Syllabus	:	Trade Certificate in Auto

1. **Basic Fitting and Measurement** :
    a. Manufacturing processes in brief. Outline of various subjects to be covered. Introduction to hand tools and their safety. Introduction to Metrology, Objectives of Metrology – measurements – principles – methods of measurement Environmental Factors and Personal Safety.
    b. Marking and punching tools and their uses. Hacksaw – types, specification and their uses. Chiesel – types, Specification and their uses. Terminology used in Metrology – Accuracy – Repeatability –Resolution, etc. SI Units of measurements – physical quantities under SI system.
    c. Drilling machine – Types – Drilling operation – Drill bits Tool holding and work holding devices Selection of spindle RPM for drilling Standard size of threads, types Reamers – types, care and maintenance.
    d. Selection of measuring instruments, care, use and maintenance of measuring instruments – Handling of precision instruments – Vernier Caliper, Micrometer, Height Gauge, Dial Gauge (Plunger and bevel type)
    e. Taps and Dies – Description, care and maintenance Lubrication for tapping Determination of drill size for tapping Types of fasteners, Stud extractor and puller – brief description and use. Limits and fits according to IS: 919 Applications of adhesives, Metal, Shellac, etc.

2. BASIC SHEET METAL WORK AND WELDING

    a. Safety precautions to be observed in the Workshop. Importance of sheet metal work & welding in industry Safety in Gas welding & manual metal Arc welding Metals and their characteristics Sheet metal – Classification and uses Measuring & Marking Tools – Try square, dividers, trammels, marking block, Scriber, Steel rules, Calipers, SWG, etc. Types of Snips, shears and their uses Sheet metal work Tools – Mallet, Nylon Hammers, etc. Bench vice C Clamps, Pliers, Bench stakes or sheet formers, Types and uses.
    b. Cutting methods – straight cutting – circle cutting – Louver cutting, Nibbling, Slot cutting, Notching Sheet Metal Works – Folding, Bending & Flanging Brief Description and uses of guillotine shears and circle cutting machines Brief description and use of hand punching machine Description of power operated hand drilling machine, drill bits, etc. Method of laying out pattern Simple exercises on development of pattern layout in parallel line, radial line and triangulation method.

c. Fastening of sheet metal, various types of fastening devices Introduction to tube and pipe Bending of pipes Brief Description of roll forming machine types and its working principle vehicle body repairing techniques – denting spray painting.
d. Safety in welding work Types of welding processes and application Nomenclature of welding joints & Edge preparation Terms applied to welding Welding symbols – Description and uses Distortion and its control Spot welding.
e. Different process of metal joints – Bolting – Riveting- Soldering, Brazing & Welding Common gases used for welding Gas welding hand tools – uses Oxy-acetylene welding – Principles and applications Types of Oxy-acetylene flames – their uses Flame Temperature – chemistry and structure of oxy-acetylene flame.
f. Oxygen cylinder, DA Cylinder description Regulator – Types – Construction Care & maintenance of blow pipes and cutting torches Filler rods used in Gas welding. Welding flux Faults in gas welding – Causes – Corrections Solder – Different types of Solder and their uses (Soft & Hard) Heating appliances.

3. BASIC ELECTRICITY AND ELECTRONICS

a. Safety precautions and first aid. Care and maintenance of tools. Signs and symbols used in Electrical Technology. Voltage, Current and Resistance and its units. Effects of resistance on the length and cross sectional area of a conductor, conductors and insulators.
b. Cumulative resistance of parallel and series connected circuits, Exercises on series and parallel circuits. The parts of a simple electrical circuit Ohm's law – Exercises on Ohm's law. Method of using Ohmmeter. The use and method of connecting a D.C. moving call voltmeter and ammeter. Use of voltmeter to detect loose connections. Type of solder and flux required for soldering aluminum and copper conductor. Introduction to equipment used for soldering.
c. Description of an automobile electrical circuit Earth return wiring, Polarity of earth connection, Description of switch, fuse, rating of use and their location on the circuit. Description of various automobile electrical equipment and their function in brief, Description of starter motor, Description of changing circuit – details of connections and cables sizes.
d. Lead acid battery connections, Working principles, Terminal polarity, voltage and ampere-hour capacity of battery, Care and maintenance of batteries, Method of checking of batteries and recharging on a bench charger.
e. Basic electronics devices such as transistors, Integrated circuit, Thysistors, Triac, Diac, etc. Simple electronics circuits such as oscillators, amplifiers, rectifier circuits, power supplies, etc. Use of simple instruments for electronic measurements such as

multimeters Digital and Analog, Application of electronics in modern automobiles such as Automatic voltage regulators, Electronic charging circuits.

f. Principles of Digital electronics. Number systems and Truth table concept and application, logic gates and their applications, Simple digital circuits.

4. BASIC MICRO PROCESS AND COMPUTER OPERATION

a. Study of basics of micro processor. Application of micro processor in automobile system. Approach to trouble shooting in micro processor controlled systems.

b. Introduction to computer fundamentals and its parts, familiarizing with Disk Drives, Booting of a computer system, using the mouse, right click, left click and use of operating systems like windows XP, Linux, menu system, tool bars, file structures, directories, moving and copying a file from floppy to hard disk, Hard disk to floppy disk, creating directories. Formatting floppy disk.

c. Use of desktop, control panel settings, Explorer, regional settings, creating shortcuts, use of simple applications like Paint, Notepad.

d. Study of Internet Explorer, Modem, Settings in the IE and Modem, Dial up and Broadband connections, Outlook Express, Viewing E mail from the web site and Outlook Express, Creating e mail Accounts, using search engines, Video conferencing, MS Chat.

e. Creating sample documents using MS WORD. Text wrapping, Text formatting, changing letters to different case, drawing table, mail merging, page formatting, using different font types, printing a document.

Using Excel as spread sheet, familiarizing with cells, formulae, text numbers and date, using shortcuts for entering date and numbers in progressive cells, copying formulae, text and numbers, using borders, merging cells, unmerging, changing cell width, row height, printing an area of the sheet, options of printing like fit to paper, shrinking, etc, using different sheets in a work book, changing colour of cells, fonts, text.

f. Internet and e-mail; Computer networking and types of networks.

5. BASICS OF PETROL & DIESEL ENGINES

a. Introduction to the trade and general precautions to be observed in the trade in storing and handling fuels, brake fluids, lubricants, acids, refrigerants, dust and asbestos. Description of safety equipment, its purpose and use. Elementary First Aid. Types of materials used in packing and gaskets, Fastening devices.

General description, working principle, classification and characteristics of Petrol & Diesel engines. Working principle of two stroke petrol engine. Difference between petrol and diesel engines. Difference between two stroke and four-stroke engines.

b. Precautions in starting, running and stopping a petrol & diesel engine. Brief description of engine auxiliaries and function of various gauges used with the engine., concept of torque, clamping force, torque wrench-use and care method of torquing, and detorquing.

c. Engine details – types, functions, materials and maintenance of, cylinder heads, cylinder, cylinder liners, Piston, piston rings, crank shaft, cam shaft, vibration damper and fly wheel.

d. Valve and valve operating system, valve timing diagram, camshaft and timing gears, Importance of correct tappet clearance and timing.

e. Ignition system of petrol engines, purpose of induction coil, flywheel magneto, distributor and spark plug. Working principle of carburetor and its adjustments. Importance of correct air fuel mixture on the engine performance. Introduction to Multi Point Fuel Injection (MPFI) System,

f. General description, working principle and constructional details of Diesel engines. Precautions while starting, running and stoping diesel engine. Precautions while dismantling diesel engine and engine assembly procedure.

g. Functions and types of Fuel feed systems in diesel engines. Various components of fuel feed system and their functions. Common troubles in fuel feed systems and remedies, Types, purpose and application of fuel injection pump. Details of In - line fuel Injection pump and Injectors.

h. Engine cooling systems. Functions and types of lubrication systems. Various components of lubrication system and their functions. Types of lubricants and their properties. Common troubles in lubrication systems and remedies.

6. Basics of TRANSMISSION, SUSPENSION , STEERING SYSTEMS & BRAKES

a. Description of single plate and multiplate clutches functions of different parts of the clutch assembly. Material for linings.

b. Purpose of the gearbox, different types of power flow layouts (Front wheel drive, Rear wheel drive etc), gear ratios and function of a sliding mesh gearbox and its draw backs. Lubrication system in a gearbox. Description and advantage of (1) constant mesh gearbox, (2) synchromesh gearbox. Function of the gear shifter rod. Type of lubricating oil used in gearboxes.

c. Working of propeller shaft, 'U' joints and a rear axle. Description and function of final drive (differential). Tooth contact and backlash adjustment in rear axle assembly.

d. General description of conventional suspension system, Leaf spring & shock absorber, Wheels, tyres and tube sizes, applications, care & maintenance.

e. Types and functions of steering gear boxes. Layout of steering assembly and linkages, function of each part. Lubrication of linkages and steering gear box.

f. Steering geometry: Ackerman steering, castor, camber, king pin inclination, toe, toe-out on turns, description and purpose, common steering troubles and remedy.

g. Introduction to Pneumatics, Pneumatic Symbols, block diagrams, Compressed Air Theory, Production, Purification and Distribution.
Construction and applications of directional control valve, pressure control valve and flow control valve with accessories.

h. Direction control valves – types, construction and functions. Pressure Control valves - types, construction and functions. Flow control valves- types, construction and functions. Construction of circuits using single acting cylinders, double acting cylinders with direction control valves and flow control valve on the trainer kit.

i. Types of braking systems. Layout of Mechanical & hydraulic brake systems. Description and advantages of vacuum assisted hydraulic brakes. Master Cylinders – types including the tandem master cylinder, special features ,Construction , functions , common troubles and remedy. Drum brakes and disc brakes.

j. Brake linings – types and materials. Relining the brake shoes – precautions to be observed.

k. Layout of air brake system – Major components in the system, description and purpose of each part, their care and maintenance. Troubles in Air brake assembly and their remedy. Brake testing – efficiency of brakes. Introduction to anti-lock braking system (ABS).

7. WORKSHOP CALCULATION & SCINECE

A. Workshop Calculation

a. Applied Workshop problems involving multiplication, division.

b. Common fractions, additions, subtractions, multiplications and divisions of fractions.

c. Applications of fractions to shop problems (Measurement in units). Conversion from decimal to common fractions shop problems (Measurement in units.)

d. Decimals addition, subtraction, multiplication, conversion from decimal to common fractions shop problems (Measurement in units).

e. Square roots of a perfect square root of whole number and decimals.

f. Ration and proportion and shop problems (including percentage calculations).

g. Algebraic symbols, addition, subtractions, multiplication and division of expressions involving algebraic symbols.. Simple equations and transposition problems. Standard Formulae, simple simultaneous equations with two unknown quantities, Simple algebraic problems.

h. Menstruation area of rectangles, squares, triangles, circles, regular polygons etc. Calculation of areas, calculation of volumes and weight of simple solid bodies such as cubes, squares and prisms shop problems,. (cylinder, pyramid, cone, rotating body, examples out of automotive assemblies).

i. Geometry properties of lines, angles, triangles and circles, simple solid problems.

j. Reading of simple graphs. Exercises in reading in monograph. Calculations of volume.

B. Science

a. Mass, units of mass, force, weight of a body, units of weight, shop problems MKS & SI system of units of force, weight etc. their conversion shop problems. Forces, torque and lever.

b. Heat and temperature thermometric scales conversion of °F & °C and vice versa. Temperature measuring instruments used in workshops. Heat and thermal quantities: Temperature, units of temperature, heat quantity and units, calorific value, fuel value, specific melting resp. evaporation heat, heat extension (length and volume).

c. Properties and uses of cast iron, wrought iron, plain carbon steel. HSS and alloy steel.

d. Properties and uses of copper and aluminum, brass, bronze, solder, bearing metals.

e. Characteristics of ferrous and non-ferrous metals.

f. Alloying of ferrous and non-ferrous metals are explained in terms of binary systems. (Brass, carbon steel, solder.)

g. Characteristics of ferrous and non-metals are identified and related to their application. (Mechanical properties, mach inability, cast ability, weld ability, formability, corrosion resistance,.)

h. Heat treatment, hardening, annealing, tempering and normalizing. Case hardening their standards and measurements. Heat treatment processes of ferrous metals are explained in terms of procedures. (Homogenizing, annealing, normalizing, stress relieving, sub-critical annealing, hardening, tempering, case hardening.) Hardening and tempering are completed and related to color method for temperature determination of tool. (Punch, scriber, chisel.) Heat treatment of non-ferrous metals is explained in terms of procedures. (Homogenizing, annealing, stress relieving, solution treatment, precipitation hardening). o Meaning of tenacity, elasticity, malleability, brittleness, hardness. Compressibility and ductility examples.

i. Work, units of work, energy, power, different forms of energy simple applied problems., Horsepower and brake Horsepower, mechanical advantage and velocity ratio.

j. Meaning of stress, strain, modules elasticity and ultimate strength., Examples,. Factors of safety.

k. Electricity and its uses, electric current positive and negative terminals. Use of switches and uses, conductors and insulators. Electricity: atomic mode, potential, current, voltage and resistance, ohms law, serial, parallel circuits, specific resistance, conductivity, current density, voltage drop, preheating of diesel engine (glow plug)": Electric work, power and efficiency, examples to starter alternator and battery.

l. Velocity, average velocity, circumferential velocity, rotation speed cutting velocity.

m. Friction: Static friction, dynamic friction, rolling friction, dry fiction, friction and lubrication; examples for clutches, brakes, tire and pavement.

n. Belt drive and simple gear drive, transmission, calculation of transmission ratio, rotation speed and circumferential velocity.

o. Engine calculation: Calculation of volume, compression ratio, force on the piston due to combustion pressure, average piston velocity, internal power of engine respecting two or four stroke, calculation of effective power on crank shaft by using mechanical efficiency.

p. Lubricants: The main functions of lubricants are described according to manufacturer's specifications. Lubricating, cooling, preventing corrosion, cleaning, seating.

q. Fuels: The main differences between types and grades of petrol that are commercially available are described according to oil company specifications. (Regular, super). The need for fuel additives to prevent valve seat recession is identified. The properties of a diesel fuel are described according to oil company specifications. Viscosity, flashpoint, self-ignition temperature, ignition qualities, sulphur content, cloud point, effects of contamination, energy content. The different grades of diesel fuel are defined. (Cetane number).

8. BASIC ENGINEERING DRAWING

a. Free hand sketching of straight lines, rectangles, circles, polygon's simple solids, cube, rectangular blocks, cylinders, their dimensioning.

b. Free hand sketching of nuts, bolts, rivets, washers, keys screw threads, keys with dimensions from samples. Dimensioning technique.

c. Explanation of simple orthographic projection first angle and third angle. Sketching of different views of simple solid and hollow bodies with dimensions.

d. Use of different types of lines and symbols of drawing welding symbols, electric symbols.

e. Simple isometric drawing, isometric views of square, rectangle, circle, cubes, various types of prism.

f. Use of drawing instruments. Drawing simple figures and solids with dimensions and titles. Use of different types of seals and lettering numbers and alphabets. Isometric drawings with dimensions of various simple objects.

g. Sections and sketching orthographic views of various solids and hollow objects with section views.

h. Blue print reading. Preparation of simple working drawings from sketches.

i. Dimensioning, system of dimensioning, various methods of dimensioning.

j. Introduction to Auto CAD.

Note: The above syllabus is indicative and the questions in the test may include similar other topics pertaining to the level and content of essential qualification.