Syllabus	**:**	Syllabus for 3 years Diploma in Auto Engineering

(Applied Mathematics)	
	Integration: 1.1 Definition of integration as anti-derivative. Integration of standard function. 1.2 Rules of integration (Integrals of sum, difference, scalar multiplication). 1.3 Methods of Integration. 1.3.1 Integration by substitution 1.3.2 Integration of rational functions. 1.3.3 Integration by partial fractions. 1.3.4 Integration by trigonometric transformation. 1.3.5 Integration by parts. 1.4 Definite Integration. 1.4.1 Definition of definite integral. 1.4.2 Properties of definite integral with simple problems. **1.5 Applications of definite integrals.** 1.5.1 Area under the curve. Area bounded by two curves, 1.5.2 Volume of revolution. 1.5.3 Centre of gravity of a rod, plane lamina. 1.5.4 Moment of Inertia of uniform rod, rectangular lamina 1.5.5 Theorems of parallel and perpendicular axes.
	Differential Equation 2.1 Definition of differential equation, order and degree of differential equation. Formation of differential equation for function containing single constant. 2.2 Solution of differential equations of first order and first degree such as variable separable type, reducible to Variable separable, Homogeneous, Nonhomogeneous, Exact, Linear and Bernoulli equations. 2.3 Applications of Differential equations. **2.3.1** Rectilinear motion (motion under constant and variable acceleration) **2.3.2** Simple Harmonic Motion.
	Probability Distribution 3.1 Binomial distribution. 3.2 Poisson's distribution. 3.3 Normal distribution 3.4 Simple examples corresponding to production process.
	Numerical Methods **4.1 Solution of algebraic equations** Bisection method, Regulafalsi method and Newton – Raphson method. **4.2 Solution of simultaneous equations containing 2 and 3unknowns** Gauss elimination method. Iterative methods- Gauss Seidal and Jacobi's methods.

(Development of Life Skills-II)

	SOCIAL SKILLS SOCIETY, SOCIAL STRUCTURE, DEVELOP SYMPATHY AND EMPATHY.
	Swot Analysis – Concept , How to make use of SWOT.
	Inter personal Relation Sources of conflict, Resolution of conflict , Ways to enhance interpersonal relations.
	Problem Solving **I) STEPS IN PROBLEM SOLVING,** 1) IDENTIFY AND CLARIFY THEPROBLEM, 2) INFORMATION GATHERING RELATED TOPROBLEM, 3) EVALUATE THEEVIDENCE, 4) CONSIDER ALTERNATIVE SOLUTIONS AND THEIRIMPLICATIONS, 5) CHOOSE AND IMPLEMENT THE BESTALTERNATIVE, 6) REVIEW **II) Problem solving technique**.(any one technique may be considered) 1) Trial and error, 2) Brain storming, 3) Lateral thinking
	Presentation Skills Body language -- Dress like the audience Posture, Gestures, Eye contact and facial expression. PRESENTATION SKILL – STAGE FRIGHT, Voice and language – Volume, Pitch, Inflection, Speed, Pause Pronunciation, Articulation, Language, Practice of speech. Use of aids –OHP,LCD projector, white board
	Group discussion and Interview technique – Introduction to group discussion, Ways to carry out group discussion, Parameters— Contact, body language, analytical and logical thinking, decision making **INTERVIEW TECHNIQUE** NECESSITY, TIPS FOR HANDLING COMMON QUESTIONS.
	Working in Teams UNDERSTAND AND WORK WITHIN THE DYNAMICS OF A GROUPS. TIPS TO WORK EFFECTIVELY IN TEAMS, ESTABLISH GOOD RAPPORT, INTEREST WITH OTHERS AND WORK EFFECTIVELY WITH THEM TO MEET COMMON OBJECTIVES, TIPS TO PROVIDE AND ACCEPT FEEDBACK IN A CONSTRUCTIVE AND CONSIDERATE WAY , LEADERSHIP IN TEAMS, HANDLING FRUSTRATIONS IN GROUP.
	Task Management INTRODUCTION, TASK IDENTIFICATION, TASK PLANNING ,ORGANIZING AND EXECUTION, CLOSING THE TASK

(Strength of Materials)	
	Mechanical Properties of Materials, Simple stresses & Strains 1.1 Types of loads, Simple stresses & strains viz. tensile, compressive, Shear, Crushing, Thermal stresses, Hoop stresses & corresponding strains, Volumetric Strain, Bulk modulus, Hook's law, Young's modulus, Modulus of Rigidity, stress-strain curves for ductile & brittle materials, Poisson's ratio. 1.2 Concept of stresses & strains in thin cylindrical & spherical shells subjected to internal pressure. 1.3 Concepts of Buckling – Rankine's & Euler's formulae for buckling load for columns / shafts under compression, concepts of equivalent length for various end conditions. 1.4 Concepts of Deflection & slope of beams – relation between bending moment & slope. Deflection of simply supported beams and cantilever beams subjected to point load. (No derivation) (Problems on compressive & tensile stresses, Thermal stresses, butt & lap riveted joints, simple cases of buckling).
	Strain Energy 2.1 Concept, derivation & use of expression for deformation of axially loaded members under gradual, sudden & impact load. 2.2 Strain energy due to self-weight.
	Bending Moment & Shear Force 1.1 Shear force, bending moment & relation between them. 1.2 Shear force & bending moment diagrams for simply supported beam & cantilevers subjected to point loads & Uniformly distribution load, concept of Uniformly varying load & couples acting on beam
	1.3 Location of point of contra flexure. (Problems to be based on simply supported & cantilever beams with point load & UDL only)
	Moment of Inertia 4.1 Definition of Moment of inertia, Moment of inertia of different laminae, radius of gyration. 4.2 Parallel & perpendicular axis theorem. 4.3 Moment of inertia of rectangular, circular, semicircular. Triangular, Hollow Rectangular, symmetrical I -Section, Channel section, Tee- section, angle section about centroidal axis. 4.4 Polar moment of inertia.
	Bending & Shear stresses 5.1 Theory of simple bending, equation of bending. 5.2 Assumptions in the theory of bending, moment of resistance, section modulus & neutral axis. 5.3 Shear stresses – concepts of direct & transverse shear stress.
	Combination of Bending & Direct stresses 6.1 Axial load, eccentric load, direct stresses, bending stresses maximum & minimum stresses. 6.2 Application of the above concepts for machine parts such as offset links, C-clamp, Bench vice, Drilling machine frame, stresses at base of a short column, condition for no tension at extreme fibres, total stress variation diagrams. (Simple problems on above applications)

	Principal Planes & Principal Stresses 7.1 Definition of principal plane & principal stresses. 7.2 Expression for normal and tangential stress, maximum shear stress. 7.3 Stresses on inclined planes. 7.4 Position of principal planes & planes of maximum shear. 7.5 Graphical solution using Mohr's circle of Stresses.
	Torsion 8.1 Concept of Pure Torsion, Torsion equation for solid and hollow circular shafts. Assumptions in theory of pure Torsion. 8.2 Comparison between Solid and Hollow Shafts subjected to pure torsion (no problem on composite and non homogeneous shaft)

(Mechanical Engineering Drawing)	
	Auxiliary views: - Study of auxiliary planes, Projection of objects on auxiliary planes. Completing the regular views with the help of given auxiliary views (Use first angle method of projection)
	Intersection of solids:- Curves of intersection of the surfaces of the solids in the following cases (a) Prism with prism, Cylinder with cylinder, Prism with Cylinder When (i) the axes are at 90□andintersecting (ii) The axes are at 90□and Offset (b) Cylinder with Cone When axis of cylinder is parallel to both the reference planes and cone resting on base on HP and with axis intersecting and offset from axis of cylinder
	Developments of Surfaces. Developments of Lateral surfaces of cube, prisms, cylinder, pyramids, cone and their applications such as tray, funnel, Chimney, pipe bends etc.
	Conventional Representation:- 1. Standard convention using SP – 46(1988) (a) Materials C.I., M.S, Brass, Bronze, Aluminum, wood, Glass, Concrete and Rubber (b) Long and short break in pipe, rod andshaft. (c) Ball and Roller bearing, pipe joints, cocks, valves, internal / external threads. (d) Various sections- Half, removed, revolved, offset, partial and aligned sections. (e) Knurling, serrated shafts, splined shafts, and chainwheels. (f) Springs with square and flat ends, Gears, sprocketwheel (g) Countersunk &counterbore. (h) Tapers
	Limits, Fits and Tolerances:- 1. Characteristics of surface roughness- Indication of machining symbol showing direction of lay, roughness grades, machining allowances, manufacturingmethods. 2. Introduction to ISO system of tolerencing, dimensional tolerances, elements of interchangeable system, hole & shaft based system, limits, fits & allowances. Selection offit. 3. Geometrical tolerances, tolerances of form and position and its geometric representation. 4. General welding symbols, sectional representation and symbols used in Engineeringpractices

	Details to Assembly 1. Introduction- 2. Couplings – Universal couplings & Oldham'sCoupling 3. Bearing – Foot Step Bearing & PedestalBearing 4. Lathe toolPost 5. Machine vice & PipeVice 6. ScrewJack 7. Steam StopValve
	Assembly to Details 1. Introduction – 2. Pedestal Bearing 3. Lathe TailStock 4. DrillingJig 5. Piston & connecting rod 6. Gland and Stuffing boxAssembly 7. Valve – Not more than eightparts 8. Fast & Loose Pulley

(Automobile Transmission Systems)	
	Vehicle layout and Chassis frame: 1.1 Classification and specifications of Chassis- 2-Wheeler, Passenger car, CommercialVehicle. 1.2 Vehicle layout & its types—2 Wheel Drive- Front Engine Front Wheel Drive, Rear Engine Rear Wheel Drive, Front Engine Rear Wheel Drive & 4 WheelDrive. 1.3 Major assemblies – their locations andfunctions. 1.4 Various loads acting on chassisframe. 1.5 Type of frames, frames construction, and material- 2 wheeler and 4 - wheeler.
	Clutches 2.1 Principle and necessity of Clutch. 2.2 Various types of clutches used in Automobiles – singleplate, multiplate clutches - dry & wet clutches, centrifugalclutch, Semi-centrifugal clutch, diaphragm clutch. 2.3 Materials used for clutchlining. 2.4 Hydraulic & mechanical clutch linkage, Cable operated clutch linkage. 2.5 Fluid coupling- principle, construction andworking.
	Gear Boxes 3.1 Principle and necessity of Gear Box. 3.2 Types, construction and working of gear boxes & their layouts such as sliding mesh, constant mesh, synchromesh type, vario -drive, transfer case. 3.3 Gear ratios with the help of power flow diagrams. 3.4 Gear shift mechanism. 3.5 Overdrive 3.6 Concepts of automatic gear box. 3.7 Torque Converter- principle, construction andworking
	Propeller shafts, universal joints & slip joints 4.1 Necessity and function of PropellerShaft. 4.2 Constant velocity Joints- Inboard & outboard Joints- Rzeppa Joint, TripodJoint. 4.3 Universal joint and slipjoint. 4.4 Hotchkiss drive and torque tubedrive.

	Final drive 5.1 Principle, Necessity and function of final drive anddifferential. 5.2 Working of differential and differential lock. Backlash in differential. 5.3 Types of rear axles such as semi - floating, three quarter floating and full floating type. 5.4 Transmission in two wheeler- chain drive and beltdrive. 5.5 Spur differential construction.
	Wheels and Tyres 6.1 Types of wheels, rims andtyres. 6.2 Tyre materials, construction. 6.3 Necessity and types oftreads. 6.4 Tyre inflation and its effect. Tyre rotation andnomenclature

(Materials & Manufacturing Processes)	
	Engineering Materials : 1.1 Introduction - 1.1.1 Classification of engineeringmaterials. 1.1.2 Mechanical properties of metals - Strength, Elasticity, Plasticity, Ductility, Malleability, Toughness, Hardness, Brittleness, Resilience, Creep,Fatigue. 1.2 Ferrous metal and their alloys: 1.2.1 Cast iron: types, composition and applications. 1.2.2 Plain carbon steel: types, composition and applications. 1.2.3 Effects of alloying elements like- Nickel, chromium, silicon, molybdenum & tungsten on the properties of steel. Alloy steels like stainless steel, Tool steels, Heat resistance steels, Shock resistance steels, their composition, applications & color coding as per BIS. 1.3 Designation of cast iron and steel. Designation as per IS and SAE 1.4 Non-ferrous metals and their alloys: 1.4.1 Aluminium and its alloys: duralumin, 'Y' alloy, their composition and applications. 1.4.2 Copper and its alloys: brass, bronze, gun metal, Babbitt metal their composition and applications. 1.5 Polymeric materials : Thermoplastics , thermosetting Plastics, Fibre, rubber their properties and applications. 1.6 Composite materials
	Heat treatment: 2.1 Introduction : purpose, advantages, Fe-C phase transformation diagram, TTTdiagram. 2.2 Common heat treatment processes : Annealing, sub- critical annealing, normalizing, hardening, tempering. 2.3 Surface hardening processes : case carburizing, nit riding, Induction and flamehardening. 2.4 Selection and applications of heat treatmentprocesses.

	Foundry: 3.1 Types of Foundries , Advantages and disadvantages of foundryprocess. 3.2 Pattern Making 3.2.1 Pattern materials and theirselection. 3.2.2 Types of pattern and theirselection. 3.2.3 PatternAllowances. 3.2.4 Pattern colourcoding.
	Fundamentals of machining: 4.1 Mechanism of chipformation. 4.2 Types ofchips. 4.3 Types of cutting tools: single and multipoint. 4.4 Cutting tool materials: Selection, Properties andtypes. 4.5 Single point cutting Tool nomenclature and toolsignature. 4.6 Cutting fluids: Properties,types.
	Lathe and drilling machine : 5.1 Process capability, geometrical and dimensional accuracy that can be achieved on lathe and drillmachine. 5.2 Classification of lathes and drillingmachines. 5.3 Accessories and attachments used onlathe. 5.4 Operations performed on lathe – Turning, Facing, Knurling,Threading. 5.5 Operations performed on drilling machines – drilling,reaming. 5.6 Cutting parameters: speed, feed and depth of cut.

(Automobile Engines)	
	Engine principles and fundamentals 1.1 Introduction 1.2 Basic engine nomenclature. 1.3 Classification of automobile ngines. 1.4 Use of engines 1.5 Merits and Demerits of vertical and horizontal engines. 1.6 Four stroke SI and CIengine 1.7 Two stroke cycle engine. 1.8 Comparison of two stroke and four stroke cycle engine 1.9 Reasons for using single cylinder two stroke and four stroke cycle engine.
	Constructional features of automobile engine components. 2.1 Cylinder block, cylinder liner, types of liner, comparison of dry and wet liners, cylinder head, gaskets, type of gaskets, piston, piston ring pin etc. 2.2 Piston, piston rings, Piston ring joints, piston pin. 2.3 Crank shaft, camshaft, connecting rod, valve, valve cooling, valve mechanisms, valve timing, port-timing diagram, manifolds, silencers, fly wheel etc. 2.4 Types of cam shaft drives. 2.5 Rotary and reed valve

	Engine cooling system 3.1 Introduction – Purpose of cooling 3.2 Systems- Air cooling system, water cooling systems. 3.3 Comparison of air & water cooling systems. 3.4 Parts of cooling system. Thermostat, water expansion tank, Temperature Indicator Pressure cap, water pump, fan and fan belt, radiator. 3.5 Cooling water additions
	Lubrication systems 4.1 Introduction 4.2 Purpose of lubrication, parts to be lubricated, functions and properties of engine lubricating oils, additives for lubricants, classification of lubricating oils. 4.3 Dry Sump lubrication system, wet sump lubrication system, petrol lubrication system, pressurized lubrication system, splash lubrication system.
	Fuel Systems Part A 5.1 Fuel feed system in petrol engines. 5.2 Mechanical fuel pump, electrical fuel pump 5.3 Principles of carburetion. 5.4 Simple112 arburetor. 5.5 Starting, Idling & slow running, acceleration, Main metering system, choke system. 5.6 S.U. Carburettor, solex112arburetor. 5.7 Carburettors used in two wheelers and four wheelers.
	Part B 5.8 Requirement of fuel injection system. 5.9 Various components & Diesel Fuel injection system. 5.10 Types of fuel injection pumps for single and multi cylinder engines, inline and rotary types of fuel injection pumps. 5.11 Types of fuel injectors. 5.12 Air fuel mixture ratio in a petrol and diesel engine and comparison. 5.13 Mixture requirement for Transient conditions.
	I.C. Engine Testing. 6.1 Engine Power – Indicated, Brake and Frictional Power. 6.2 Efficiency- Mechanical, Thermal, Relative and Volumetric. 6.3 Fuel Consumption-BSFC 6.4 Morse test, Motoring test. 6.5 Heat Balance Sheet.

(Automobile Manufacturing Processes)	
	Forging 1.1 Forgeable materials and forgeability. 1.2 Advantages and limitations of forging process. 1.3 Classification of forging processes. 1.4 Forging by open and close dies. 1.5 Forging sequences for connecting rods, crankshafts, camshafts, spanners and gears.

	Press and press work R.P Materials used in presswork. 2.2 Classification of presses. 2.3 Major parts of mechanical press and their functions. 2.4 Drive mechanisms used on presses. 2.5 Parts of standard dieset. 2.6 Operations which can be performed on presses like Punching, piercing, blanking, forming, drawing. Press components used in automobiles.
	Welding processes 3.1 Classification of welding process. 3.2 Working principle of Gas welding and types of flames. 3.3 Arc welding process like metal arc, TIG.MIG.
	3.4 Resistance welding (spot, projection, seam, butt) 3.5 Alluminium and Cast iron welding. 3.6 Brazing and soldering. 3.7 Introduction to Plasma arc welding. Specific applications pertaining to auto industry.
	Surface Treatment and finishing processes 4.1 Selection and use of surface treatment and finishing process. 4.2 Surface cleaning processes: blasting, tumbling, alkaline, acid and electrolytic cleaning. 4.3 Surface coating processes : electroplating, galvanizing, Metal Spraying, painting. 4.4 Surface finishing processes: Lapping, honing, Superfinishing, buffing, burnishing. (Applications from auto industry to be given).
	Introduction to CNC machines 5.1 NC and CNC machines. 5.2 Classifications of CNC machines. 5.3 Advantages and disadvantages of CNC machines. 5.4 Working principle of CNC machines. 5.5 Principle of Computer aided part programming. 5.6 Part programming – Do loop, Subroutine, Canned cycle.

(Automobile Systems)	
	Front Axle and Steering : 1.1 Types of front axle – Dead axle, live axle, type of stub axle arrangements- Elliot, reverse Elliot, lamoine, reverse lamoine. 1.2 Front wheel assembly. 1.3 Steering geometry – Caster, camber, king pin inclination, toe in– toe out, Correct Steering angle. 1.4 Under steering and over steering, Turning radius & its effect. 1.5 Construction, working & application of Steering gear box – rack and pinion type, recirculating ball type, worm & roller type. 1.6 Steering linkages & steering column. 1.7 Ackerman Principle &linkage. 1.8 Power assisted steering & its types (Hydraulic &electrical)
	Brakes: 2.1 Function and necessity. 2.2 Classification of brakes and braking systems. 2.3 Principle, construction and working of –disc brakes, drum brake Construction and working of the following–Mechanical braking system, Hydraulic Braking system, Air braking system, Hydraulic operated air assisted braking system.

	2.5 Properties of brake fluids and their specifications 2.6 Concept and working of antilock braking system. 2.4 Parking brake
	Suspension Systems : 3.1 Types of suspension systems – Rigid & independent suspension 3.2 Types of Independent suspension system-McPherson strut, wishbone type. 3.3 Semi-elliptical Leaf spring, coil spring , torsion bar arrangement 3.4 Telescopic shock absorber, Gas filled shock absorber, hydraulic shock absorber 3.5 Air Suspension System. 3.6 Anti roll bar, stabilizer bar.
	Body Engineering: 4.1 Effect of stream lining on vehicle performance. 4.2 Materials used in body construction and types of bodies. 4.3 Protective and anti corrosive treatments, painting procedure. 4.4 Safety devices –air bags, exhaust brake, emergency brake, Central locking, collapsible steering.
	Car Heating Ventilation & Air Conditioning System(HVAC): 5.1 Basic principle- vapour compression cycle, layout and operation of HVAC. 5.2 Types of refrigerant used in car air conditioning and their Properties. 5.3 Human comfort conditions. 5.4 Temperature control system, humidity control.
	Vehicle Performance : R.P Resistance faced by the vehicle- Air resistance, rolling Resistance, gradient resistance. 6.2 Define traction, tractive efforts, draw bar pull, gradeability and Acceleration, pitching, Bouncing, Rolling, Sway andyaw. 6.3 Stability of vehicle on turn and slopes (No mathematical Treatment).

(Computer Programming)	
	Introduction – Problem, definition and analysis, algorithm, flow charts, tracing and dry running of algorithms. Introduction to 'C' programmining, simple program using Turbo 'C' compiler and execution of 'C' program
	C Fundamentals: Character set, constants, data types, identifiers, key words, variable declarations Types of Operators – unary, binary, arithmetic, relational, logical, assignment. Hierarchy of operators, expressions, library functions, Use of input/ output functions viz. Printf( ), Scanf( ), getch( ), putch( )
	Use of Control Statements:- if-else, while loop, do – while loop, for loop, switch, break and continue. Writing, Compiling, Executing and debugging programs
	Introduction to Subscripted variables, arrays, defining and declaring one and two dimensional arrays, reading and writing
	Concept of String, string input / output functions Defining and accessing a user defined functions, Passing of arguments, declaration of function prototypes Storage classes: automatic, external, static variables

(Heat Power Engineering)	
	Fundamental concepts of thermodynamics and various thermodynamic processes: 1.1 Basic concepts of– i) system ii) surrounding iii) Universe iv) open system v) closedsystem vi) Isolated system vii) steady flow energy equation viii) internal energy ix) enthalpy x) entropy. 1.2 Zeroth, first and second law of thermodynamics, General gas equation, Characteristics of gas constant, Mol of gas, Universal gas constant, specific heats of ideal gases. 1.3 Thermodynamic processes of ideal gases. Isobaric, Isochoric, Isothermal, Adiabatic and polytropic with representation on P-V and T-S diagram, work done, change in internal energy, change in enthalpy and relation between P,V & T (Derivations only for adiabatic process) 1.4 Air cycles: - P-V and T-S diagram and equations for air standard efficiency of Otto, Diesel & Dual combustion cycle.
	Properties of steam and steam power: 2.1 Formation of steam, various phases like wet steam, dry saturated Steam, super heated steam. 2.2 Dryness fraction, degree of superheat, sensible heat, Latent heat, calculation of enthalpy of wet, dry saturated & superheated steam using steam table. 2.3 Study of boilers like three pass packaged type boiler, Water Tube & Fire Tube Boiler. Mountings – Bourdan Pressure Gauge, Safety valves, Water level Indicator and fusible Plug. Accessories – Economiser, super heater and air pre-heater. 2.4 Steam condenser: Principle, Function, locations in steam power plant. Surface condenser & its Applications. 2.5 Steam Turbines: Classification of turbines, construction and working of Impulse and Reaction turbine. Application of equation of continuity to steam turbine.
	Air Compressors: 3.1 Various uses of compressed air and classification of compressors. 3.2 Construction and working of single stage and two stage reciprocating air Compressors with P.V diagram. Necessity of multi staging and inter cooling. 3.3 Construction & working of rotary compressors i) Centrifugal compressor ii) Axial flow compressor iii) Screw compressor 3.4 Comparison of various compressors 3.5 Air compressor terminology like i) Free air delivered ii) Capacity of compressor iii) Piston displacement iv) I.P., B.P. R. Volumetric efficiency vi) Isothermal efficiency vii) Overall Isothermal or Compressor efficiency
	Gas Turbines: 4.1 Brayton cycle- P. V. diagram and thermal efficiency 4.2 Classification of gas turbines. 4.3 Construction and working of gas turbines i) open cycle ii) closed cycle gas turbines, P.V. & T.S diagrams. 4.4 Turbojet & turboprop engine.

	Sources of Energy & Power plants: 5.1 Classification of various conventional and non-conventional sources of energy. 5.2 Construction and working of power plants based on conventional energy sources: i) Thermal power plant ii) Diesel power plant iii) Gas turbine power plant. 5.3 Parameters of site selection: 5.4 Study the working and construction of non- conventional energy sources.I)Solar ii)Bio-diesel
	Heat transfer: 6.1 Modes of heat transfer–conduction, convection andradiation. 6.2 Conduction – Fourier's law , thermal conductivity, conduction through cylinders, thermal resistance, composite walls, combined conduction and convection. 6.3 Thermal radiation, absorptivity, transmissivity, reflectivity, emissivity, black and gray bodies, Stefan-Boltzman law, Heat transfer by radiation. 6.4 Heat transfer in condenser andradiator.

(Theory of Machines and Mechanisms)	
	Fundamentals and types of Mechanisms 1.1 Kinematics of Machines: - Definition of Kinematics, Dynamics, Statics, Kinetics, Kinematic link, Kinematic Pair and its types, constrained motion and its types, Kinematic chain and its types, Mechanism, inversion, machine and structure. 1.2 Inversions of Kinematic Chain. 1.2.1 Inversion of four bar chain, coupled wheels of Locomotive & Pentograph. 1.2.2 Inversion of Single Slider Crank chain- Rotary I.C. Engines mechanism, Whitworth quick return mechanism, Crank and Slotted lever quick return mechanism. 1.2.3 Inversion of Double Slider Crank Chain- Scotch Yoke Mechanism & Oldham's Coupling. 1.3 Common Mechanisms 1.3.1 Bicycle free wheel Sprocket mechanism. 1.3.2 Geneva Mechanism. 1.3.3 Ackerman's Steering gear mechanism. 1.3.4 Foot operated air pump mechanism.
	Velocity and Acceleration in Mechanism 2.1 Concept of relative velocity and relative acceleration of a point on link, angular velocity and angular acceleration, inter- relation between linear and angular velocity andacceleration. 2.2 Drawing of velocity and acceleration diagram of a given configuration, diagrams of simple mechanisms. Determination of velocity and acceleration of a point on link by relative velocity method [Excluding coriollis components of acceleration]. 2.3 Analytical method [no derivation] and Klein's construction todetermine velocity and acceleration of different links in single slider crank mechanism.

	Cams and Followers 3.1 Concept, definition and application of Cams andFollowers. 3.2 Classification of Cams andFollowers. 3.3 Different follower motions andtheir displacement diagrams like uniform velocity, SHM, uniform acceleration andRetardation. 3.4 Drawing of profile of radial cam with knife-edge and roller follower with and without offset with reciprocating motion (graphicalmethod).
	Power Transmission 4.1 Types of Drives – Belt, Chain, Rope, Gear drives & theircomparison. 4.2 Belt Drives – flat belt, V– belt & its applications, material for flat and V- belt, angle of lap, belt length. Slip and creep. Determination of velocity ratio, ratio of tight side and slack side tension, centrifugal tension and initial tension, condition for maximum power transmission(Simple 133umerical) 4.3 Chain Drives – Advantages & Disadvantages, Selection of Chain & Sprocket wheels, methods oflubrication. 4.4 Gear Drives – Spur gear terminology, types of gears and gear trains, their selection for different application, train value & Velocity ratio for compound, reverted and simple epicyclic gear train, methods of lubrication, Law ofgearing. 4.5 Rope Drives – Types, applications, advantages & limitations ofSteel ropes.
	Flywheel and Governors 1.1 Flywheel – Concept, function and application of flywheel with the help of turning moment diagram for single cylinder 4-S I.C. Engine (no Numericals). Coefficient of fluctuation of energy, coefficient of fluctuation of speed and itssignificance. 1.2 Governors – Types, concept, function and application & Terminology of Governors. 1.3 Comparison between Flywheel andGovernor.
	Brakes, Dynamometers, Clutches & Bearings 6.1 Function of brakes and dynamometer, types of brakes and Dynamometers, comparison between brakes and dynamometer. 6.2 Construction and working of i) shoe brake, ii) Band Brake, iii) Internal expanding shoe brake iv) DiscBrake. 6.3 Concept of Self Locking & Self energizingbrakes. 6.4 Numerical problems to find braking force and braking torque for shoe & bandbrake. 6.5 Construction and working of i) Rope Brake Dynamometer, ii) Hydraulic Dynamometer, iii) Eddy currentDynamometer. 6.6 Clutches- Uniform pressure and Uniform Wearheories. 6.7 Function of Clutch and its application, Construction and working of i) Single plate clutch, ii) Multiplate clutch, iii) Centrifugal Clutch iv)Cone clutch v) Diaphragm clutch. (Simple 134umerical on single and Multiplate clutch). 6.8 Bearings – i) Simple Pivot, ii) Collar Bearing, iii) Conical pivot. Torque & power lost in friction (no derivation). Simple134umerical.
	Balancing & Vibrations 7.1 Concept of balancing. Balancing of single rotating mass. Graphical method for balancing of several masses revolving in sameplane. 7.2 Concept and terminology used in vibration, causes of vibrationsin machines, their harmful effects and remedies.

(INDUSTRIAL PROJECT AND ENTREPRENEURSHIP DEVELOPMENT)	
	Entrepreneurship, Creativity & Opportunities Concept, Classification & Characteristics of Entrepreneur 1.2) Creativity and Risk taking. 1.2.1) Concept of Creativity & Qualities of Creative person. 1.2.2) Risk Situation, Types of risk & risk takers. **1.3)** Business Reforms. **1.3.1)** Process of Liberalization. 1.3.2) Reform Policies. 1.3.3) Impact of Liberalization. 1.3.4) Emerging high growth areas. **1.4)** Business Idea Methods and techniques to generate business idea. **1.5)** Transforming Ideas in to opportunities transformation involves Assessment of idea &Feasibility ofopportunity SWOT Analysis
	Information And Support Systems **2.1) Information Needed and Their Sources.** **Information related to project, Information related to support system, Information related to procedures and formalities** **2.2) SUPPORT SYSTEMS** ➢ **Small Scale Business Planning, Requirements.** ➢ **Govt. & Institutional Agencies, Formalities Statutory Requirements and Agencies.**
	Market Assessment 3.1) Marketing –Concept and Importance 3.2) Market Identification, Survey Key components 3.3) Market Assessment
	Business Finance & Accounts Business Finance 4.1) Cost of Project 1) Sources ofFinance 2) Assessment of workingcapital 3) Product costing 4) Profitability 5) Break Even Analysis 6) Financial Ratios and Significance **Business Account** 4.2) Accounting Principles, Methodology 1) Book Keeping 2) Financial Statements 3) Concept of Audit,

	Business Plan & Project Report 5.1) Business plan steps involved from concept to commissioning Activity Recourses, Time, Cost **5.2) Project Report** 1) Meaning and Importance **2)** Components of project report/profile **(Give list**) 5.3) **Project Apprisial** 1) Meaning and definition 2) Technical, Economic feasibility 3) Cost benefit Analysis 4) Probable Causes Of Sickness 5) Quality Assurance 6) Importance of Quality, Importance of testing

(ADVANCED AUTOMOBILE ENGINES)	
	Engine Selection 1.1 Comparison of SI and CI engines on the basis Thermal efficiency and fuel consumption 1.2 Comparison of SI and CI engines on the basis of thermodynamic and operatingvariables. 1.3 Comparison of performancecharacteristics. 1.4 S.I. and C.I. Engine application- with purpose ofselection. Note: - assignment on comparative study of engine specification and it rating on basis of various parameters.
	Fuels and Alternative Energy Options for Auto Engines 2.1 Different types of fuels, calorific value 2.2 Properties of S.I. Engine fuel 2.3 Properties of C.I. Engine fuel 2.4 Fuel additives and their effects 2.5 LPG as SI engine fuel. 2.6 Alcohol as gasoline fuel blends. 2.7 Alcohol as CI engine fuel. 2.8 Natural gas as a Transport fuel. 2.9 Electric cars and hybrid vehicles.

	Theory Of Combustion 3.1 Ignition limits 3.2 Stages of combustion in SI engine 3.3 Effect of engine variables on Ignition lag. 3.4 Effects of engine variables on flame propagation 3.5 Abnormal combustion- Detonation, pre-ignition, surface ignition, Effects of detonation. 3.6 Control of detonation. 3.7 SI engine combustion Chambers 3.8 Stages of combustion in CI engine 3.9 Air Fuel ratio in Diesel engines 3.10 Delay period and variables affecting delay period. 3.11 Diesel knock and its control. 3.12 CI engine combustion chambers.
	Computer Controlled Fuel-Injection System **Part A** 4.1 Throttle body injection (TBI) system, comparison with carbureted engine fuel supply system. 4.2 Multi-Point fuel Injection system (MPFI)/ Port fuel injection (PFI) system. Types of injection- sequential, grouped and simultaneous injections. Comparison of MPFI and TBI systems. 4.3 Electronic control module (ECM) control functions. 4.4 Inputs and outputs of electronic control module(ECM). 4.5 Output control functions- Fuel Injection control, Spark advance control, Idle speed control, Exhaust gas recirculation control and other controls. **Part B** 4.6 Construction and working of fuel Injector and fuel pump. 4.7 Electronically controlled diesel Injection pump. 4.7.1 Electronic control system 4.7.2 Fuel system 4.7.3 Glow plug circuits 4.7.4 Injection pump timing 4.7.5 Electronic Injection advance. 4.8 Common rail direct injection system.
	Fuel Economy, Air pollution and Emission Control 5.1 Fuel Economy standards. 5.2 Methods of improving fuel economy. 5.3 Pollutants from gasoline engines. 5.4 Effect of engine maintenance on exhaust emission 5.5 Gasoline engine emission control, Catalytic Converters. 5.6 Diesel emission, Diesel smoke and control 5.7 Exhaust-Gas recirculation (EGR) – EGR Valve and control 5.8 Early fuel evaporation system 5.9 Positive crankcase ventilation (PCV)system 5.10 Electric assist choke system 5.11 Evaporation emission control system 5.12 Euro Norms and Bharat stage Norms. Equipment for checking Exhaust emission from vehicles. 5.13 Comparison of diesel and gasoline emission

(AUTOMOBILE COMPONENT DESIGN)	
	Basic concepts of Design 1.1 Introduction to design 1.2 Classification of design 1.3 Design consideration 1.4 Design procedure 1.5 Stress analysis: 1.5.1 Types of external loads 1.5.2 Types of induced stresses: tensile, compressive, shear, Crushing and bearing pressure, bending, torsion, thermal stresses, creep, proof stresses, resilience, principal stresses 1.5.3 Stress – strain diagram for ductile & brittle material & it's importance 1.5.4 Variable stresses in machine parts, fatigue &endurance limit, stress – time diagrams for variable stresses 1.5.5 Working stresses for static load, variable or fatigue load 1.5.6 Factor of safety, selection of factor of safety. 1.5.7 Stress concentration causes and remedies 1.5.8 Introduction to theories of failure –Maximum principle stress theory, Maximum shear stress theory, Distortion energy theory. 1.5.9 Selection of material and justifications for Automobile components. Advanced Materials for automotive components 1.6.0 Concept of standardization , Preferred numbers& interchangeability in design practice. 1.6.1 Common types of fasteners with their applications - Through Bolts, tap bolts, studs, cap screws , and machine screws ,designation of screw thread according to I.S., stresses in screw fasteners , Bolts of uniform strength. 1.6.2 Bearings-Classification ,location in Automobiles systems & selection of bearings 1.6.3 Post design aspects - Ergonomic aspect, Aesthetic consideration (shape, color, surface finish) for Automobile
	Design of machine elements 2.1 Design of socket & spigot type cotter joint. 2.2 Design of knuckle joint 2.3 Design of Turnbuckle 2.4 Applications of above machine elements in an automobile.
	Design of shafts, keys & Couplings. 3.1 Conceptual understanding of shaft, axles &spindles. 3.2 Design of shaft for torsion, rigidity, bending, combined Torsion &bending. 3.3 Comparison of solid & hollow shafts. 3.4 Design of propeller shaft, whirling & critical speed. 3.5 Design of rear axle. 3.6 Types of keys, design of sunk rectangular key, woodruff key. 3.7 Effect of keyways on shaft. 3.8 Design of couplings- muff, flange, and bush pin type flexible.
	Design of levers. 4.1 Types of levers 4.2 Design of 4.2.1 rocker arm, 4.2.2 bell crank lever, 4.2.3 hand lever 4.2.4 Pedals for rectangular cross-section & fulcrum pin only.

	Design of Chassis Component 5.1 Design of clutch- Single plate & Multi plate. 5.2 Teeth calculation of gears for sliding mesh/constant mesh gear box for given data. 5.3 Design of semi elliptical leaf spring , helical spring - torsion & compression
	Design of engine components 6.1 Data of engine specifications and calculations of cylinder dimensions for given power 6.2 Design of cylinder head thickness and bolts 6.3 Design of valve seat & valve lift 6.4 Design of piston crown by bending strength and thermal considerations. 6.5 Design of piston rings and skirt length 6.6 Design of piston pin for bearing, bending & shear considerations 6.7 Design of connecting rod cross -section (I section). 6.8 Design of big end, cap and bolts. 6.9 Design of overhung crankshaft.

(ENVIRONMENTAL POLLUTION & CONTROL)	
	Introduction 1.1 Environment 1.2 Ecosystem 1.3 Classification of pollution &pollutants 1.4 Environment & pollution control acts 1.5 ISO 14OOOstandards, 1.6 Kyoto treaty / protocol, carbon units.
	Air Pollution Part A 2.1 Sources & classification of air pollution 2.2 Effects of air pollution on human health 2.3 Effects of air pollution on economy 2.4 Photochemical air pollution 2.5 Air pollution from major Industrial operations e.g. Fertilizer industries aluminum manufacturing plants, Acid plants, Cement industries, Coal& tar industries, paper industries, Refinery & petrochemical industries **Part B** Air pollution due to Automobiles-design and operating parameters and methods of control 2.6 Pollution due to S. I. Engines. Design & operating parameters responsible for emission and methods of pollution control. 2.7 Pollution due to C. I. Engines. Design & operating parameters responsible for emission and methods of pollution control. 2.8 Air quality & emission standards of India &Europe 2.9 Air pollution in Indian metro cities- Delhi, Mumbai, Chennai,Kolkata

	Water Pollution 3.1 Sources of water pollution. 3.2 Effects of water pollution. 3.3 Water pollution analysis 3.3.1 Physical examination of water 3.3.2 Chemical characteristics of water 3.3.3 Biological investigation of water 3.4 Definitions of Important terms used in water pollution – DissolvedO_2 ,Chemical O_2 demand, Biological O2 demand, Theoretical O2 demand, Total solids, Total suspended solids, Total dissolved solids, Turbidity, Alkalinity, Acidity. 3.5 Water quality standards 3.6 Steps in Water treatment 3.7 Sampling & analysis of water pollution
	Noise Pollution 4.1 Definition of noise 4.2 Sources of noise 4.3 Types of noise – Impulsive & sonic noise 4.4 Effects of noise on health 4.5 Noise measurement 4.6 Noise mapping
	Other Types Of Pollution 5.1 Solid waste 5.1.1 Classification of solids 5.1.2 Solid waste management 5.1.3 Method of solid waste disposal 5.1.4 Reuse, Recycling & recovery of materials from refuse 5.2 Soil pollution 5.2.1 Chemistry of soil 5.2.2 Soil irrigation by effluents 5.2.3 Agricultural pollution 5.3 Radiation pollution 5.3.1 Sources & effects of radiation 5.3.2 Radiation exposure standards 5.3.3 Radiation protection 5.3.4 Treatment & disposal of radiation waste 5.4 Global pollution 5.4.1 Green house effect 5.4.2 Acid rain 5.4.3 Ozone depletion problem

(HYDRAULICS & PNEUMATICS)	
	Fluid Mechanics 1.1 Overview of fluid properties Ideal fluid , Real Fluid, Specific Weight, Specific gravity, Surface tension, Capillarity, Viscosity. Definitions and applications only. Specifications and standards of hydraulic fluids. Pascal's law. 1.2 Measurement of Pressure Concept of atmospheric pressure, gauge pressure, absolute Pressure. Pressure Gauges - Piezometer tube, simple and differential manometer, micro – manometer. (Theoretical Treatment only, No Analytical treatment / Problems on Manometers.) Bourdon tube pressure gauge.
	Hydrodynamics 2.1 Law of continuity. Law of continuity and its applications. 2.2 Bernoulli's Theorem. Energy possessed by the liquid in motion. Bernoulli's theorem and its applications such as Venturimeter, Orifice meter and pitot tube. (Analytical treatment with derivation for measurement of discharge is expected). 2.3 Hydraulic coefficients Concept of Vena Contracta. Coefficient of contraction, coefficient of velocity, coefficient of discharge, Coefficient of resistance. Relation between the hydraulic coefficients. 2.4 Types of fluid flow Steady, unsteady, rotational, irrotational, laminar, turbulent, one, two & three dimensional flow, Uniform & non uniform flow.

	Hydraulic Devices 3.1 Simple Hydraulic Devices. Working principles, construction and applications of Hydraulic jack, Hydraulic ram, Hydraulic lift, Hydraulic press. 3.2 Centrifugal Pumps. Types, Construction and working of centrifugal pump Types of casing. Need of priming. Heads, Losses and Efficiencies of Centrifugal Pump. (No Analytical Treatment.) Net positive suction head, Fault findings and remedies. Pump selection. 3.3 Reciprocating Pumps Construction & Working of single & Double Acting Reciprocating pump. Positive & Negative slip. Air vessels - their function & Advantage. Power and Efficiencies of Reciprocation Pump. (No Analytical Treatment.) Reasons of cavitations and separation. 3.4 Other Pumping Devices. Gear pumps used in hydraulic circuits, Vane type, Screw pumps, Swash plate pump. Comparison of above pumps for various characteristics. 3.5 Air Compressors. Reciprocating Compressors. Rotary compressor used in pneumatic circuits
	Basic Components of Hydraulic & Pneumatic Systems 4.1 Hydraulic & Pneumatic symbols 4.2 Air Motors: Type, construction ,working. 4.3 Hydraulic Motors: Type, construction, working. 4.4 Valves: Classifications of valves, poppet, ball, needle, throttle, pressure control directional control, sequencing synchronizing ,rotary spool, sliding spool two position, multi position. Non-return valves. Construction & operation of above valves.
	Accessories of Hydraulic & Pneumatic circuit 5.1 Filters: Types, function, construction. 5.2 Hoses & Connectors: Type, construction and applications. 5.3 Seals & Gaskets: Types, function, construction.

	Hydro Pneumatic Systems & Circuits 6.1 Comparison of Hydraulic and pneumatic circuits. 6.2 Hydraulic Circuits: Meter in, Meter out, Bleed off, Sequencing. Applications of hydraulic circuits: Hydraulic power steering – Reaction piston type, Mobile Hydraulic system and Earthmovers 6.3 Simple Pneumatic Circuits. Speed control circuits. Sequencing circuits. Applications of pneumatic circuits – Air brake, Low cost Automation in industries, Pneumatic power tools.

(MECHATRONICS (ELECTIVE-I))	
	Introduction to Sensors, Transducers and Actuators Principle, working and applications of-Limit switches, proximity switches like inductive ,capacitive and optical (deflecting and through beam type) , Thumb wheel switches magnetic reed switches ,Optical encoders-displacement measurement,rotary,incremental, opto-couplers. Actuator – solenoids – on-off applications, latching, triggering Types of relays- solid state Types of motors – DC motors, DC brushless motors, AC motors, stepper motors , servo motors
	8085 Microprocessor Architecture, Pin configuration, working of microprocessor, and applications. Introduction to ICs used for interfacing such as – Programmable peripheral devices , USART, memory, keyboard, display – LCD,LED,I/O device, ADC, DAC etc **8051 Microcontroller** Architecture, Pin configuration, working of microcontroller, Applications Comparison of microprocessor and microcontroller , advantages and disadvantages
	Programmable Logic Controller (PLC) Introduction, PLC definition, PLC block diagram, Difference between relay panel and PLC, ,power supply, input/output modules (analog, digital) concepts of sink/source, set/reset, latch/unlatch, advantages and disadvantages, installation , troubleshooting and maintenance
	Selection of a PLC Programming equipment, Programming formats Ladder diagrams and sequence listing, large process ladder diagram construction, flowcharting as a programming method , Basic PLC functions Register basics, timer functions, counter functions Intermediate functions – Arithmetic functions, number comparison and number conversion functions Data handling functions- SKIP, Master control relay, Jump, Move, Block move, Table to register and register to table move functions. FIFO and LIFO functions, File Arithmetic and Logic function
	ONS and CLR functions and their applications PLC digital bit functions and applications Sequencer functions and cascading of sequencers PLC matrix functions Discrete and analog operation of PLC, Networking of PLCs. PLC auxiliary commands and functions,

	Online, offline, stop/run modes of operations, uploading/downloading between PLC and PC, Introduction to SCADA and DCS

(VEHICLE AERODYNAMICS AND DESIGN (ELECTIVE-I))	
	Aerodynamics: 1.1 Introduction of aerodynamics: Historical Examples andfuture trends. 1.2 Classification & practical objectives of aerodynamics 1.3 Fundamental aerodynamic variables like Pressure, Density, Temperature, Flow Velocity. 1.4 Aerodynamic forces & moments like Relative Wind, Free Stream, Lift, Drag. 1.5 Concept of airfoil and air dam.
	PART A : Ergonomic consideration 2.1 Concept of Visibility 2.2 Concept of Blind spot
	2.3 Driver seat design requirement 2.4 Passenger seat design requirement 2.5 Child seat design requirement 2.6 Aerodynamic properties **PART B : Aerodynamics properties of basic shape** 2.7 Lift &pitching. 2.8 Side forces & yaw moment. 2.9 Rolling moment.
	Fundamentals of Aerodynamic Drag Part A 3.1 Types of carbodies. 3.2 Flow field around the car -Air flow pattern, Pressure distribution 3.3 Local origins of flow field - Front end, windshield wiper, A-pillar, Roof, Rear end 3.4 Water and dirt accumulation on the body -Safety, water flow, Dirt Deposits **Part B** 3.5 Wind tunnels: 3.5.1 Concept (no analytical treatment) 3.5.2 Construction 3.5.3 Existing wind tunnels:- Large, Small full scale wind tunnel, Wind tunnel for scale model, Climatic tunnel, Climatic wind chamber
	3.6. Wind noise: 3.6.1 Wind noise sources: - Leak noise, Cavity noise, Wind- rush noise; 3.6.2 Design features of A-pillar, Outside rearview mirror, Wind shield wipers, Radio antenna, Roof racks, Doors.
	Directional Stability 4.1 Aerodynamic stability 4.2 Driving behavior in crosswind 4.3 Driving with trailer 4.4 Stability of vehicle on slope(derivation &numerical problems) 4.5 Stability of vehicle on turns(derivation &numerical problems)

	Vehicle Performance (numerical problems) 5.1 Various resistances faced by vehicle (air, rolling, gradient) 5.2 Power required to propel the vehicle 5.3 Maximum Drawbar pull 5.4 Tractive efforts,Traction, 5.5 Relation between vehicle & engines peed. 5.6 Acceleration and gradeability.

(VEHICLE TESTING (ELECTIVE-I))	
Contents : Theory (Name of the Topic)	
	Overview of Vehicle Testing 1.1 Need and importance of vehicle testing 1.2 Classification, Accuracy, Test data. 1.3 Basis of tests- driving cycles,Homologation 1.4 Requirements of test- Test equipments, Procedure, Quality Personnel. 1.5 Testing instruments and equipments- Use, capabilities and Parameters of the following equipments to be recorded Engine dynamometer, Compression tester, Stroboscope, Computerized engine analyzer, Petrol/Diesel engine scanner, Infrared exhaust gas analyzer, Diesel smoke meter, Vacuum tester, Chassis dynamometer etc. Testing Standards- SAE, ASMT standards; ARAI, CMVI regulations. 1.7 Significance of test. 1.6 Production part approval process
	Laboratory Testing of Vehicle Subsystems Part A: 2.1 Noise, Vibration and Harshness (NVH) testing- Types of NVH- Pass by noise, In cab noise, Floor vibrations. 2.2 Engine Performance parameters testing- Power, Torque, Efficiency, Fuel consumption, Dry and wet compression test, Charging system test, Regulated voltage test, Starter motor voltage drop test, Ignition system oscilloscope test. 2.3 Engine emission testing as per Indian drivingcycles. 2.4 Lubricating oil pump pressuretest. **PART B:** 2.6 Cooling system- Leakage test, pressure test, Vacuum testof pressure cap, Corrosion test- Hot spots and coldspots. 2.7 Fuel Injection pump – pressure test, Injectortesting, Calibration andPhasing. 2.8 Transmission Testing- Efficiency Vs O/P Speed, Torque ratio Vs O/P Speed, Input speed Vs O/P Speed, O/P Torque Vs O/P Speed, Parasitic losses Vs Input Speed, NVH test. 2.9 Tyre Testing- Tyre wear pattern identification andcauses, Endurance test, Strength test, High speed performance test, Tubeless tyre resistance to bead unseating.
	On-Road Testing of Vehicles PART A: 3.1 Introduction of samplingtechnique. 3.2 Vehicle level performance parameters- Acceleration, Drive ability, Gradeability, Restartability, Brakes testing, Steering effort Testing, Speedometer and odometertesting. 3.3 Accelerated endurance testing procedures- Torturetracks

	e.g. Belgian Pave, Corrugated, Long wave pitching, Pot hole, Sand patch, Mud patch, Steering pad, High speed, Serpentine courses, Gradient, Shallow water trough, Deep wading trough, Cross Country, Step Climbing, Draw bar or winch pull test. **PART B:** 3.4 Moving barrier collision test- Frontal impact, Rear impact, Side impact, roof crash. 3.5 Barrier Collision test with vehicle acceleration and occupantloading. 3.6 Roll over test withoutcollision. 3.7 Inverted vehicle drop test 3.8 Vehicle ride and handling parameters and effect of steering changes, suspension changes on handling characteristics- Definitions of – Ride and comfort, Roll, Lurch, Tramp, Yaw, pitching, bouncing,Steady-state cornering, Steering characteristics.

(BASIC ELECTRICAL AND ELECTRONICS)	
	Basic concepts & principles of Electrical Engineering 1.1 Voltage, Current, Resistance, Ohm's law 1.2 Magnetism, Electromagnetism, Law of Electromagnetic Induction 1.3 AC fundamentals, Concept of active and reactive power 1.4 Application of measuring Instruments – volt meter, ammeter, inductive/ tongue tester and multimeters. 1.5 Principles of transformers. Ampere turns ratio. 1.6 Construction of transformer. 1.7 Core and shell type transformer.
	1.8 Auto transformer-types and comparison.
	Electric Motors and Generators 2.1 DC motors:-Principle, Construction, types and applications 2.2 AC motors:-Principle, Construction and applications 2.3 Stepper motor-Types of stepper motor, principle, construction, applications and specifications. 2.5 Concept and working principle of D.C. generator and alternator.
	Wiring and Lighting Circuit 3.1 Symbols of electrical circuits and wiring colour code, size, comparison of insulated & ground return system, Positive & negative return system, their comparison. 3.2 Need of wiring Harness, Wiring diagram of :-Head light, Turn indicator, Horn, Windshield wiper, Power window, Power seat, Battery ignition, Magneto ignition.

	Basic Electronics 4.1 Semiconductors, 4.2 Diode :-PN junction, zener diode symbol, Characteristics and application. 4.3 Rectifier-half, full, Bridge type with filters(C,LC,Πtype). 4.4 Transistor:- BJT:-NPN, PNP transistor, symbol, working. 4.5 TRIAC, DIAC, , Silicon control rectifier(SCR):-Symbol, working . Comparison between Transistor and SCR. 4.6 Amplifier:-Common emitter configuration only 4.7 Power device:-photodiode, LED, LDR, phototransistor working 4.8 TRIAC,DIAC, Silicon control rectifier(SCR):-Symbol, working 4.9 Concept of Oscillators
	Transducers/Sensors and their applications 5.1 Electromechanical type transducers: -Potentiometric resistances type, Inductive (LVDT), Capacitive, Piezoelectric. 5.2 Photoelectric type transducers: Photoemissive ,Photovoltaic, Photoconductive 5.3 AC/DC Electronic timer block diagram study 5.4 Concept of General measurement system & difference between mechanical and electrical/electronic instruments 5.5 Measurement of Pressure:- Working of thermocouple vacuum gauge, Pirani vacuum gauge, Varying pressure measurement; 5.6 Measurement of Flow:- Hot wire anemometer, Ultrasonic flow meter; Measurement of Temperature:- Working of Thermopiles, Thermister ; 5.8 Measurement of Speed:- contactless electrical tachometer:- Inductive, Capacity type tachometer, Stroboscope; 5.9 Measurement of Force:- Strain gauge load cell; 5.10 Electrical method for moisture measurement
	Digital Electronics 6.1 Define analog signal and digital signal 6.2 Study of logic gates(NOT,OR, NOR, AND, NAND) symbols and truth table 6.3 Study of flip flops only RS & D : symbols and truth table 6.4 Working principle with block diagram of shift register &counter 6.5 Working principle with block/ logic diagram of encoder & decoder 6.6 Working principle with block/logic diagram of multiplexerand demultiplexer 6.7 Working of seven segment LED display

ALTERNATE ENERGY SOURCES AND MANAGEMENT (ELECTIVE-II)	
	Introduction to Energy Sources 1.1 Introduction. 1.2 Major sources of energy: Renewable and Non-renewable. 1.3 Primary and secondary energy sources. 1.4 Energy Scenario: - Prospects of alternate energy sources. - Need of Alternate energy sources.

	Solar Energy 2.1 Principle of conversion of solar energy into heat and electricity 2.2 Solar Radiation: Solar Radiations at earth's surface Solar Radiation Geometry: Declination, hour angle, altitude angle, incident angle, zenith angle, solar azimuth angle 2.3 Applications of Solar energy: - - Construction and working of typical flat plate collector and solar concentrating collectors and their applications, advantages and limitations - Space heating and cooling. - Photovoltaic electric conversion. - Solar distillation, Solar cooking and furnace. - Solar pumping and Green House. Agriculture and Industrial process heat. (no derivations and numericals)
	Wind Energy 3.1 Basic Principle of wind energy conversion. 3.2 Power in wind, Available wind power formulation, Power coefficient, Maximum power 3.3 Main considerations in selecting a site for windmills. 3.4 Advantages and limitations of wind energy conversion. 3.5 Classification of wind mills 3.6 Construction and working of horizontal and vertical axis wind mills, their comparison 3.7 Main applications of wind energy for power generation and pumping.
	Energy from Biomass 4.1 Common species recommended for biomass. 4.2 Methods for obtaining energy from biomass 4.3 Thermal classification of biomass a) Gasified, b) Fixed bed and fluidized 4.4 Application of gasifier 4.5 Biodiesel production and application 4.6 Agriculture waste as a biomass 4.7 Biomass digester 4.8 Comparison of Biomass with conventional fuels
	Energy Conservation A. Energy conservation and Management:- 5.1 Global and Indian energy market 5.2 Energy scenario in various sectors and Indian economy 5.3 Need and importance of energy conservation and management 5.4 Concept of Payback period, Return on investment (ROI), Life cycle cost, Sankey diagrams, specific energy consumption.
	Energy Conservation Techniques 6.1 Distribution of energy consumption 6.2 Principles of energy conservation. 6.3 Energy audit 6.4 Types of audit 6.5 Methods of energy conservation 6.6 Cogeneration and its application

	6.7 Combined cycle system 6.8 Concept of energy management 6.9 Study of different energy management techniques like - Analysis of input - Reuse and recycling of waste - Energy education - Conservative technique and energy audit
	Economic approach of Energy Conservation 7.1 Costing of utilities like steam, compressed air, electricity and water. 7.2 Ways of improving boiler efficiency 7.3 Thermal insulation, Critical thickness of insulation. 7.4 Waste heat recovery systems, their applications, criteria for installing unit. An introductory approach of energy conservation in compressed air, refrigeration, air conditioning, pumps and fans.

(AUTOMOTIVE ELECTRICAL AND ELECTRONIC SYSTEMS)	
	Electrical & Electronic Components 1.1 Purpose and operation of electrical components like switches, relays, solenoids, buzzers, and resistors. 1.2 Purpose of circuit protection devices like fuses, maxi fuses, circuit breakers (Manual and automatic resetting types.) and fusible links 1.3 Testing of circuit defects like open circuit, shorts, shorts to grounds, voltage drop. Working of Electromagnetic gauges like temp Gauges, fuel gauge, engine oil pressure gauge, Speedo-meter gauge. Features of scan tester. 1.6 Working of electrical accessories like wind shield wiper, washer pumps, blower motor, electro chromic mirror, power window, power seat, power door lock
	Battery 2.1 Lead acid battery – components &operation. 2.2 Maintenance free battery –construction. 2.3 Concept of Low maintenance battery. 2.4 Hybrid Battery –construction. 2.5 Battery ratings and specifications. 2.6 Battery maintenance and safety precautions. 2.7 Battery testing – Battery terminal test, Leakage test, Specific Gravity. Test, Open circuit test, Capacity test, Battery draintest. 2.8 Battery charging – Initial charging procedure, dry charged battery- precautions. Slow and fast rate charging and tricklecharging. 2.9 Jump starting-Procedure and precautions. 2.10Factors affecting battery life. 2.11Battery failures – cycle failure ,internal short circuit, overcharging, local action and sulphation

	Starting And Charging System Part A 3.1 Construction and working of starting system. Types of starter drive (Bendix and overrunning clutch types only) construction and working. 3.2 Testing of starting system – Quick testing, Current draw test, Insulated circuit resistance test, Ground circuit test, No crank test, free speed test. **Part B** 3.3 Construction & operation of alternator. Initial excitation and self excitation. 3.4 Alternator testing – Current out put test, Field current draw test. Regulator output test. 3.5 Alternator components testing- rotor, stator, Internal regulator and rectifier. 3.6 Regulation- Electronic, Computer Regulation circuit layout and operation. 3.7 Operation of charge indicator light circuit.
	Ignition Systems 4.1 Need of ignition system. 4.2 Triggering of Primary circuit – Inductive, Hall Effect and Optical method. Mutual Induction. 4.3 Classification of ignition systems on basis of – a) triggering system b) source-battery & magneto c) spark timing- dual spark timing (vacuum and centrifugal advance), electronic spark timing 4.3 Magneto ignition system- construction and working of CDI system. 4.4 Components of ignition system:- Ignition coil types, Distributor, spark plug, cords, and condenser. 4.5 Advance & retard timing mechanism-construction and working. 4.6 Electronic (or solid state) ignition system with distributor- circuit diagram and working. 4.7 Distributor less/ computer controlled coil ignition system operation. 4.8 Sensors and Ignition Control Module for triggering and timing of spark.
	<u>Advanced lighting accessories -fundamentals</u> 5.1 Operation of automatic headlight dimming. 5.2 Operation of automatic on/off headlight with time delay. 5.3 Use and working of fiber optics & its diagnosis 5.4 Operation of keyless entry 5.5 Operation of common anti-theft system 5.6 Purpose & operation of automatic door lock system
	Diagnosis of electronic components & Systems 6.1 Sensor testing:- Oxygen sensor, Engine coolant sensor, Intake air temp. sensor, Throttle position sensor, Manifold absolute pressure sensor. 6.2 Electronic fuel Injector testing:- only sound test, Ohm meter test. 6.3 Onboard diagnosis (OBD):- 6.3.1 Purpose of (onboard diagnostic second generation) OBD II, flash codes of Malfunction indicator light. 6.3.2 OBD II terminology:- Drive cycle, Trip, Warm up cycle (Definitions only) 6.3.3 SAE J2012 standards Diagnostic Trouble Code(DTC) :-5 digits only 6.4 Troubles of electronic gauges like. 6.4.1 Gauge reads low constantly. 6.4.2 Gauge reads high constantly. 6.4.3 Inaccurate Gauge reading.

(AUTOMOBILE AIR CONDITIONING (ELECTIVE-II))	
	Introduction 1.1 Environmental & safety aspects in heating, ventilation &air conditioning systems 1.2 Human comfort control - comfort zone, air movement, wind chill factor, odour problems & effects of humidity. 1.3 Heat transfer fundamentals- forced & natural convection, radiation, evaporation & conduction. 1.4 Requirements of heating, ventilation & air conditioning in cars, multi utility vehicles, vans, safari, heavy passenger vehicles, coaches, cargo vehicle cabin, vehicle carrying perishable commodities & cryogenic substances. 1.5 Controlled & uncontrolled ventilation -working, application & comparison.
	Case & Duct System 2.1 Construction & working of Air intake section, core section &distribution section. 2.2 Construction & working of Downstream, upstream, split & hybrid. 2.3 Construction & working of rear heating & cooling system.
	Air Conditioning System **Part A** 3.1 General layout of Air conditioning system. 3.2 Construction & working of following refrigeration sub systems – thermostatic expansion valve, fixed orifice tube & rotary vane air cycle system. 3.3 Construction & working of evaporator, condenser, accumulator. 3.4 Receiver driers & accumulator- Types, construction &working 3.5 Construction & working of reciprocating, scroll & rotary vane compressors. Drive systems for compressors.
	Part B *3.1 Construction & working of electromagnetic clutch* *3.2* Metering devices- comparison of thermostatic expansion valve &fixed orifice tube. Types working & comparison of thermostatic expansion valves i.e. H valve, block type, internally equalized & externally equalized. 3.3 Functions of thermostatic expansion valve i.e. Throttling action, modulating action & controlling action. Construction & working of remote bulb.

	System Control Devices & Electrical Circuits 4.1 System controls - Construction & working of typical vacuum system & electronic temperature control system. 4.2 Construction & working of vacuum operated devices i.e. vacuum reserve tank, vacuum restrictor, vacuum motor, check valve & check relays. 4.3 Switches - Construction & working of high- side temperature switch, low-side temperature switch, high- pressure switch, low- pressure switch, pressure regulator, ambient switch & superheat switch. 4.4 Sensors- Construction & working of sun load sensor, outside temperature sensor & in car temperature sensors. 4.5 Construction & working of Aspirator. 4.6 Construction & working of blower clutch control, heater control, and time delay relay for heater control. 4.7 Mode doors and temperature doors. 4.8 Electrical circuits- Typical climate control system& Electronic climate control system, their electrical circuits & working.
	Repairs & maintenance of Air Conditioning system 5.1 Visual & acoustic check, side glass, leak test, temperature test, Procedure of charging & discharging. Moisture removal procedure. 5.2 Service equipments & tools – Vacuum pump, Manifold &gauge i.e. Low side & high side, gauge calibration, recovery unit & recycling unit, Halide (freon) & Fluorescent leak detector, nitrogen leak test 5.3 Compressor service - Symptoms, faults, cause &remedy. 5.4 Electromagnetic clutch service - Symptoms, faults, cause & remedy. 5.5 Performance testing procedure of thermostatic expansion valve & fixed orifice tube. 5.6 Refrigerant lubricants- Properties &types 5.7 Refrigerant- types, Packaging, storage, restrictions, color code &purity test Hoses & connectors – construction of system hoses, charging hose with shutoff valve & connectors. Retrofitting from CFC- R12 to HFC- 134 A – need, procedure & Precautions
	Comfort Heating System 6.1 Function, construction, working, maintenance, general faults and their remedies of Comfort Heating System.

(CAD-CAM & AUTOMATION (ELECTIVE – II))	
	Introduction to CAD/CAM Computers in industrial manufacturing. Product Cycle, CAD/CAM CAD/CAM hardware:- basic structure, CPU, Memory, I/O devices, Storage devices and system configuration

	Geometric Modelling Requirement of geometric modelling, Types of geometric models. Geometric construction method-sweep, solid modelling- Primitives & Boolean operations, free formed surfaces (Classification of surface only) (No numerical treatment)
	Introduction to computer numerical Control Introduction - NC, CNC, DNC, Advantages of CNC, The coordinate system in CNC, Motion control system - point to point, straight line, Continuous path (Contouring). Application of CNC.
	Part programming Fundamentals, manual part programming, NC –Words, Programming format, part programming, use of subroutines and do loops, computer aided part programming (APT).
	Industrial Robotics Introduction, physical configuration, basic robot motions, technical features such as - work volume, precision and speed of movement, weight carrying capacity, drive system, End effectors, robot sensors. Application – Material transfer, machine loading, welding, spray coating, processing operation, assembly, inspection.
	Automation Basic elements of automated system, advanced automation functions, levels of automation. Flexible manufacturing system :-Introduction, FMS equipment, FMS application, Introduction to CIM

TECHNOLOGY (MANAGEMENT)	
	Overview Of Business 1.1. Types of Business • Service • Manufacturing • Trade 1.2. Industrial sectors Introduction to • Engineering industry • Process industry • Textile industry • Chemical industry • Agro industry 1.3 Globalization • Introduction • Advantages & disadvantages w.r.t. India 1.4 Intellectual Property Rights(I.P.R.)
	Management Process 2.1 What is Management? • Evolution • Various definitions • Concept of management

	• Levels of management • Administration & management • Scientific management by F.W.Taylor 2.2 Principles of Management (14 principles of Henry Fayol) 2.3 Functions of Management • Planning • Organizing • Directing • Controlling
	Organizational Management 3.1 Organization:- • Definition • Steps in organization 3.2 Types of organization • Line • Line &staff • Functional • Project 3.3 Departmentation • Centralized &Decentralized • Authority &Responsibility • Span of Control 3.4 Forms of ownership • Propriotership • Partnership • Joint stock • Co-operative Society • Govt. Sector
	Human Resource Management 4.1 Personnel Management • Introduction • Definition • Functions 4.2 Staffing • Introduction to HR Planning • Recruitment Procedure 4.3 Personnel– Training &Development • Types of training ➢ Induction ➢ Skill Enhancement 4.4 Leadership &Motivation • Maslow's Theory of Motivation 4.5 Safety Management • Causes of accident • Safety precautions 4.6 Introduction to – • Factory Act • ESI Act • Workmen Compensation Act • Industrial Dispute Act

	Financial Management 5.1. Financial Management- Objectives &Functions 5.2. Capital Generation &Management • Types of Capitals • Sources of raising Capital 5.3. Budgets and accounts • Types of Budgets ➢ Production Budget (including Variance Report) ➢ Labour Budget • Introduction to Profit & Loss Account (only concepts) ; Balance Sheet 5.4 Introduction to– • Excise Tax • Service Tax • Income Tax • VAT • Custom Duty
	Materials Management 6.1. Inventory Management (No Numericals) • Meaning &Objectives 6.2 ABC Analysis 6.3 Economic Order Quantity • Introduction & Graphical Representation 6.4 Purchase Procedure • Objects of Purchasing • Functions of Purchase Dept. • Steps in Purchasing 6.5 Modern Techniques of Material Management • Introductory treatment to JIT / SAP /ERP
	Project Management (No Numericals) 7.1 Project Management • Introduction & Meaning • Introduction to CPM & PERT Technique • Concept of Break Even Analysis 7.2 Quality Management • Definition of Quality , concept of Quality , Quality Circle, Quality Assurance • Introduction to TQM, Kaizen, 5 'S', & 6Sigma

(SPECIAL PURPOSE VEHICLES (ELECTIVE-II))	
	Earth Moving Machines – Introduction 1.1 General layout, Application & Classification of earth moving machines. Comparison of tyred & crawler tractor 1.2 General Specifications of a typical earth moving machine. 1.3 Comparison between general automobile & earth moving machine on following parameters: • Traveling Speed • Working conditions • Power output & power variations • Controls • Torque & torque variations. • Steering • Suspension • Fuel & fuel consumption • Hydraulics • Power take offs • Clutch • Brakes • Driving license • RTO registration 1.4 Implications of earth moving machines on economy & infrastructure development: o Next five year plan o Role of earth moving machine in road laying, bridge construction, building construction, tunnel, mining & in disaster management.
	Tractor Dozer 2.1 Tractor dozer- types, layout , power train & bucket swing Applications i.e. ripping, blasting Vsripping) 2.2 Rippers – types i.e. hinge & parallelogram, their application & comparison. 1.6 Ripper tip selection. 1.7 Dozing, & Underwater application. 2.5 Dozer blade – types i.e. straight dozer, angle dozer, S' blade, 'U' blade, 'C' blade, 'A' blade, and theirapplications. 2.6 Track shoe construction & working. 2.7 Under carriage maintenance. 2.8 Safety precautions for Dozer operations.
	line (Rope Operated Excavator) 3.1 Applications of dragline i.e. excavating channels, ditches, trenches, underwater soil, stripping overburden, shallow grading, general excavation, loading into hoppers, loading hauling units, sloping & grading.(simple sketches only) 3.3 Clamshell - application, capacity, bucket, construction &size 3.4 Hoe and Cranes - their working &Application.

	Loaders & Excavators: 4.1 **Crawler loader** – working & attachments i.e. standard bucket, bulk handling bucket, fork lift attachment, crane attachment Stability &safety of crawler loader operations. 4.2 **Wheeled loader** –types i.e. back hoe & front hoe, working, capacity & output. 4.3 **Hydraulic Excavator**: Application, block diagram, types of buckets & their applications e.g. 3 in 1 bucket, ejector bucket, square hole bucket, ditch digging bucket, clay bucket and hydraulic grab. 4.4 **Scraper:** Block diagram, types – Towed &self-propeller, 4.5 **Motor Grader** – Block diagram, constructions, application, stability & safety, capacity &outputs.
	Tractor: 5.1 Comparison of tractor with an automobile 5.2 Indian tractor industry 5.3 General Layout of a tractor 5.4 Power train & transmission layout of atractor 5.5 Tractor Power take off its working &construction 5.6 Tractor tyres construction & selection 5.7 Counterweight & its importance 5.8 Types of implements in tractors, its uses & its effect on performance of a tractor 5.9 Power tiller- Comparison with tractors, Various attachments &its applications
	Forklift Truck , tipper & road roller 6.1 Forklift Truck- Types, layout, lifting mechanism, counterweight &steering mechanism. Safety in operation. 6.2 Tipper – Types, construction & working tipping mechanism &maintenance. Safety in operation of tipper. 6.3 Road roller- Types, layout , operation &maintenance.

(TRANSPORT MANAGEMENT)	
	Introduction to transport management *1.1 Motor Vehicle Act:* Short titles used in MVA, Definitions, Terms regarding vehicle. ***1.2*** **Licensing of Drivers of MotorVehicle:** Necessity, Age limit, Responsibility of owners, Restriction on holding a driving license, General, Preliminary test and driving test. ***1.3*** **Conductor's license:** Necessity, Eligibility, Documents required and rules for conductors. ***1.4*** **Registration of Vehicles:** Necessity, Where to be made, How to be made, Temporary registration, Production of vehicle at the time of registration, Form and manner of display of registration mark, Size of letters and numerals of registration

	mark, Transfer of Ownership of Motor Vehicle. **1.5 Control of Transport:** Transport authorities, Difference between STA & RTA, Necessity of Permit, All types of Permit, Transfer of permit, Temporary permit, Tourist permit, National permit. Speed limits. **1.6 Construction of Motor Vehicle:** Overall dimensions, General provision regarding construction and maintenance of motor vehicle. Power of central government to make rules. **1.7 Taxation:** Objectives, Basis of taxation, Methods of levying tax, Tax exemption. **1.8 Insurance:** Motor Vehicle Insurance, No-fault liability, Procedure for accident claim.
	Transport Management ***Part A*** **2.1 Terms used in transportation:** Road transport service, Transport vehicle, Public service vehicle, Goods vehicle, Public place, Depot, Route, Trip, Time table, Vehicle schedule, Fare. **2.2 Comparison of** Modes oftransport. **2.3 Requirements of goods and passenger transport on the basisof—** Volume, type, weight of material; class of passenger. **2.4 Basic elements in TransportManagement:** **2.4.1 Market potential:** Type of goods/ passengers, Period of use, Probable competition. **2.4.2 Selection of vehicle:** Type of load, Class of passenger, Type of service. **2.4.2 Organizationsetup:** Govt., Semi Govt.,Private. **2.4.4 Legal compliance:** Documents required as per MVA, Registration. **2.4.5 Policies of transport organization:** Policies towards passenger, employees, like Long distance service, Express service, Night service and others. **Part B** **2.4.6 Layout of organization:** **Location, elements considered in location, Passenger amenities, infrastructural facilities.** **2.4.7 Scheduling:** Basic factors in bus, crew(staff) and maintenance scheduling, calculation of number of buses. **2.4.8 Freight calculation:** **Time base, Distance base, Contract, per passenger, cubic feet tone**

	method. Structure of fare, fixed cost- Maintenance cost, depreciation cost, insurance, interest on capital, variable cost, Hiring of trucks, Toll, staff wages, Miscellaneous cost. 2.4.9Record keeping : **Log book, Trip operational sheet, Vehicle ledger, Truck history card, Monthly operational sheet, Goods consignment note, various types of bookings, Use of Computer.**
	Estimation and Valuation of Vehicle: 3.1 Role of surveyor. 3.2 Procedure of survey and valuation of vehicle. 3.3 Accident survey report. **3.4 Importance of warranty system and protection of law: How to deal with defects, benefits of warranty system. Protection oflaw.**
	3.5 Buying a new vehicle: Factors to be considered- Ex-showroom price and on road price, use of vehicle, when and where to buy, Closing the deal, Running in. inspecting the vehicle, Points to check: test drive, Controls, Bonnet, Suspension, Switches, Seat, Noise, Ventilation, Safety, Boot, Interior Storage. **3.6 Buying a used vehicle:** When & where to buy: Dealers, used car firms, Private sellers, Garages, Auctions. Factors to be considered-- Depreciation, Model and year, Oil leak, Oil Pressure, Exhaust , Battery, Odometer, Bonnet, Crash damage, Rust, Suspension damage, Tyres,Switches & accessories, Lights, Chrome, Wiring , Steering, Hydraulic System, Structural corrosion, Floor, Test drive. **3.7 Preparations for selling :** When to sell, How to sell, Auctions, Garages, Private sale, Preparing the car, Documentation, Selling price, Safeguards.
	Driving skills: **4.1 Instructions in driving of motor vehicle:** Driving theory, traffic education, light vehicle driving practice, Vehicle mechanism & repair, Public relations for drivers, Fire hazards, vehicle maintenance, firstaid. **4.2 Trafficsigns:** **M**andatory signs, Cautionary signs, Informatory signs. Traffic signals. Causes of accident and remedies. **4.3 Measures to avoid accidents** **4.4 Defensive driving :** **4.5 Rain and flood, fog and mist, snow andice,** **4.6 Fitness to drive :** Driving and age, stress due to traffic jam, night driving.
	Motor Industry 5.1 The Automobile Industry In India (Collection of Data of various companies) 5.2 Importance of Automobile Engineer. 5.3 Working of Various State Transport Organizations. (MSRTC,BEST)
	Functions & Role in Automobile Industry: Various Research Organizations like- Central Institute of Road Transport. Automotive Research Association of India. Vehicle Research, Development & Establishment. Central Road Research Institute. Petroleum Conservation & Research Association

(VEHICLE MAINTENANCE)	
Contents : Theory	
	Auto Workshop Layout & Equipments 1.1 General safety precautions and procedures. 1.2 Functions of General shop equipments and tools (of the below mentioned tools and equipments only) -wheel balancer, wheel aligner, crankshaft aligner and straightner, engine analyzer, arbor press, drill press, battery charger, tyre changer, car washer, lift, FIP calibration machine, head light aligner, valve grinder, honing machine, cylinder boring machine. 1.3 Layout with equipments required for dealers of two- wheeler, Four wheelers - cars and commercial vehicles. For road - side garages. Layout of modern workshop for specialised job work, crankshaft grinding, engine (re-boring), F.I.P repairs, crankshaft journal boring, brake drum boring.
	Maintenance management and record Keeping 2.1 Necessity of maintenance 2.2 Types of maintenance and their applications 2.2.1 Preventive maintenance system. 2.2.2 Scheduled maintenance system 2.2.3 Break down maintenance system 2.3 General maintenance schedule -Daily, weekly, monthly & periodic maintenance. for various vehicles -Two –wheelers, LMV, HMV 2.4 General servicing procedure. Decision to repair or replace. 2.5 Workshop records- history sheet, work order, activity file
	Engine Maintenance Part A: 3.1 Troubles, Causes & remedies in engine, fuel system, cooling system, lubrication system & MPFI Engine. 3.2 Checking and Servicing of following engine components: cylinder head, cylinder block, cylinder liners, piston, piston ring, crank-shaft, connecting rod, valves. 3.3 Tuning of engine **Part B:** 3.4 Fuel feed system service carburetor dismantling, cleaning and tuning, injector cleaning and testing, FIP phasing and calibration, MPFI -injector testing and cleaning. sensor testing). 3.5 Lubrication system service. – change oil filter, check oil pump, and diagnose causes for excessive oil consumption, external oil leakage, and low oil pressure in an automobile engine.

	Chassis & Body Maintenance Part A: 4.1 Checking and repairing of Clutch for clutch plate thickness, run- out, rivet depth, warpage of pressureplate. 4.2 Adjustment of clutch. 4.3 Troubles, Causes and remedies of clutch. 4.4 Checking gearbox for run out of main shaft and lay shaft, for wear of synchronizer and worn bearings, checking oilseals. 4.5 Troubles, Causes and remedies of gearbox 4.6 Checking and adjusting differential for ring gear run-out, backlash in ring gear, tooth contact between ring gear and pinion, bearing preload. 4.7 Troubles, Causes and remedies of propeller shaft, differential and rear axle. 4.8 Inspection and repair of master cylinder, wheel cylinder, brake drum, brake disc, brake linings and brake pads.
	4.9 Adjustment of hydraulic brakes – shoe clearance, brake pedal free travel, pedal to wall clearance, parking brake adjustment. 4.10 Bleeding of hydraulic brakes 4.11 Troubles, Causes and remedies in brakesystem. **Part B:** 4.12 Troubles, Causes and remedies of suspension system. Lubrication of leaf springs 4.13 Procedure of wheel alignment (after chassis height adjustment) by wheel alignment gauges and procedure of wheel balancing. Troubles, Causes and remedies of steering system. 4.14 Care of wheels and tires, retreading of tires and vulcanizing. Tire rotation. 4.15 Frame repairs (cracks, loose rivets, skewness in frames) and alignments. 4.16 Body repairs- denting, denting tools andequipments 4.17Repainting procedure, patchwork. 4.18Painting defects. 4.19Adjustment of doors and locks

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.