, day time running lamps, rain-sensing wipers, keyless entry.

## **IC ENGINES :**

Petrol engines, carburetors, stoichiometric air fuel ratio, EFI system, types SPFI, MPFI and GDI. Diesel engines: Conventional fuel injection, FIP- inline and distributor type, CRDI its advantages and parts, Fuel injectors, working and construction, emission control devices. Engine lubrication system & engine cooling system: Lubricating oil and its grades, multi grade oils, types of lubrication system; splash, pressure feed, mist lubrication, dry sump and wet sump lubrication, types of oil pumps; gear, vane and rotor pump. Types of cooling: air cooling, water cooling, coolant properties, water pump, radiator, pressure cap, expansion tank, thermostat valve. Intake and exhaust: air filters, Variable valve timing, Turbo charger types, parts and working, catalytic converter, exhaust mufflers types, construction and working.

## **HEAT POWER ENGINEERING:**

Thermodynamic terms, thermodynamic equilibrium, ideal gas equation, specific heats, internal energy, flow energy, enthalpy, entropy, thermodynamic process, laws of thermodynamics, Carnot cycle, Otto cycle, Diesel cycle, air standard cycle, efficiency of cycles, Indicated power, Brake power, friction power, heat balance sheet.

## **STRENGTH OF MATERIALS:**

Tensile strength, compressive strength, ductility, malleability, toughness, creep resistance, cooling curve for iron, Heat treatment, alloying, composites, tensile strength, ductility, malleability, hardness, creep, fatigue strength. Annealing, tempering, hardening, nitriding, factor of safety, moment of inertia. Type of beam loadings, sagging and hogging, SF and BM diagrams, torsion, angle of twist, torsion equation, power transmission by shaft, solid and hollow shaft.

## **AUTOMOBILE CHASSIS AND TRANSMISSION:**

Clutch: types, parts. Transmission gear box: types, parts. Torque converter: parts, planetary gear box; parts, automatic transmission. Propeller shaft, differential unit, transfer case. Tyres: designation, tyre types, tyre tread designs, parts, camber, castor, steering axis inclination, toe-in etc. Suspension parts, Mac-Pherson strut suspension, rigid axle suspension, independent suspension. Air suspension: parts and working, steering types, rack and pinion steering, re-circulating ball type, worm and roller type, power assisted steering, hydraulic brakes, parts, functions, metering valve, proportioning valve, drum brakes, disc brakes, vacuum boosters, air brakes.

## **DESIGN OF AUTOMOTIVE COMPONENTS:**

Stress strain diagram for ductile and brittle material, working stress and factor of safety, kinematic link, kinematic pair, lower pair, higher pair, kinematic chain, inversions, four bar mechanism, crank and slider, Keys, types of keys, couplings, types of couplings. Bearings: types of bearings, bearing materials, designation of roller bearings: Gears: gear terminology, types. Gear trains; simple gear train, compound gear train, reverted gear train, gear ratios. Belt drives: types, slip in belt drive. Chain drive and types. Cam and cam terminology, types of cam followers.

## **AUTOMOTIVE POWER TRAIN CONTROLS:**

Engine control: open loop and closed loop, oxygen sensor, air flow sensor, pressure sensor, position sensors, knock sensor, temp. Sensor, EGR system, solenoid switches, relay.

## **ELECTRIC AND HYBRID VEHICLES:**

Series hybrid, parallel hybrid, series-parallel hybrid, regenerative braking, electric vehicle recharging, Li-ion batteries, fuel cells, types.

## **AUTOMOTIVE VEHICLE AND BODY CONTROL SYSTEMS:**

Electronic power steering, four wheel steering, cruise control, adaptive cruise control, ABS, traction control, car A/C, Air bags, seat belts. Vehicle safety: active and passive, seat belt pre-tensioners, air bags, tyre pressure monitoring system.

**MVD RELATED TOPICS:**

Driving licence, hand signals, road signals, vehicle classification based on GVW, vehicle documents, PUC certificate.

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