Engineering and Management Institute of India

Diploma in Engineering

Automobile Engineering Syllabus

Department of Automobile Engineering

Vision:-

To strengthen the region through imparting superior quality technical education and research; which enables the fulfillment of industrial challenge and establish itself as a Centre of Excellence in the field of Automobile Engineering.

Strength of Material (AE-2.1)

UNIT-I

Simple Stresses & Strains : - Elasticity and plasticity – Types of stresses & strains–Hooke's law – stress – strain diagram for mild steel – Working stress – Factor of safety – Lateral strain, Poisson's ratio & volumetric strain – Elastic moduli & the relationship between them – Bars of varying section – composite bars – Temperature stresses. Strain energy – Resilience – Gradual, sudden, impact and shock loadings.

UNIT –II

Shear Force and Bending Moment Diagrams: - Definition of beam – Types of beams – Concept of shear force and bending moment – S.F and B.M diagrams for cantilever, simply supported and overhanging beams subjected to point loads, u.d.l., uniformly varying loads and combination of these loads – Point of contra flexure.

UNIT – III

Flexural Stresses: - Theory of simple bending – Assumptions – Derivation of bending equation: M/I = f/y = E/R Neutral axis – Determination bending stresses – section modulus of rectangular and circular sections (Solid and Hollow), I, T, sections. Shear Stresses: Derivation of formula – Shear stress distribution across various beams sections like rectangular, circular, triangular, I, T sections.

UNIT – IV

Thin Shells:- Definition – Thin and thick cylindrical shell Failure of thin cylindrical shell subjected to internal pressure Derivation of Hoop and longitudinal stress causes in a thin cylindrical shell subjected to internal pressure simple problems change in dimensions of a thin cylindrical shell subjected to internal pressure -problems Derivation of tensile stress induced in a thin spherical shell subjected to internal pressure simple problems change in diameter and volume of a thin spherical shell due to internal pressure.

UNIT –V

Torsion of Circular Shafts: - Theory of pure torsion, Derivation of torsion equations: T/J=q/r=Nθ/LAssumptions made in theory of pure torsion-Torsional moment of resistance – Polar section modulus – Power transmitted by shafts. Thin Cylinders: Thin seamless cylindrical shells – Derivation of formula for longitudinal and circumferential stresses – hoop, longitudinal and volumetric strains – changes in dia, and volume of thin cylinders.

Reference Book: -

1.Strength of Materials by (R.K. Bansal ,Laxmi Publications 2010).

2. Strength of materials by (Sadhu Singh.Khanna Publications).

3. Strength of Materials by (S.Timshenko)

Fluid Mechanics (AE-2.2)

UNIT-I

Fluid statics:- Dimensions and units: physical properties of fluids-specific gravity, viscosity and its significance, surface tension, capillarity, vapor pressure. Atmospheric gauge and vacuum pressure –measurement of pressure. Manometers- Piezometer, U-tube, inverted and differential manometers. Pascal's law, hydrostatic law. Buoyancy and floatation: Meta center, stability of floating body. Submerged bodies. Calculation of metacenter height. Stability analysis and applications.

UNIT –II

Fluid kinematics:- Introduction, flow types. Equation of continuity for one dimensional flow, circulation and vorticity, Stream line, path line and streak lines and stream tube. Stream function and velocity potential function,differences and relation between them. Condition for irrotational flow, flow net, source and sink, doublet and vortex flow.

Fluid dynamics:- surface and body forces –Euler's and Bernoulli's equations for flow along a stream line,momentum equation and its applications, force on pipe bend.

Closed conduit flow:- Reynold's experiment- Darcy Weisbach equation- Minor losses in pipes- pipes in series and pipes in parallel- total energy line-hydraulic gradient line.

UNIT – III

Boundary Layer Theory:- Introduction, momentum integral equation, displacement, momentum and energy thickness, separation of boundary layer, control of flow separation, Stream lined body, Bluff body and its applications, basic concepts of velocity profiles.

Dimensional Analysis:- Similitude and modelling – Dimensionless numbers.

Performance of hydraulic turbines:- Geometric similarity, Unit and specific quantities, characteristic curves,governing of turbines, selection of type of turbine, cavitation, surge tank, water hammer. Hydraulic systemshydraulicram, hydraulic lift, hydraulic coupling. Fluidics – amplifiers, sensors and oscillators. Advantages,limitations and applications.

UNIT – IV

Basics of turbo machinery:- hydrodynamic force of jets on stationary and moving flat, inclined, and curved vanes, jet striking centrally and at tip, velocity diagrams, work done and efficiency, flow over radial vanes.

of turbo machinery:- hydrodynamic force of jets on stationary and moving flat, inclined, and curved vanes, jet striking centrally and at tip, velocity diagrams, work done and efficiency, flow over radialvanes.

UNIT –V

Centrifugal pumps:- classification, working, work done – manometric head- losses and efficiencies- specificspeed- pumps in series and parallel-performance characteristic curves, cavitation & NPSH.

Hydraulic Turbines:- classification of turbines, impulse and reaction turbines, Pelton wheel, Francisturbine and Kaplan turbine-working proportions, work done, efficiencies, hydraulic design –draft tube- theoryfunctions and efficiency.

Reference Book :-

1. Fluid Mechanics and Fluid Power Engineering by D.S. Kumar, Kotaria & Sons.

2. Hydraulic Machines by Banga & Sharma, Khanna Publishers.

Basic Electrical & Electronics (AE-2.3)

UNIT-I

DC AND AC FUNDAMENTALS:-

DC Circuits :- Definition and units of Voltage, Current, Potential Difference, Power, Energy, Resistance, Conductance, Resistivity - Ohm's Law - Kirchhoff's law - Series circuits - Parallel circuits – Series Parallel Circuits – Simple problems on Ohm's law and series parallel circuits .

AC Fundamentals:- Concepts of alternating voltage and current – Difference between AC and DC - Definition of cycle, frequency, time period, amplitude, instantaneous value, average value, rms value, maximum value, form factor and peak factor.

Batteries:- : Classification of cells – Construction of Lead Acid Cell – Methods of charging - Care and Maintenance of Lead Acid Battery – Indications of a fully charged battery – Maintenance free batteries.

UNIT –II

ELECTRICAL MACHINES:-

DC Machines :- Constructional details of DC machine – DC generator – Principle of working emf equation –Types – Applications

DC Motors :- Principle of working – back emf – Types – Application – Starting of motors using 3 point and 4 point starter.

Single phase transformer:- Principle – Construction - emf equation of transformer - Efficiency - Losses in a transformer - Auto transformer – Instrument transformers (C.T and P.T).

AC Motors:- Classification - Induction motor- construction – types - principle of operation application – Need for starter – Starter used for starting an induction motor – Alternator Working principle – construction - stepper motor: construction - Working Principle – applications.

UNIT – III

ANALOG DEVICES:-

Semi conductor theory:- Intrinsic and Extrinsic Semiconductors - N type and P type materials -majority and minority carriers - Semi conductor diode - PN junction - V I characteristics of PN Junction diode.

Rectifiers:- Working and Waveforms of Half wave - Full wave - Bridge rectifiers (without filters) – Differences.

UNIT – IV

ALGEBRA AND LOGIC GATES:-

Logic gates:- Positive and Negative logic – Symbolic representation - Definition, truth table, symbol and logical equations of logic gates: AND – OR - NOT- NAND - NOREXOR - EXNOR (Only 2-inputs) – Universal gates.

Arithmetic circuits:- Half Adder and full adder- Truth table, Circuit diagram – Parallel binary adder – circuit diagram

Half subtractor and Full subtractor - Truth table, Circuit diagram - Parity Generator and Parity checker circuit.

UNIT –V

LOGIC SYSTEM:-

Registers:- Functions – Serial –in – serial out, Serial – in – parallel out, Parallel – in – serial out, parallel – in – parallel out – 4 bit right shift and 4 bit left shift registers.

Counters:- Asynchronous counter- 4 bit Asynchronous Counter – Mod n counter (3, 5, 7)- decade counter - Synchronous counter – 4 bit Synchronous binary counter.

Reference Book :-

1. Basic Electrical & Electronics by B.R. Patil.

2. Basic Electrical & Electronics by S.K. Bhattachaarya.

Workshop Technology (AE-2.4)

UNIT-I

Introduction and Demonstration: -

Introduction to various shops / sections and workshop layouts. Safety norms to be followed in a workshop should be conveyed to students.

Carpentry Shop:-

Introduction of Tools & operations, Types of woods & their applications, Types of Carpentry hardware and their uses, Carpentry Joints, carpentry operations such as marking ,sawing, planning, chiseling, grooving, boring, joining, types of woods and carpentry hardware.

UNIT –II

Fitting Shop:-

Introduction of Tools & operations, Types of Marking tools & their uses, Types of fitting cutting tool & their uses, fitting operations such as chipping, filing, scraping, grinding, sawing, marking, drilling, tapping.

Smithy Shop:-

Tin Smithy: - Introduction of Tools like hammers, stakes, scissors etc, & operations like shearing , bending ,joining. Types of Sheet metal joints and applications. Black Smithy: Introduction of forging tools and it's operations.

UNIT – III

Metal Joining Shop: -

Introduction of Tools, Types of welding Joint, Arc welding, Gas welding. Gas Cutting. Soldering, Brazing.

Machine Shop:-

Introduction of machine tools and operations, Demonstrations of basic machine tools like Lathe, Shaper, drilling, Milling machine and CNC with basic operations and uses.

UNIT – IV

Masonry:-

Different types of Bricks, Different size and part of Bricks, Different types of Bonds, Types of tools used for various masonry works.

Electrical:-

Measure voltage, current, frequency, phase difference, power, power factor for single and three phase supply, Wire fan, tube light, two-way control, Wire MCB, ELCB for a given load circuit.

UNIT –V

Electronics:-

Introduction to basic electronics components,Controller and its testing: Resistors, Inductors, Capacitor, Diode, BJT, Introduction to testing and Measurement Instruments: Power Supply, Function Generator, Oscilloscope.

Reference Book :-

1. Internal Combustion Engine by V. Ganesan.

2. Internal Combustion Engine by R.K. Rajpoot.

Auto Engineering Design (AE-2.5)

UNIT-I

1. Layout of Fuel filing cum service station.

2. Layout of fully equipped modern garage.

3. Layout of inspection pit and service ramp.

4. Layout of modern paint booth.

5. Layout of road ways workshop.

6. Layout of seating arrangement in buses.

7. Chassis specifications and drawings of LMV, HGV & HPV.

UNIT –II

Draw the dimensioned sketches of the following automobile engine components:-

1. 4-cylinder and 6-cylinder engine cam shaft.
2. 2-Stroke and 4-stroke petrol engine pistons.
3. Diesel engine pistons.
4. 4-cylinder and 6-cylinder engine crank shaft.

UNIT – III

Electrical symbols:-

Complete wiring diagram of passenger car, medium vehicle ,heavy vehicle and two wheelers.

Assembly drawing of-

1. Connecting rod 2. Assembly of single cylinder engine.

3. Overhead & side valve mechanism with all parts (with side cam shaft and overhead cam shaft).

4. Spark plug & fuel injector.

UNIT – IV

INTRODUCTION TO 2D DRAFTING:-

Drawing, Editing, Dimensioning, Layering, Hatching, Block, Array, Detailing, Detailed drawing.

1. Bearings - Bush bearing, Plummer block.
2. Valves – Safety and non-return valves.
3. Cams and Followers.

UNIT –V

Keys:-

Parallel key, Taper key, Feather key, Gib-head key and Woodruff key.

Joints:-

Cotter joint (socket and spigot), knuckle joint (pin joint) for two rods.

Couplings:-

Split Muff coupling, Protected type flanged coupling, pin (bush) type flexible coupling, and universal coupling (Hooks' Joint).

Reference Book :-

1. K.L.Narayana by B.C. Punmia.
2. K.Venkata Reddy by T.P Kanetkar and Kulkarney

Material & Metrology (AE-2.6)

UNIT-I

Classification and Properties of Materials:- Introduction :- To engineering materials Classification of materials Thermal, chemical, electrical, mechanical properties of various materials Selection criteria for use in industry.

Structure of Metals and Their Deformation:- Metal structure Arrangement of atoms in metals crystalline structure of metals Crystal imperfections Deformation of metal Impact of cold and hot working on metal structure.

UNIT –II

Ferrous Materials:- Classification of iron and steel Sources of Iron ore and its availability Manufacture of pig iron, wrought iron, cast iron and steel Types of cast iron: white, malleable grey, mottled, nodular and alloy and their usage. Classification of steels Different manufacturing method of steel open hearth, bessemer, electric arc. Specification as per BIS and equivalent standards Effect of various alloying elements on steel Use of alloy steel (high-speed steel, stainless steel, spring steel, silicon steel).

Non Ferrous Materials:- Important ores and properties of aluminium, copper, zinc, tin, lead Properties and uses of nonferrous alloys.

UNIT – III

Engineering Plastics and Fibers: - Introduction of plastics Classification - Thermoplastic and thermosetting Various trade names of engineering plastics Fibers and their classification : Inorganic and organic fibers Uses of fiber.

Insulating Materials: - Various heat insulating material and their usage like asbestos, glass, wool thermocole, cork, puf, china clay. Various electrical insulating materials and their use.

Inspection: - Inspection - concept, need and methods Types of inspection.

UNIT – IV

Introduction: - Units and standards of measurement International, National and company standards Line and end standards Errors in measurement Precision and accuracy.

Linear and Angular Measurement :- Vernier calliper, micrometers, height and depth gauges Bevel protractor, sine bar, slip gauges, angle gauges and clinometers Auto collimator, angle dekkar, Taper measurements Cylinder bore gauge, Telescopic gauge, feeler and wire gauge.

Measurement of Surface Finish :- Meaning of surface texture, primary and secondary texture Terminology of surface roughness Factors affecting surface finish Representation of surface roughness parameters CLA and RMS values Comparison and direct instrument methods of surface finish measurements. Classification, advantages and working mechanism of dial indicators, passmeters Mechanical, Electrical, Electronic and pneumatic comparators.

UNIT –V

Light Wave Interference: - Principle of interference Interferometry applied to flatness testing N.P.L. flatness interferometer

Gear and Screw Measurement :- Screw thread terminology, errors in threads Effective diameter measurement by two wire and three wire methods Major and minor diameter measurement, Thread micrometers Gear tooth terminology Gear tooth vernier calliper and its application Measurement of gear pitch.

Machine Tool Metrology: - Alignment tests Performance tests Alignment test on lathe and drilling machine.

Reference Book: -

1. Engineering Metrology and Measurement by Raghavendra. Krishnamurthy.

2. Engineering Materials and Metallurgy by RK Rajput.

Manufacturing Technology (AE-2.7)

UNIT-I

General Introduction:- (a) Scope of subject "Workshop Technology" in engineering (b) different shop activities and broad division of the shops on the basis of nature of work done such as (i) Wooden Fabrication-carpentry (ii) Metal Fabrication (shaping and Forming, Smithy, sheet metal and Joining-welding, Riveting, Fitting and Plumbing). (B) Carpentry: (a) Fundamental of wood working operations (b) Common Carpentry Tools Their classification, size, specification (name of the parts and use only): (i) Marking and measuring tools (ii) Holding and supporting tools: (iii) Cutting and Sawing Tools: (iv) Drilling and Boring Tools (v) Striking Tools-Mallet and Claw hammer (vi) Turning Tools & Equipment(vii) Miscellaneous Tools.

UNIT –II

(A) Joining of Timber Components for Fabrications Works: Assembly of joints (Preparation steps and tools used only) Mortise, Tenon, Rivet, Groove, Tongue, Dowel, operations in assembly-simple lap and butt, Mortise, Tenon, Dovetail, Miter & briddle joints. Metal Fabrication.

(B) Metal Shaping-Smithy: (i) Operations involved (concept only) (ii) Tool and equipment used (Names, size, specification for identification only) (iii) Heating and fuel handling equipment(iv) Holding and supporting tools(v) Striking Tools(vi) Cutting tools(vii) Punching & Drifting Tools (viii) Bending Tools and figures (ix) Forming & Finishing Tools(x) Defects Occurring & its remedy.

UNIT – III

Sheet metal working-Tools and operation: (1) Operations involved (Names and concept only) (2) Sheet metal joints(3) Tools and equipment used (Name, size, specifications for identification only) (4) Marking tools(5) Cutting and shearing Tools (6) Straightening tool(7) Striking Tools(8) Holding Tools(9) Supporting Tools(10) Bending tools(11) Punching-Piercing and Drafting tools (12) Burring Tools-Files (13) Defects Occurring & its remedy.

UNIT – IV

A) Metal Joining During Fabrication- (a) Permanent Joining: (i) Welding methods(ii) Electric welding (b) Soldering & Brazing: (i) Its concept, comparison with welding as joining method and classification (ii) Soldering operation(iii) Materials Used(iv) Defects Occurring & its remedy (B) Riveting- (i) Its comparison with welding as joining method. (ii) Rivets and Materials. (iii) Operation involved(iv) Tools and equipment used(Names, Size, specification and uses)), Elementary knowledge about working of pneumatic, hydraulic and electric riveter. Temporary Joining (Fasteners & their uses), General Idea about temporary fasteners & their uses (C) Familiarity with the Use of Various Tools Used in Mechanical Engineering Workshop (a)Marking & Measuring Tools (b) Holding Tools(c) Cutting Tools(d) Files(e) Thread Cutting Tools(h) Miscellaneous Tools They should be shown physically to each student for familiarity

UNIT –V

Painting: Its need, Introduction to methods of painting (classification only) operations involved description steps only, surface preparation materials, tools and equipment used (name, size specification for identification), Brushes-round and flat wire brush, scraper, trowel, spray gun, compressor, Defects likely to occur in painting and their remedies (b) Varnishing & Polishing: Its need, operation involved (description of steps only), surface preparation method of old and new articles, application of polishing materials, materials used for preparation of french and sprit polish, copal varnish, Defects likely to occur. Safety of Personnel, Equipment & Tools to be observed (B) Foundry Work: Elementary idea of patterns, green sand moulds and moulding, tools and equipment used in green sand moulding.

Reference Book: -

1. Manufacturing Technology by H.N Gupta.

2. Manufacturing Technology by R.K Jain.

MECHANICS OF VEHICLE (AE-2.8)

UNIT-I

Occupational Safety & Health:- Importance of Safety and general Precautions to be observed in the shop. Basic first aid, safety signs - for Danger, Warning, caution & personal safety message. Safe handling of Fuel Spillage, Fire extinguishers used for different types of fire. Safe disposal of toxic dust, safe handling and Periodic testing of lifting equipment, Authorization of Moving & road testing vehicles.

UNIT –II

Energy conservation:- Definition, Energy Conservation Opportunities (ECOs)-Minor ECos and Medium ECOs, Major ECOs), Safety disposal of Used engine oil, Electrical safety tips.

Drilling machine :- Description and study of Bench type Drilling machine, Portable electrical Drilling machine, drill holding devices, Work Holding devices, Drill bits.

UNIT – III

Basic electricity:- Electricity principles, Ground connections, Ohm's law, Voltage, Current, Resistance, Power, Energy. Voltmeter, ammeter, Ohmmeter Multi meter, Conductors & insulators, Wires, Shielding, Length vs. resistance, Resistor ratings Fuses & circuit breakers, Ballast resistor, Stripping wire insulation, cable colour codes and sizes, Resistors in Series circuits , Parallel circuits and Series-parallel circuits, Electrostatic effects, Capacitors and its applications, Capacitors in series and parallel.

UNIT – IV

Systems of measurement:- Description, care & use of - Micrometers- Outside and depth micrometer, Micrometer adjustments, Vernier callipers, Telescope gauges, Dial bore gauges, Dial indicators, straightedge, feeler gauge, thread pitch gauge, vacuum gauge, tire pressure gauge.

Hand & Power Tools:- Marking scheme, Marking materialchalk, Prussian blue. Cleaning toolsScraper, wire brush, Emery paper, Description, care and use of Surface plates, steel rule, measuring tape, try square. Callipers-inside and outside. Dividers, surface gauges, scriber, punches-prick punch, centre punch, pin punch, hollow punch, number and letter punch. Chisel-flat, cross-cut.

UNIT –V

Introduction to Hydraulics & Pneumatics: - Definition of Pascal law, pressure, Force, viscosity. Description, symbols and application in automobile of Gear pump-Internal & External, single acting, double acting & Double ended cylinder; Directional control valves-2/2, 3/2, 4/2, 4/3 way valve, Pressure relief valve, Non return valve, Flow control valve used in automobile. Pneumatic Symbols, Description and function of air Reciprocating Compressor. Function of Air service unit (FRL-Filter, Regulator & Lubricator).

Reference Book :-

1.MECHANICS OF VEHICLE by Raghavendra. Krishnamurthy.

2. MECHANICS OF VEHICLE by RK Rajput.

AUTO ENGINEERING WORKSHOP (AE-2.9)

UNIT-I

Torque Convertors:-

Principal of Torque Conversion - Single - Multi Stage and Polyphase Torque Converters - Performance Characteristics - Constructional and Operational Details of Typical Hydraulic Transmission Drives (E.G.) Leyland - White Hydro Torque Drives.

UNIT –II

Sensors and Actuators:-

Inductive- Hall Effect- Thermistor- Piezo Electric- Piezoresistive- Based Sensors. Throttle Position- Mass Air Flow- Crank Shaft Position- Cam Position- Engine Speed Sensor- Exhaust Oxygen Level (Two Step- Linear Lambda and Wideband)- Knock- Manifold Temperature and Pressure Sensors. Solenoid- Relay (Four and Five Pin)- Stepper Motor.

UNIT – III

Combustion Modelling:-

Basic Concepts of Engine Simulation – Governing Equations- Classification of Engine ModelsThermodynamic Models For intake and Exhaust Flow Process – Quasi Steady Flow - Filling and Emptying - Gas Dynamic Models. Thermodynamic Based in Cylinder Models for SI Engine and CI Engines.

UNIT – IV

Vehicle Structure and Engines: - Introduction: General Classification of Automobiles, Layout of Chassis, Types of Drives of Automobile. Chassis and Body – Body Parts, Functions, Material and Vehicle Construction. Engines – Types of Engines, Components, Functions and Materials, Working Principle, Comparison of Four Stroke and Two Stroke Engines.

UNIT –V

Fuel Cells: - Fuel Cell Characteristics- Fuel Cell Types – Alkaline Fuel Cell- Proton Exchange Membrane; Direct Methanol Fuel Cell- Phosphoric Acid Fuel Cell- Molten Carbonate Fuel Cell- Solid Oxide fuel Cell- Hydrogen Storage Systems- Reformers- Fuel Cell EV- Super and Ultra CapacitorsFlywheels.

Reference Book: -

1. AUTO ENGINEERING WORKSHOP by H.N.Gupta.

2. AUTO ENGINEERING WORKSHOP by R.K.Rajpoot.

ELEMENT OF MECHANICAL ENGINEERING (AE-2.10)

UNIT-I

Sources of Energy :- Introduction and application of energy sources like fossil fuels, hydel, solar, wind, nuclear fuels and bio-fuels; environmental issues like global warming and ozone depletion.

Basic concepts of Thermodynamics:- Introduction, states, concept of work, heat, temperature; Zeroth, 1st, 2nd and 3rd laws of thermodynamics. Concept of internal energy, enthalpy and entropy (simple numericals).

Steam:- Formation of steam and thermodynamic properties of steam (simple numericals).

UNIT –II

Boilers:- Introduction to boilers, classification, Lancashire boiler, Babcock and Wilcox boiler. Introduction to boiler mountings and accessories (no sketches).

Turbines:- Hydraulic Turbines – Classification and specification, Principles and operation of Pelton wheel turbine, Francis turbine and Kaplan turbine (elementary treatment only).

Hydraulic Pumps:- Introduction, classification and specification of pumps, reciprocating pump and centrifugal pump, concept of cavitation and priming.

UNIT – III

Internal Combustion Engines:- Classification, I.C. Engines parts, 2 and 4 stroke petrol and 4-stroke diesel engines. P-V diagrams of Otto and Diesel cycles. Simple problems on indicated power, brake power, indicated thermal efficiency, brake thermal efficiency, mechanical efficiency and specific fuel consumption.

Refrigeration and Air conditioning:- Refrigeration - Definitions - Refrigerating effect, Ton of Refrigeration, Ice making capacity, COP, relative COP, Unit of

Refrigeration. Refrigerants, Properties of refrigerants, List of commonly used refrigerants. Principle and working of vapor compression refrigeration and vapor absorption refrigeration. Domestic refrigerator. Principles and applications of air conditioners, window and split air conditioners.

UNIT – IV

Properties, Composition and Industrial Applications of engineering materials:- Metals – Ferrous: cast iron, tool steels and stainless steels and nonferrous: aluminum, brass, bronze. Polymers - Thermoplastics and thermosetting polymers. Ceramics - Glass, optical fiber glass, cermets. Composites - Fiber reinforced composites, Metal Matrix Composites Smart materials – Piezoelectric materials, shape memory alloys, semiconductors and insulators.

Joining Processes: Soldering, Brazing and Welding:- Definitions. Classification and methods of soldering, brazing and welding. Brief description of arc welding, oxy-acetylene welding, TIG welding, and MIG welding.

UNIT –V

Lathe -Principle of working of a center lathe. Parts of a lathe. Operations on lathe - Turning, Facing, Knurling, Thread Cutting, Drilling, Taper turning by Tailstock offset method and Compound slide swiveling method, Specification of Lathe.

Milling Machine -Principle of milling, types of milling machines. Working of horizontal and vertical milling machines. Milling processes - plane milling, end milling, slot milling, angular milling, form milling, straddle milling, and gang milling. (Layout sketches of the above machines need not be dealt. Sketches need to be used only for explaining the operations performed on the machines).

Reference Book :-

1. Element of Mechanical Engineering by H.N.Gupta.

2. Element of Mechanical Engineering by R.K.Rajpoot.

Chassis Body &Transmission(AE-2.11)

UNIT-I

Vehicle Aerodynamics:- Types of Chassis frames & body, aerodynamic consideration in body profiling, ergonomic consideration, defects in frame and body. Vehicle drag and types, various types of forces and moments, effects of forces and moments, side wind, various body optimization techniques and Aerodynamic Aids for Optimization of drag.

UNIT –II

Car Body Details :- Types, Regulations, Drivers seat design & dimensions parameters, drivers visibility, methods for improving visibility and space in cars, design for safety, safety requirements for car (with reference to Vehicle Body Engineering), car body construction. Crash Test and Roll over test regulations. Heating and ventilation systems. Dash boards, instrument panel and passenger compartment lighting, Audio – visual systems.

Commercial Vehicle Details:- Types of body, flat platform, drop side, fixed side, tipper body, tanker body, light commercial vehicle body types. Dimensions of driver's seat in relation to controls, drivers cab design. Tipper body designs, volume/weight considerations, pay load and related regulations.

UNIT – III

Body Materials:- Metal sheets (Steel, Aluminum etc.), plastics, timber, GRP, FRP, Insulating materials, adhesives and sealants. Wind screen, Back light & window Glasses and regulations for glasses. Difference between toughened glass, sheet glass & laminated glass. Composite materials, properties of materials, corrosion, anti-corrosion methods, selection of paint and painting process, body trim items, body mechanisms.

UNIT – IV

Body Loads:- Idealized structure, structural surface, shear panel method, symmetric and asymmetric vertical loads in a car, longitudinal load, different loading situations, chassis frame design. Construction of Doors, door apertures, windows. Spare wheel carrier construction and design for different types of vehicle and weight distribution criteria in relation to Spare wheel location. Sources of body noises testing and methods of elimination. Water leakage test.

UNIT –V

Transmission systems Driveline:- Definition,forces&torquesacting;typesofdrives-Hotchkiss,torque tube & radius rod drives; components- propeller shaft, slip joint, universal joints & constant velocity universal joints; front wheel drive; Final drive: definition; types- worm- wheel, straight-bevel gear, spiral-bevel gear & hypoid-gear drives; double-reduction & twin- speed final drives; Differential: Function, principle, construction and working; non-slip differential; differential lock; rear axle- loads acting & types; multi-axle vehicles.

Reference Book :-

1. Automotive Chassis & Body, by P. L. Kohli,

2. Automotive Chassis, by Crouse W.H.& Anglin D.L

Automobile Engineering (AE-2.12)

UNIT-I

Introduction: - Components of an automobile Classification of vehicles on the basis of load, wheels, final drive, fuel used, position of engine Layout of chassis, conventional frame and frame less construction.

Engine Unit: - S.I. and C.I. engines Multi cylinders engine, engine balancing Schematic diagrams of fuel feed and exhaust system Air cleaners - viscous type and dry type Intake manifold, exhaust system, exhaust manifold, muffler or silencer. Engine troubleshooting and remedies

UNIT –II

Electrical System :- Storage battery Generator Working of generator Cut out relay, regulator for generators Comparison between alternator and dynamo Starting motor Working of starting motor Drive unit of starting motor Ignition Introduction Types of ignition system - battery and magneto ignition system Electronic ignition system Ignition timing, effect of advance and retard Ignition system troubles and remedies Lighting and wiring circuit of an automobile.

UNIT – III

Brakes :- Functions of brakes and classification Construction and principle of mechanical brakes : internal expanding brakes and disc type brake Hydraulic brake system, master cylinder, wheel cylinder Bleeding of brakes Introduction of air brakes, parking and emergency brake Maintenance of brakes, brake troubles and remedies.

Power Transmission System :- Clutch – Function Constructional details of single plate and multi-plate clutch Gear box Functions construction of sliding mesh and constant mesh gear box Synchro mesh gear box Shifting mechanism Final drive Functions and working of propeller shaft, universal joint, slip joint Differential gear box.

UNIT – IV

Steering System:- Function of steering system Steering mechanisms and steering gear box Steering linkage, wheel alignment Steering geometry - camber, king pin inclination, caster, toe-in and toe-out Power steering, collapsible steering.

Suspension System:- Function of suspension system Suspension systems- rigid axle, front wheel suspension and independent front wheel suspension Leaf springs, coil springs and torsion bar Shock absorbers - Function and working of telescopic shock absorbers.

UNIT –V

Wheels and Tyres:- Wheels, assembly, types of wheels - disc wheel and wire wheel Types of tyres - Tube tyre and tubeless tyre, tyre properties. Tyre specifications (size), constituents of tyre, Importance of tyre pressure, tyre wears Tyre maintenance, tyre troubles and repairs Introduction to wheel balancing.

Air Pollution :- Sources of air pollution Characteristics of various pollutants -carbon mono oxide, oxides of nitrogen, Hydrocarbons Elementary knowledge about Euro standards I and II.

Reference Book :-

1. A Text Book of Automobile Engineering by SK Gupta.

2. A Text Book of Automobile Engineering by R. K. Rajput.

Garage Equipment (AE-2.13)

UNIT-I

General Tools Specifications and applications :- Screw drivers Spanners and wrenches. Pliers . Hammers . Chisels . Files. Hacksaw. Tools for tubes flaring. Taps and dies. Reamers. Soldering tools. Measuring tools- vernier calipers, inside and outside micrometers. Feeler gauge. Tommy bar. Nut runner. Cleaning tools. Nipple forming tools.

General Equipment Specifications and applications:- Drilling machine (portable) along with set of drills Bench grinder. Air compressor and pneumatic gun. Hydraulic and electric hoists. 103 High pressure washing equipment (Car washer, Car vacuum cleaner, Buffing. tool) Oil sprayers. Grease Guns-manual and bucket type, pneumatic. Tyre inflation gauge (Manual and Digital type automatic). Tyre Changer (Manual and Automatic). Creepers. Electric and gas welding equipment. Fire extinguisher. First aid box.

UNIT –II

Tuning and Testing Equipment Specifications and applications:-

Vacuum Gauge Compression Gauge (Pressure Gauge). Distributor Tester, cam (dwell) angle tester, r.p.m. tester. Battery Tester. Spark plug cleaner and tester. Ignition timing light. Fuel injector tester. Fuel consumption tester.

Electrical Repair Equipment Specifications and uses:-

Electrical Test Bench.

Battery Charger.

Head Lights Beam Aligner and Tester (Electronic and Digital type).

Growler.

UNIT – III

Engine Repair Tools/Measuring and Testing Equipment Specifications and applications:- Torque wrench, pneumatic wrench Piston ring compressor. Valve lifter and valve spring tester. Piston ring files, groove cleaner. Scrappers. Piston ring remover. Cylinder Dial gauge. Smoke meter. Exhaust gas analyzer. Engine Analyser /Scanner Part degreasing tank.

UNIT – IV

Reconditioning/Testing Equipment for Chassis and Body:- Brake Efficiency Tester (Chassis Dynamometer) or brake testing equipment Clutch Fixtures and Brake Line Rivetters, pop riveting gun. Crane and Chain Pulley Block. Jacks – mechanical, hydraulic, trolley type. Paint chamber. Paint Spray Gun. Paint Drying Equipment. Tools for tyres, automatic tyre remover. Trolleys. Axle/chassis stands. Steering work stands. Jib crane. Spring tester. Frame strengthening equipment. Chassis alignment equipment. Computerized wheel balancer –static and dynamic. Computerized wheel alignment equipment.

UNIT –V

Engine Reconditioning and Testing Equipment Specifications and use:-

Cylinder Boring Machine and Honing Machine Crankshaft Machine and Camshaft Grinding Machine. Connecting Rod Aligner. Line Boring Machine and Arbor Press. Nozzle Grinding and Lapping Machine. Fuel Injection Pump Calibrating Machine. Valve Refacer, Valve Seat Cutting and Grinding. Radiator Tester. Cylinder head leakage testing fixture. Fuel injector tester. Nozzle cleaning equipment.

Reference Book :-

1. Garage Equipment by S. C. Sharma, T. R. Banga.

2. Garage Equipment by Dr.Kripal Singh.

Auto Electrical & Electronics (AE-2.14)

UNIT-I

Introduction :- Various Electrical components/system in Automobile, their function and demands, earth return system., types of earthing, 6V, 12V system.

Batteries:-

Lead Acid Batteries :- Construction, working, elements, types, materials used. Electrolyte and its strength, effect of added plate area and temperature, rating capacity, efficiency, temperature characteristics, terminal voltages, charging and discharging.

Battery Testing :- Electrolyte testing by hydrometer, voltage test, high discharge and cadmium test. (Voltage).

Battery Charging:- Constant potential and constant current, initial charging, normal charging, trickle charging, intermittent charging, boost charging.

Battery Defects:- Stipulation, plates decay, working, erosion, cracking, sedimentation, separator defects, short circuits, overcharging.

Alkaling Batteries :- Construction, working, merits and demerits of Ni-Fe, Ni-Cd, Ag-Zn cells.

Lithium ion Battery:- Construction and working.

UNIT –II

Charging System:- Circuits, function and various components, dynamo and alternator, types, construction, working, advantages and disadvantages of dynamo and alternators, drives cut out relay.

Regulation :- Functions of various compoments of two unit, three unit and heavy duty regulators, Regulator adjustments, Regulators for alternators.

Starting System :- Function of various components, torque terms, principle and constructional details of starter motor, switches, types starter to engine drive and their types, Starter-alternators.

UNIT – III

Ignition System :- Constructional details of coil, distribution, condenser, meaning of cam angle, Ignition advancing mechanisms, centrifugal and vaccum type, transistorized lgnition system, Construction and working details of magneto ignition system.

Spark Plug :- Construcitonal details of spark plugs, classification as per reach, heat range, diameter and effect of leaded fuels, care and maintenance of spark plug.

UNIT – IV

Lighting System :- Various lighting circuits, head lamp, types and constructional details, sealed beam, double filaments, asymmetric and dual units, vertical and side control lamps, fog light, side light, break light, instrument light, Indicator light, reversing light, lamp ,mounting.

Wiring :- : HT and LT, their specifications, cable colour codes, wiring harness, cable connections, wiring diagrams of car and two wheeler, Fuses, faults and rectification.

UNIT –V

Miscellaneous Electric Equipment :- Impulse speedometer, tachometer, heaters, defrosters, Air conditioner and Electric Door locks, Window actuation, Seat adjustments.

Electrical Accessories :- Fuel gauges, bimetallic and balancing coil type, Air pressure gauges, temperature gauges, Ammeter, warning, Light speedometer, wind speedometer, wind screen wipers, horns, horn relay, electic fuel pump, Faults and rectification.

Reference Book :-

1.Auto Electrical & Electronics by P.D. Kulkarni.

2. Auto Electrical & Electronics by A.K. Babu.

MOTOR VEHICLE & TRANSPORT MGMT (AE-2.15)

UNIT-I

Introduction:-

Introduction to various transport systems, Advantages of motor transport, Staff administration, Recruitment and Training, welfare, driver's health and safety, Basic principles of supervising, Organizing time and people, Driver and mechanic hiring, economical and safe driving tips for city and highway, understanding of traffic rules, Trip leasing, Vehicle operation and types of operations.

UNIT –II

Transport Management:-

Transport organization structure, operations, Forms of ownership ,management – internal organization, centralized condition, decentralized condition (Engineering, traffic and administration)Planning Scheduling operation & control, Propaganda, publicity and passenger amenities Parcel traffic, General set up, transport industry, Government / (STU) State Government Undertakings and private Bus transport organizations, Bus depot organisation structure, Truck fleet operators organization, Requirements and Problems on fleet management. Fire brigade, fleet and Ambulance operations management 108, organisational activities and it's benefits for the society.

UNIT – III

Motor Vehicle Act:-

Short titles & definitions, Laws governing to use of motor vehicle & vehicle transport, Licensing of drivers & conductors, Registration of vehicle, State & interstate permits, Traffic rules, Signals & controls, Accidents, Causes & analysis, Liabilities & preventive measures, Rules & regulations, Responsibility of driver, Public & public authorities, Offences, penalties & procedures, Different types of forms, Government administration structure, Personnel, Authorities & duties, Rules regarding construction of motor vehicles, Licensing of taxies and buses, testing and passing of vehicles, Description of goods carrier, delivery van, tanker, tipper, municipal, firefighting and break down service vehicle. Taxation: Taxation Objectives, Structure & methods of laving taxation, Onetime tax, Tax exemption & tax renewal Toll tax reasons & operational management. Build Operate Transfer arrangement. Highway traffic rules, Traffic signs, National and international driving conditions / rules.

UNIT – IV

Accident & Prevention:-

Vehicle accident, laws, injury, safety precautions, road transport regulations. Insurance Insurance types & significance, Comprehensive, Third party insurance, Furnishing of particulars of vehicles involved in accident, MACT (Motor Accident Claims Tribunal), Solatium Fund, Hit & Run case, Duty of driver in case of accident, Surveyor & Loss Assessor, Surveyors report.

UNIT –V

Laws Related to Pollution Under Control (PUC):-

Pollution Under control certification agency, Authority & procedure for PUC certification agency. Harmful exhaust gas constituents, permissible limits, Euro / Bharat Stage -I, II, III, IV, V, VI norms and implementation, testing and measurements. Study of Odd-Even formula, high power to weight ratio & higher capacity diesel vehicles and other possible methods for reduction of atmospheric pollution and it's impact.

Reference Book: -

1. MOTOR VEHICLE & TRANSPORT MGMT by Ahmadul Ameen.

2. MOTOR VEHICLE & TRANSPORT MGMT by Manohar Prasad.

Entrepreneurship Development & Management(AE-2.16)

UNIT-I

Introduction:- Meaning and Importance, Evolution of term 'Entrepreneurship, Factors influencing entrepreneurship, Psychological factors, Social factors, Economic factor, Environmental factors, Characteristics of an entrepreneur, Entrepreneur and Entrepreneur, Barriers to entrepreneurship.

Types of entrepreneur:- According to Type of Business, According to Use of Technology, According to Motivation, According to Growth, According to Stages, New generations of entrepreneurship viz. social entrepreneurship, Edupreneurship, Health entrepreneurship, Tourism entrepreneurship, Women entrepreneurship etc.

UNIT –II

Entrepreneurial Motivation:- Motivation, Maslow's theory, Herjburg's theory, McGragor's Theory, McClelland's Need – Achievement Theory, Culture & Society , Values / Ethics , Risk taking behavior.

Creativity:- Creativity and entrepreneurship, Steps in Creativity, Innovation and inventions, Using left brain skills to harvest right brain ideas, Legal Protection of innovation, Skills of an entrepreneur, Decision making and Problem Solving (steps indecision making).

UNIT – III

Organisation Assistance:- Assistance to an entrepreneur, New Ventures, Industrial Park (Meaning, features, & examples), Special Economic Zone (Meaning, features & examples), Financial assistance by different agencies, MSME Act Small Scale Industries, Carry on Business (COB) licence, Environmental Clearance, National Small Industries Corporation (NSIC), Government Stores Purchase scheme (e-tender

process), Excise exemptions and concession, Exemption from income tax, Quality Standards with special reference to ISO, Financial assistance to MSME, Modernisation assistance to small scale unit, The Small Industries Development Bank of India(SIDBI), The State Small Industries Development Corporation(SSIDC), Export oriented units, Incentives and facilities to exports entrepreneurs, Export-Import Bank of India, Export oriented zone.

UNIT – IV

Rules And Legislation:- Applicability of Legislation, Industries Development (Regulations) Act, 1951., Factories Act, 1948, The Industrial Employment (Standing Orders) Act, 1946, Suspension, Stoppage of work, Termination of employment, West Bengal Shops and Establishment Act, 1963, Environment (Protection) Act, 1986, The sale of Goods Ac, 1950, Industrial Dispute Act 1947.

Project Report:- Introduction, Idea Selection, Selection of the Product / Service, Aspects of a Project, Phases of a Project, Project Report, Contents of a Project Report, Proforma of a Suggested Project Report for a manufacturing Organization, Suggested Readings.

UNIT –V

Agencies for industrial assistance:- West Bengal Electronics Development Corporation, ICICI West Bengal Infrastructure Development Corporation, West Bengal Industrial Infrastructure Development Corporation, Other Corporations with focus as specific segments, State Industrial Development Corporation (SIDC), State Financial Corporation (SFCs), Directorate General of Supplies and Disposals(DGS & D), Registration with DGS & D, Registration Categories, Registration Procedure, Benefits of DGS & D, Information facilities centre in DGS & D, Khadi and Village Industries Commission (KVIC), Industrial Estate, Financing of Industrial Estates, Shilpabandhu-M Incentives for entrepreneurs 9reference to The West Bengal State Support for Industries Scheme 2008 & 2013.

Reference Book :-

1. Entrepreneurial Development, by S S Khanka.

2. The Entrepreneur, by Mark Casson

Industrial Management (AE-2.17)

UNIT-I

Basic of Management:- Management - Definition – Administration- Definition – Henry-Fayol's principles of management- Business Organisation-Types-Proprietorship-Partnership- Joint stock- Cooperative Society-Advantages and disadvantages -Functions of Management – PlanningDefinition-Functions-Organisation-Definition- types of organisation –Line-Functional-Line &staff-advantages and disadvantages- Leadership -Types –Quality of good leaderMotivation - Maslow's Theory of Motivation -Hierarchy of needs- Communication - Process of Communication – Barriers for effective communication.

UNIT –II

Production Management:- Concept of project work - Project planning -Market survey- Project capacity-selection of site for project- Plant layout-Types of Plant layout-Product design-Stages in product designdrawing-Specifications-Material requirement-operation-Planning-Production-definition-Job, Batch & Mass production with their advantages and disadvantages-Productivity-definitionfactors to improve productivity-Production planning and Control (PPC)-definition-Functions of PPC- planning, routing, scheduling, dispatching and Inspection-Introduction to CPM and PERT –Comparision.

UNIT – III

Material Management:- Material management - definition, functions- Purchase - Objectives, different methods of purchasing -Purchase procedure-Comparative statement-purchase order-Tender-Types of tender- Storekeeping- classification of stores - Functions of store keeper. Store managementBin Card - Material Issue Requisition- Material Returned Note- Store ledgers -Codification of stores-Inventory Management- Definition - functions of Inventory Control- Advantages of Inventory Control. Material management - definition, functions- Purchase - Objectives, different methods of purchasing -Purchase procedure-Comparative statement-purchase order-Tender-Types of tender- Storekeeping-classification of stores - Functions of store keeper. Store managementBin Card - Material Issue Requisition- Material Returned Note- Store ledgers -Codification of stores-

Inventory Management- Definition - functions of Inventory Control- Advantages of Inventory Control.

UNIT – IV

Total Quality Management:- Quality–Concept-Quality control- Definition - Factors affecting quality- Advantages of quality control –Inspection-Different types of inspection Total Quality Management-Meaning- Principles of total quality management-PDCA cyclesQuality Circles-definition-Function. TQM Tools- Flow charts, Control charts, Histograms, Pareto charts, Cause and effect diagram-5-S- Kaizen, and Six-sigma Quality Certification Systems- ISO 9000 series quality standards, QS14000– ISO 9000, ISO 9001,ISO9002,ISO9003 & ISO 9004- ISO9000 quality certification procedure.

UNIT –V

Plant Maintenance and Industrial Safety:- Plant maintenance-Definition -Types of maintenance-Preventive maintenance- Break down maintenance-Advantages and disadvantages- Total Productive Maintenance-Meaningbenefits of TPM -Tools of TPM-planned maintenance and predictive maintenance. Industrial safety –Meaning - Accident-causes for accident- Direct and indirect losses due to an accident-Personal protective devices for preventions of accidents-Safety department- role of safety officer – safety supervisor -safety committee – Fire prevention and Protection- Fire triangle-principles of fire extinguishing- various classes of fire- A, B,C, D types of fire extinguishers.

Reference Book :-

1. Industrial Engineering and Management by S. C. Sharma, T. R. Banga.

2. Industrial Engineering and Management by Ravi, V.

Final year Project

Project (AE-2.18)

Select any one topic:-

1. Fabrication of Lube oil cooler.
2. Sand collecting vehicle.
3. Fabrication of Hybrid Vehicle.
4. Power Generation using speed breakers.
5. Remote controlled Scrap Collecting Vehicle.
6. Fabrication of solar race car.
7. Fabrication of Electric Two-wheeler.
8. Sensor-Base Automatic car.