

B. Tech. in AUTOMOBILE ENGINEERING / MECHANICAL & AUTOMOBILE ENGINEERING

Syllabus of Paper – 1

THERMODYNAMICS

Basic Concepts and First Law of thermodynamics: Concept of thermodynamic work and heat, equality of temperature, Zeroth law of thermodynamics. First Law of Thermodynamics, Energy and its Forms, Internal Energy and Enthalpy, P-V Plot for Different Processes, Steady Flow Energy Equation, 1st Law Applied to Non-Flow Process, Steady Flow Process and Transient Flow Process, Throttling Process and Free Expansion Process. Second Law of Thermodynamics and Availability: Limitations of First Law, Thermal Reservoirs, Heat Engine, Kelvin-Planck and Clausius Statements and Their Equivalence, Carnot Cycle, Carnot Theorem and Its Corollaries, Entropy, Clausius Inequality, Principle of Entropy Increase, Entropy Change in Different Processes, Thermodynamic Relations. High and Low Grade Energy, Availability and Unavailable Energy, Loss of Available Energy Due to Heat Transfer Through A Finite Temperature Difference, Dead State of A System, Availability of A Non-Flow and Steady Flow System, Helmholtz and Gibbs's Functions. Properties of Pure Substance: Pure Substance and Its Properties, Phase and Phase Transformation, Vaporization, Evaporation and Boiling, Saturated and Superheat Steam, T-V, P-V and P-T Plots, Properties of Dry, Wet and Superheated Steam, Temperature – Entropy (T-S) and Enthalpy – Entropy (H-S) Diagrams, Throttling and Measurement of Dryness Fraction of Steam. Steam boilers & Vapor power cycle: Fire and water tube boiler, Boiler mountings and accessories. Rankine cycle and its analysis; effects of operating variable on the Rankine cycle, reheating, ideal and actual regenerative cycle and its limitations. Fuels and Combustion: Classification of Fuels- Solid, Liquid & Gaseous Fuels, Combustion Equations, Stoichiometric Air-Fuel Ratio, Excess Air, Exhaust Gas Analysis, Orsat Apparatus. Enthalpy and Internal Energy of Combustion, Enthalpy of Formation, Adiabatic Flame Temperature, Calorific Values of Fuel. First & second law analysis of combustion systems. Ideal and Real Gases: Basic Gas Laws, Vander Waal's Equation of State, Reduced Co-Ordinates, Compressibility Factor and Law of Corresponding States. Mixture of Gases, Mass, Mole and Volume Fraction, Gibbs theorem, Dalton's Law.

THEORY OF MACHINES

Kinematic fundamentals, Mechanisms and machines, kinematics and kinetics. Degrees of freedom, types of motion, elements of kinematic chain, determination of degrees of freedom, paradoxes, isomers, linkage transformation, intermittent motion mechanism, inversion, Grashof's criterion, straight line generating mechanisms. Acceleration analysis: Graphical and vector solution: Position of any point on linkage, transmission angles, velocity by velocity polygon and instantaneous center method, acceleration, Coriolis acceleration. Analytical solution for four-bar, slider-crank mechanism. Kinematic synthesis of mechanisms: Functioning and path generation, Chebyshev spacing of precision points, three position synthesis. Cam profile analysis: Motion of the follower, cam profile constructions, analysis of cams with specified contours. Kinematic analysis of gears: Nomenclature and classification, law of gearing, path of contact, arc of contact, interference for spur gears. Gear trains: simple, compound, reverted, epicyclic gear trains, compound epicyclic, epicyclic with bevel gears, sun and planet gears. Dynamic analysis and balancing: Slider-crank mechanism,

turning moment computations and flywheel. Gyroscopes: Gyroscopic law, effect of gyroscopic couple on automobiles, ships and aircrafts. Balancing: Static and dynamic balancing, balancing of revolving and reciprocating masses, single and multi-cylinder engines, V-engines. Vibrations: Vibration analysis of SDOF systems, natural, damped, forced vibrations, transmissibility ratio, vibration isolation and vibration of mass supported on foundations subject to vibrations, whirling of shafts.

MECHANICS OF SOLIDS

Stress and strain tensors: State of stress at a point, Principal stresses, Three stress invariants, Mohr's circle, Strain tensors, Constitutive laws, Theories of failure. Strain Energy Methods: Strain energy in torsion and bending, Maxwell's reciprocal theorem, Castiglione's theorem, slope and deflection. Bending & Torsion: bending of straight bars, T and I-sections. Torsion of thin-walled circular tubes. Thin and thick cylinders under internal fluid pressure, wire winding of thin cylinders, stresses in shrink-fit and shaft. Rotating discs of uniform thickness. Columns: Elastic instability, theory of long columns, end conditions, Rankine Gordon formula and other empirical relations. Springs: Helical, Spiral and leaf springs.

MATERIAL ENGINEERING & METALLURGY

Nature and properties of materials: Engineering materials: metal, ceramic, polymer, composites, Crystal structures, space lattices, miller indices, Defects: point defect, line defect, surface defect and bulk defect and theory of dislocation. Structure determination using x-ray diffraction, Slip, twinning, effect of cold and hot working on mechanical properties, principles of recovery, re-crystallization and grain growth. Phase evolution: Definition of a phase, phase rule, solidification of metal and alloys, eutectic, eutectoid, peritectic, peritectoid reactions with examples, iron-carbon equilibrium diagram, TTT curve, heat treatment of plain carbon steels, annealing, normalizing, hardening, tempering, case-hardening-carburizing, cyaniding, nitriding, Induction Hardening, flame hardening, precipitation hardening of aluminum alloys. Mechanical behaviour: Concept of yield point and elastic modulus, fracture in ductile and brittle materials, Griffith's theory, Fracture toughness, ductile to brittle transition, fatigue and Design considerations. Creep, Mechanism of creep, creep curve, creep resistant materials, and effect of material variables on creep properties. Materials: plain carbon steels, effect of alloying elements, properties, uses and heat treatment of tools, stainless, spring and wear-resisting steels; production, composition, properties and use of non-ferrous alloys, e.g., brasses, bronzes, duralumin, die-casting and bearing alloys IS standards codes for steels. Powder metallurgy: principles, techniques, application and advantages, surface treatment. Fiber Reinforced Composites: General characteristics, Applications, Introduction to Fibers— glass, carbon, Kevlar 49 fibers. Matrix – Polymeric, Metallic, Ceramic Matrix, Coupling agents and fillers.

MANUFACTURING PROCESSES AND MACHINES

Mechanics of orthogonal and oblique cutting-Mechanics of chip formation-Types of chips- Cutting forces and power-Temperature in cutting-Tool life –Tool wear- Cutting Tool Materials- Cutting fluids. Lathe: Types-Parts- Feed Mechanisms- Specifications of lathe- Lathe Operations- Accessories & Attachments - Capstan and Turret lathe-Lathe Tools - Cutting Speed- feed and machining time estimation. Drilling: Operations – Types – Mechanisms - Nomenclature of twist drill – Tool and work holding devices - Machining time estimation. Shaper and Planer: Types –

Specifications – Operations - Crank and slotted link mechanism - Stroke length adjustments - Automatic feed mechanisms – Hydraulic shaper - Tool and work holding devices - Machining time estimation – Shaper Tools - Difference in Shaper/Slotter/Planer. Milling: Types - Up Milling Vs Down Milling - Types of milling cutters - Operations -Machining time, Estimation - Dividing head. Broaching: Types, - Operations – Broaching Tools. Grinding: Specification and selection of grinding wheels - Truing, Dressing – Classification of Grinding wheels - Mounting of grinding wheels. Grinding machines Types: Cylindrical grinder, surface grinders and special grinding machines. Finishing Processes: Lapping - Honing - Super-finishing processes. Modern Machining: High speed machining - Precision machining. Introduction to Unconventional machining methods. Conventional Machining : General Principles of Working, Types and Commonly Performed Operations in the Following Machines - Lathe, Shaper, Planer, Milling Machine, Drilling Machine, Grinding Machine, Gear Cutting - Basic of CNC Machine. Unconventional Machining Processes : Need for Unconventional Machining Processes – Nonconventional machining: Studies on basic principle, working and effects of process parameters of the following processes: Ultrasonic machining (USM), Abrasive jet machining (AJM), Electro-discharge machining (EDM), Electro-chemical machining (ECM), Electron beam machining(EBM), Plasma arc machining (PAM) and Laser beam machining (LBM). Ion Beam Machining(IBM), Biochemical Machining. Design Features of Machine Tools: Design requirements of machine tools, Kinematic drives of machine tools, Types of machine tool drives, Design of machine tool spindle. Jigs & Fixtures: Important considerations in jigs and fixture design. Main principles of designing of jigs& fixtures. Different devices and methods of locations. Different types of clamps used in jigs & fixtures. Metrology: Introduction to Metrology and its relevance, Linear and angular measurements.

FLUID MECHANICS AND HYDRAULIC MACHINES

Basic Concept & Properties: Fluid – Definition, Distinction Between Solid and Fluid – Units and Dimensions – Properties of Fluids – Density, Specific Weight, Specific Volume, Specific Gravity, Temperature, Viscosity, Compressibility, Vapour Pressure, Capillary and Surface Tension – Fluid Statics: Concept of Fluid Static Pressure, Absolute and Gauge Pressure Measurements by manometers and pressure gauges. Fluid Kinematics and Fluid Dynamics: Fluid Kinematics - Flow Visualization – Lines of Flow –Types of Flow –Velocity Field and Acceleration – Continuity Equation (one and Three Dimensional Differential Forms)- Equation of Streamline – Stream Function – Velocity Potential Function –Circulation – Flow Net. Fluid Dynamics: Equations of Motion- Euler’s Equation Along A Streamline – Bernoulli’s Equation– Applications – Venturi meter, Orifice Meter, Other Flow Measurement Instruments, Pilot Tube. Dimensional Analysis Dimensional Numbers, Their Application. – Buckingham’s π Theorem –Applications – Similarity Laws and Models. Incompressible Fluid Flow: Viscous Flow –Navier – Stoke’s Equation (Statement only) – Shear Stress, Pressure Gradient Relationship Laminar Flow Between Parallel Plates – Laminar Flow Through Circular Tubes (Hagen Poiseuille’s) – Hydraulic and Energy Gradient – Flow Through Pipes – Darcy –Weis back’s Equation – Pipe Roughness –Friction Factor – Mody’s Diagram – Minor Losses - Flow Through Pipes in Series and in Parallel – Power Transmission – Boundary Layer Flows, Boundary Layer Thickness, Boundary Layer Separation – Drag and Lift Coefficients. Hydraulic Turbines: Impact of Jet on Flat, Curved & Moving Plates –Fluid Machines: Definition and Classification – Exchange of Energy – Euler’s Equation for Turbo Machines – Construction of Velocity Vector Diagram’s – Head and Specific Work – Component of Energy Transfer – Degree of

Reaction. Hydraulic Pumps Compressor & Fans: Pumps: Definition and Classifications – Centrifugal pump: Classifications, Working Principles, Velocity Triangles, Specific Speed, Efficiency and Performance Curves – Reciprocating Pump: Classification, Working Principles, Indicator Diagram, Work Saved by Air Vessels and Performance Curves – Cavitations in Pumps Rotary Pumps: Working Principles of Gear and Vane Pumps. Definition – Classification Difference, Efficiency, and Performance Curves.

HEAT AND MASS TRANSFER

Introduction and Conduction: Various modes of heat transfer, Fourier's, Newton's and Stefan Boltzman's Law, combined modes of heat transfer, thermal diffusivity, and overall heat transfer coefficient, thermal conductivity of solids, liquids and gases, factors influencing conductivity, measurement. General differential equation of conduction, one dimensional steady state conduction, linear heat flow through a plane and composite wall, tube and sphere, critical thickness of insulation, effect of variable thermal conductivity, conduction with heat sources, heat transfer from extended surfaces, fin performances, concept of corrected fin length/ error in temperature measurement by thermometer well. Transient heat conduction- lumped system analysis, transient temperature charts (Heisler and Grober charts), transient heat conduction in multidimensional systems. Convection (Forced): Introduction, laminar boundary layer equations for internal and external flows; laminar forced convection on a flat plate and in a tube, Reynolds-Colburn analogy/Dimensional analysis and physical significance of the dimensionless parameters. Convection (Natural): Dimensional analysis of natural convection; empirical relationship for natural convection, convection with phase change, description of condensing flow, theoretical model of condensing flow, introduction to heat pipe, regimes of boiling heat transfer, empirical relationships for convection with phase change. Thermal Radiation: Introduction, absorption and reflection of radiant energy, emissivity and irradiation, black and non black bodies, Kirchhoff's law; intensity of radiation, radiation exchange between black surface, geometric configuration factor, grey body radiation exchange between surfaces of unit configuration factors, radiation shields, electrical analogy to simple problems, non-luminous gas radiation, errors in temperature measurement due to radiation. Heat Exchangers: Different types of heat exchangers; design of heat exchangers, LMTD and NTU methods, fouling factor and correction factor, Introduction to compact and plate heat exchangers. Mass Transfer: Mass and mole concentrations, molecular diffusion, Fick's law; eddy diffusion, molecular diffusion from an evaporating fluid surfaces, introduction to mass transfer in laminar and turbulent convection, dimensionless parameters in convective mass transfer, combined heat and mass transfer.

Syllabus of Paper – 2

DESIGN OF MACHINE ELEMENTS

Introduction: : Principles of mechanical design, systematic design process, aesthetic and ergonomic considerations in design, use of standards in design. Manufacturing consideration in design, casting, machining, forging. Dynamic and fluctuating stresses, fatigue failure and endurance limit, stress concentration, causes and remedies in design, Factor of safety, Tolerances and types of fits. Selection of materials. Design of Elements: Cotter and knuckle joints; screwed fastenings, bolted and riveted joint under direct and eccentric loads. Design of Welded Joints : Welded joints, strength of welded joints, eccentrically loaded joints, welded joints subjected to bending moment and torsion. Design of Shafts and Couplings : Shafts, keys and couplings –design of rigid and pin bushed flexible couplings. Design of Translation screws :Force analysis and design of various types of power screws. Springs, uses and design of close coiled helical springs. Mechanical Drives: Selection of transmission, helical, bevel and worm gears, belt and chain drives. Friction Clutches & Brakes: Common friction materials, shoe, band, cone and disc brakes their characteristics and design, friction clutches.

INTERNAL COMBUSTION ENGINES

Introduction to I.C. Engines: Principle of working, Classification; Air std. Fuel air and actual cycles, two and four stroke, SI and CI engines main parts, valve and port timing diagram. Combustion Phenomenon in SI engines: Principles of combustion in SI engine, effect of engines and operating variables on ignition delay & flame propagation, combustion chamber for SI engines, cycle to cycle variation, pre-ignition, abnormal combustion, theories of detonation, effect of engine and operating variables on detonation, surface ignition, adiabatic flame temperature, ignition systems. Combustion phenomenon in CI engines: Principles of combustion in CI engine, delay period, variables affecting delay period, diesel knock, methods of controlling diesel knock, combustion process & combustion chambers for CI engines. Fuel system and Mixture requirement in SI and CI Engine: Carburetion- working principles, chemically correct air-fuel ratio and load variation, compensating devices, venturi and jet dimension calculation, modern fuel induction system, multi point fuel injection system, fuel injection: common rail direct injection. Engine Testing, Supercharging, Lubrication and Engine Cooling: Engine performance and testing , measurement of power, supercharging limits of SI & CI engines methods of supercharging, superchargers, turbo charging, lubrication principles, function of lubricating system, properties of lubricating oil, additives, cooling system, air cooling, water cooling. Introduction to Automotive Fuels: Petroleum based fuels and their properties, necessity of alternative fuels, LPG, CNG, producer gas, biogas, H₂, biodiesel and alcohols, knock rating of engine fuels.

DESIGN OF AUTOMOBILE COMPONENTS

Design of friction clutches: common friction materials, single plate, multi plate and centrifugal clutches and their characteristics and design of friction clutches. Mechanical gears: Design of Helical, Bevel and Worm Gears, Belt and Chain drives and Automotive Gear box assembly. Brakes: Common friction materials, shoe, band, cone and disc brakes their characteristics and design of brake assembly. Design of Bearings: Rolling contact bearing: types of rolling contact bearings, static and dynamic load capacities, Stribeck's equation, equivalent bearing load, load life relationship, bearing life, load factor, selection of bearings from manufacturers catalogue. Lubrication and mountings, dismounting

and preloading of bearings, oil seals and packing. Sliding contact bearings: bearing material and their properties, bearing types, and their constructional details, hydrodynamic lubrication- basic theory, design consideration in hydrodynamic bearings, Raimondi and Boyd method relating bearing variables. Design of Engine Parts: Piston, Engine Valves, Cylinder, Connecting Rod, Crank Shaft for CI and SI engines. Introduction to the design of automobile chassis: Aerodynamic formulations, Calculation of various aerodynamic resistance.

PRODUCTION AND OPERATIONS MANAGEMENT

Operations strategy and competitiveness :Introduction to POM, Operations strategy, strategy design process, corporate and operations strategies, Operations competitive dimensions. Product and Process Design : Product design and development processes, product life cycle, Process flow chart, Types of processes, Process performance, Learning curve. Facility location and Layout: Factors affecting the location decisions, methods of facility location-factor rating systems, centroid method, and profit volume analysis; Types of layout, Block diagram and Assembly Line Balancing. Demand Forecasting :Qualitative and quantitative forecasting, Time series and regression models, Measures of forecasting errors. Inventory model :Importance of inventory, under stocking and overstocking, Fixed order quantity models and fixed time period models (EOQ models), Selective inventory management-ABC, VED, and FSN analysis. Lean Manufacturing : JIT manufacturing system, Toyota production systems- KANBAN model, and elimination of waste.

COMPUTER AIDED VEHICLE DESIGN AND SAFETY

Introduction: Study and Selection of a Vehicle; Specifications – Choice of Cycle, Fuel, Speed, Cylinder Arrangement, Number of Cylinders, Method of Cooling, Material, Design Variables and Operating Variables Affecting Performance and Emission of a vehicle. Performance Curves: vehicle Residence, Power and Torque Curve, Driving Force Against Vehicle Speed-Acceleration and Gradability in Different Gears for A Typical Car Or Truck Plotted From Specifications. Vehicle Body Details: Types: Saloon, Convertibles, Limousine, Estate Car, Racing and Sports Car. Visibility: Regulations, Driver's Visibility, Test for Visibility, Methods of Improving Visibility and Space in Cars. Safety Design, Safety Equipments for Cars. Car Body Construction; Design Criteria, Prototype Making. Vehicle Aerodynamics: Objectives. Vehicle Drag and Types: Various Types of Forces and Moments, Effects of Forces and Moments, Side Wind Effects on Forces and Moments, Various Body Optimization Techniques for Minimum Drag, Wind Tunnel Testing: Flow Visualization Techniques, Scale Model Testing, Component Balance to Measure Forces and Moments. Gear Ratios Determination of Gear Ratios, Acceleration and Gradability. Engine Design: Pressure Volume Diagram, Frictional Mean Effective Pressure, Engine Capacity, Calculation of Bore and Stroke Length, Velocity and Acceleration, Gas Force, Inertia and Resultant Force At Various Crank Angles – Side Thrust on Cylinder Walls. Indian and International Vehicle safety standards, requirement, various crash test methods, Initial Tests, Crash Tests on Full Scale Model, Dummies and Instrumentation, their computer aided simulations and applications. Testing for Emissions: Various emission standards, standard test procedure, assessment of various emission control technologies.

AUTOMOTIVE ELECTRICAL & ELECTRONICS

Automotive Electrical System: Classification of Automotive Electrical Systems – Generation,

Storage, Distribution, Starting, Ignition, Lighting, Accessories – Electrical System – Earth & Insulated Return System – Positive & Negative Earthing. Automotive Electrical System & Batteries: Principles and Construction of Lead Acid Battery, Characteristics of Battery, Rating, Capacity and Efficiency of Batteries, Non-Over Filling Devices, Various Tests on Batteries, Internal Resistance of Battery, Maintenance and Charging, Charging Sulphated Batteries, Care of Batteries in Stock, Battery Failures, Long Life Battery, Alkaline Battery, Its Advantages Over Lead Acid, Nickel –Iron Battery, Nickel Cadmium Battery, Venner Silver – Zinc Battery, Fuel Cells, Trouble Shooting of Lead–Acid Battery. Starting System & Charging System: Condition At Starting, Behaviour of Starter During Starting, Simple Motor, Torque Terms, Series Motor and Its Characteristics, Principle and Construction of Starter Motor, Working of Different Start Drive Units, Care and Maintenances of Starter Motor, Starter Switches, Trouble Shooting. Generation of Direct Current Simple, Generator, Type of D.C. Generators, Shunt Generator Characteristics, Commutation, Commutator Construction, Armature Reaction, Third Brush Regulation & Its Limitation, System of Connecting Fields, Cut out, Types of Voltage and Current Regulators, Compensated Voltage Regulator, Alternators Principle and Constructional Aspects and Bridge Rectifiers, New Developments, Trouble Shooting of Generator Alternator. Fundamentals of Automotive Electronic System: Current Trends in Automotive Electronic Engine Management System, Electro Magnetic Interference Suppression, Electromagnetic Compatibility, Electronic Dashboard Instruments, onboard Diagnostic System, Security and Warning System. Type of Sensors, Sensor for Speed, Throttle Position, Exhaust Oxygen Level, Manifold Pressure, Crank shaft Position, Coolant Temperature, Exhaust Temperature, Air Mass Flow for Engine Application, Solenoids, Stepper Motors, Relay. Programmable Logic Controls, Relay Logic Control. Motion Control. Ignition System: Composition of Ignition System, Types of Ignition Systems, Magneto Ignition, Magnetos – Ignition Coil and Its Construction, Mutual & Self Induction, Condenser, Distributor & Types – Spark Plug & Its Construction, Spark Plug Materials, Spark Plug Life, Special Plugs, Heat Ranges, Plug Fouling, Cam Angle & Contact Point Gap – Rotor Arm –Spark Plug Advance Mechanism – Centrifugal Advance – Inlet Manifold Vacuum Advance, Fully Vacuum Advance, Limitation of Coil Ignition System, Special Ignition System & Devices, Gas-Turbine Igniters, Ignition System Trouble Shooting. Lighting System: Lights Sources, Energy Demand, Head Lights & Its Construction, Head Light Beam, Headlight Dazzle, Anti-Dazzle Devices, Bulbs & Wattages, Headlight Adjustments, Fog Lamps, Side & Tail Light, Brake Warning Lights, Led Lighting System, Horn, Wiper System, Trafficator, Electrical Switches, Indicating & Wiring Devices, Electrical Pumps, Heater & Defrosters, Latest Trends, Wiring & Installation, Auto Cables, Cable Colors, Cable Connectors, Wiring Harnesses, Circuit Breakers, Fuses, Printed Circuits, Plastic Fibre optics, Trouble Shooting Telemetric –Bluetooth Technology for Communication, Consumer Electronics in Automobiles. Architecture : General 8 Bit Microprocessor and Its Architecture 8085, Z-80 and Mc 6800 Mpu and Its Pin Function Architecture - Function of Different Sections. Instruction Set : Instruction Format - Addressing Modes - Instruction Set of 8085 Mpu-T-State - Machine Cycle and Instruction Cycles - Timing Diagrams - Different Machine Cycles - Fetch and Execute Operations - Estimation of Execution Times. Assembly Language Planning : Construct of the Language Programming - Assembly Format of 8085- Assembly Directive - Multiple Precision Addition and Subtraction – BCD to Binary and Binary to BCD, Multiplication, Division, Code Conversion Using Look Up Tables - Stack and Subroutines. Data Transfer Schemes : Interrupt Structure - Programmed I/O - Interrupt Driven I/O, Dma– Serial I/O. Interfacing Devices : Types of Interfacing Devices - Input / Output

Ports 8212, 8255, 8251, 8279. Octal Latches and Tristate Buffers - A/D and/A Converters - Switches, Led's ROM and RAM interfacing. Applications : Data Acquisitions - Temperature Control - Stepper Motor Control - Automotive Applications Engine Control, Suspension System Control, Driver Information Systems), Development of A High Speed, High Precision Learning Control System for the Engine Control.

ENGINEERING ANALYSIS AND DESIGN

Specifications of Design, objectives and constraints: Problem solving principles, Need for Creativity and Innovation, Creativity in Problem Solving, lifestyle- comfort and luxury. Examples Nature inspired innovations Design of various products inspired by nature like Green building, bullettrain, Nike Clothing, Velcro, Adhesive Tape, self-heating plastic, friction reducing swimming suit, automated robot, screen display. Brain storming, Mind mapping, SWOT Analysis, Fishbone diagram, six thinking hats, Borrowing brilliance, Da Vinci's seven principles, Provocation and movement. Drawing for Design, Machine component & assembly drawings full and half section views, bill of materials. Ergonomics Concept; Man-machine-environment interaction system and user-friendly design practice; Human compatibility, comfort and adaptability; Fundamentals of ergonomics, environmental factors influencing human performance; Occupational stress; safety and health issues; Design process involving ergonomics check and ergonomic design evaluation and Participatory ergonomics aspects. IPR and Patent: Introduction to IPR; Overview & Importance; IPR in India and IPR abroad; Patents; their definition; granting; infringement; searching & filing; Utility Models an introduction; Copyrights; their definition; granting; infringement; searching & filing, distinction between related and copy rights; Trademarks, role in commerce, importance, protection, registration; domain names; Industrial Designs; Design Patents; scope; protection; filing infringement; difference between Designs & Patents' Geographical indications legal issues, enforcement.
