Syllabus for M.S.(By Research) Programme

MCE111   Civil Engineering

Engineering Mechanics, Construction Materials, Transform Techniques and Partial Differential Equations, Construction Techniques and Practices, Strength of Materials, Fluid Mechanics, Numerical Methods, Environmental Science and Engineering, Applied Hydraulic Engineering, Soil Mechanics, Surveying, Design of Reinforced Cement Concrete and Masonry Structures, Foundation Engineering, Highway Engineering, Structural Analysis, Water Supply Engineering, Design of Steel and Timber Structures, Structural Design, Wastewater Engineering, Ground Improvement Techniques, Irrigation Engineering, Structural Dynamics and Earthquake Engineering, Railways, Airports and Harbour Engineering, Estimating, Costing and Valuation Engineering

MEE111   Electrical Engineering

RLC circuits - Circuit theorems - Resonance - AC circuits - Star-Delta transformation- Field theorems - Magnetic circuits – Transformers - Equivalent circuit - regulation - Transfer functions - Root locus - Bode Plots - DC machines - Alternators - Induction motor - Digital circuits - OPAMPs - 8 bit Microprocessors - rectifiers - inverters - DC/DC converters - Fourier Transforms - Laplace Transforms - DFT - Transmission line models - Power transfer - Real and Reactive power control - Load flow - Electrical measuring instruments - measuring bridges

MIC111   Electronics and Communication Engineering
Electronic Circuits, Semiconductor Devices, Integrated Circuits, Communication Theory

MIC121   Computer Science and Engineering
MIC122   Information Technology

Programming, Data structures, Analysis of algorithms, Computer organisation and architecture, Operating systems, Database management systems, Computer networks, Software Engineering, Theory of Computation, Artificial Intelligence.

MME111   Mechanical Engineering

Foundry Technology-Hot and Cold Working- Forging- Advances in Forming Process-Principles and Applications of Joining Processes- theory of metal cutting- centre lathe and special purpose lathes reciprocating machines, milling machines & gear cutting abrasive process, broaching CNC machine tools and part programming. Machining Processes: Ultrasonic Machining-Abrasive Jet Machining-Water Jet machining-electrical discharge machining and electrical discharge wire cut-Electron Beam, Laser

Beam, Ion Beam and Plasma Arc Machining. Stress, strain and deformation of solids Transverse loading on beams and stresses in beams-Torsion-Deflection of beams-Thin cylinders, spheres and thick cylinders. Basics of mechanisms-Kinematics of linkage and cam mechanisms- Gears and gear trains-Friction. Steady stresses and variable stresses in machine members-Design of shafts and couplings- Design of energy storing elements-Design of bearings and miscellaneous elements. Force Analysis- Balancing- free and forced vibration, mechanism for control. Jigs and Fixtures. Design of transmission systems for flexible elements- spur gears and parallel axis helical gears- bevel, worm and cross helical gears Basic concept and first law-second law and entropy-thermodynamic availability- properties of pure substance and steam power cycle- psychrometry. Gas power cycles-air compressor- internal combustion engines and its systems-internal combustion engine fuels, combustion & performance-gas turbines-boilers-steam nozzle-steam turbines-cogeneration and waste heat recovery- Refrigeration and air conditioning. Heat and Mass Transfer: Conduction-convection -radiation-- heat exchangers. Steam and Nuclear Power Plants- Hydel and other power plants.

MME122   Automobile / Automotive Engineering

Front axle types, Front wheel geometry. Condition for true rolling motion. Steering geometry. Ackermann and Davis steering. Types of steering gear box. Propeller shaft. Universal joints. Final drive. Differential-types. Type of brakes and constructional details. Types of suspension. Independent suspension- front and rear. Rubber, pneumatic, hydro- elastic suspension. Construction and operation of friction clutches. Different types of gear boxes. Fluid couplings and torque converters. Wilson gear box. Hydrostatic drive systems. Electric drive. Continuously Variable Transmission (CVT). Types of car bodies. Classification of bus bodies. Body optimization techniques for minimum drag. Wind tunnel technology. Classification of vibration, definitions. Single degree of freedom, free, forced and damped vibrations. Rolling resistance, cornering properties of tyres. Directional stability of vehicle. Choice of suspension spring rate. Calculation of effective spring rate. Vehicle suspension in fore and aft. Vehicle ride model. Load distribution. Types of Batteries – Principle, Construction. Starting System, D.C. Generators and Alternators. Regulations for charging. Electronic ignition systems. Types of sensors and actuators for automobiles. Microprocessor controlled devices in automobiles. Components for electronic engine management system. PID control. Types of solid state ignition systems and their operation. Fuel control maps, open loop control of fuel injection and closed loop lambda control – Integrated engine control system. Onboard diagnosis system. Emission formation in SI and CI Engines. Effects of design and operating variables. Controlling techniques. Constant Volume Sampling Systems. Measurement techniques of HC, CO, NOx and Smoke emissions. Dilution Tunnel and Sound level meters. Properties of

alcohols, vegetable oils, biogas, natural gas, LPG and hydrogen as engine fuels. Methods of using all the fuels in SI and CI engines. Performance, emission and combustion behavior of the fuels in S.I. and CI engines.

MTE131   Biotechnology

Composition, structure and properties of Biomolecules, Aqueous chemistry. Enzymes: Mechanism of catalysis and kinetics. Biothermodynamics. Carbohydrate, Protein, Lipid and Nucleic acid synthesis and degradation. Photosynthesis and Oxidative phosphorylation. Central dogma: repair and replication of DNA , transcription and translation.

Anatomy of a cell, Cell components, Membrane, Membrane transport and protein sorting, signal transduction, Structure and function of cytoskeleton, Tissue and their cellular interactions, Cell cycle and cancer.

Immunity, Cells, tissues and organs of the immune system. Antigens, epitopes and antibody reactivity Antibodies: Structure, Classification and Functions, Complement system. Hybridomas and its applications. Organization of immunoglobulin genes and their expression, Antibody diversity B- and T-cells development and cytokines. Antigen processing and presentation-Major histocompatibility complex and their importance. Hypersensitivity and its types.

Structural organization and multiplication of bacteria, viruses, algae and fungi, methods to quantify bacterial growth; Nutritional requirements of bacteria, host-microbe interactions; anti-bacterial , antifungal and anti- viral agents; mode of action and resistance to antibiotics; biofertilizers and biopesticides; microorganism and pollution control; biosensors.

Medium requirements for fermentation processes, medium optimization methods, Stoichiometry of cell growth and product formation , Kinetics of microbial growth, substrate utilization and product formation, Simple structured models, Batch, fed - batch and continuous processes, Mass transfer in bioreactor and Aeration and agitation, Rheology of fermentation fluid, Scale - up concepts.

Polarized light - optical rotation - circular dichrosim, UV-VIS Spectroscopy - Applications, nuclear Magnetic Resonance - X -ray diffraction- application in Biology FT-IR, Raman spectroscopy , Theory of chromatography- normal phase & reverse phase chromatography - gel permeation- ion exchange & affinity chromatography

Biological Sequence Analysis, Local and Global Alignment Multiple sequence alignment and Application, Protein structure prediction, Phylogenetics, Biological databases.

MTE143   *Pharmaceutical Technology*

Unit 1 Biochemistry and microbiology

Cell components, structure and biochemical functions, membrane structure and functions, transport cell membrane, free energy, reduction potential, bioenergetics, electron transport chain, phosphorylation; Classification, physical, chemical properties and metabolism of – Carbohydrates, Lipids, Proteins and amino acids, Nucleic acids, biosynthesis, immunoglobulins. Nomenclature, classification, chemical nature, properties and function of – vitamins, hormones , coenzyme; classification of microbes, bacteriophages, media preparation, different media, growth curve, thermal death kinetics of microbes, sterilization, clinically important microorganisms of bacteria, viruses, fungi, identification and prevention, recombinant engineering – restriction enzymes, vectors, prokaryotic and eukaryotic host systems.

Unit 2 Enzymes and Biochemical Engineering

Enzyme classification, mechanisms, enzyme induction and inhibition, catalysis theories, entropy in catalysis, enzyme kinetics – single substrate reactions, Michaelis – Menten parameters, multi substrate reactions, enzyme immobilization, stoichiometry of cell growth and product formation, elemental balances, degrees of reduction of substrate and biomass, yield coefficients of biomass and product formation, energetic analysis of microbial growth and product formation, oxygen consumption, thermodynamic efficiency of growth, Modes of operation – batch, fed batch and continuous cultivation. kinetic models for microbial growth, Monod model, growth of filamentous organisms; Air Lift Reactor, Bubble Column Reactor, Immobilized enzyme reactors- packed bed, fluidized bed, membrane reactors

Unit 3 Pharmaceutical and analytical Chemistry

Molecular orbital theory and bonding, polar and non-polar bonds, resonance, intramolecular and intermolecular; Atomic and molecular spectra, electronic transitions, Beer and Lambert's law, Chromophores, Auxochromes, Spectral shifts, Solvent effect on absorption spectra, Principles of vibrational spectroscopy – Instrumentation and sampling technique – Applications in pharmaceutical sciences – NMR principles – Instrumentation – Applications, Thin Layer Chromatography Adsorbents, solvents, elutropic series, uses, limit test, TLC technique, High Performance Liquid Chromatography (HPLC), retention factor, symmetry factor, resolution, theoretical plate, Pharmacopoeial standards and applications – Melting point, boiling point, refractive index, titration curves – acid-base titration, nonaqueous and precipitation titration, iodimetry, iodometry; Argentimetric, redox, and titrations

Unit 4 Pharmaceutics and Formulation

Particle size, shape distribution and measurement, particle number, average particle size, number and weight distribution, sieving, sedimentation, determining surface area, permeability, adsorption, Powders – derived and flow properties, porosity, packing arrangement, densities, bulkiness. Liquid interface, surface and interfacial tension, surface free energy, measurement of surface and interfacial tensions, free energy, spreading coefficient, adsorption at liquid interfaces, surface active agents, HLB classification, surfactants, electrical properties of interface. Newtonian and non-Newtonian systems, thixotropy, viscosity and measurements, colloidal dispersions, suspensions and emulsions ,interfacial properties, Brownian movement, flocculation and rheological considerations, emulsions, complexation and protein binding, and drug action. Types of tablets, granulation, coating, hard and soft gelatin capsules characterization, formulation of parenteral products, Sustained release preparations, aerosol formulation.

Unit 5 Pharmacology and chemotherapy

Routes of administration, Pharmacokinetics, Pharmacodynamics, Receptors, Ionization, Drug distribution and pKa values, prodrugs; Classification, mechanism of action, structure activity relationship of various – sympathomimetic agents. adrenergic antagonists, antipsychotics, anticonvulsants, CNS stimulants, opioid analgesics, anti-anginal, vasodilators, calcium channel blockers and cardiac glycosides, anti arrhythmic and anti hyperlipidemic agents eicosanoid drugs, antipyretics, anti-rheumatoid drugs and nonsteroidal anti-inflammatory drugs, Antacids, Adsorbents and protectives, Saline cathartics; Topical Agents – Protectives, Astringents, Anti-microbials topical agent. Chemotherapeutic agents (mechanism of action, structure activity relationship) – sulphonamides, penicillins and cephalosporins, chloramphenicol, macrolides, fluroquinolones, aminoglycosides and tetracyclines; Chemotherapy of tuberculosis, leprosy, fungal, viral diseases, malignancy and immunosuppressive agents

MME123　　Manufacturing Engineering

Engineering Materials: *Structure and properties of engineering materials and their applications; effect of strain, strain rate and temperature on mechanical properties of metals and alloys; heat treatment of metals and alloys, its influence on mechanical properties.*

Applied Mechanics: *Engineering mechanics – equivalent force systems, free body concepts, equations of equilibrium; strength of materials – stress, strain and their relationship, Mohr's circle, deflection of beams, bending and shear stress, Euler's theory of columns.*

Metal Casting: Casting processes – types and applications; patterns – types and materials; allowances; moulds and cores – materials, making, and testing; casting techniques of cast iron, steels and nonferrous metals and alloys; solidification; design of casting, gating and risering; casting inspection, defects and remedies.

Tool Engineering: Jigs and fixtures – principles, applications, and design; press tools – configuration, design of die and punch; principles of forging die design.

Metal Forming: Stress-strain relations in elastic and plastic deformation; concept of flow stress, deformation mechanisms; hot and cold working – forging, rolling, extrusion, wire and tube drawing; sheet metal working processes such as blanking, piercing, bending, deep drawing, coining and embossing; analysis of rolling, forging, extrusion and wire /rod drawing; metal working defects.

Metal Joining Processes: Welding processes – manual metal arc, MIG, TIG, plasma arc, submerged arc, electroslag, thermit, resistance, forge, friction, and explosive welding;other joining processes – soldering, brazing, braze welding; inspection of welded joints, defects and remedies; introduction to advanced welding processes – ultrasonic, electron beam, laser beam; thermal cutting.

Machining and Machine Tool Operations: Basic machine tools; machining processes-turning, drilling, boring, milling, shaping, planing, gear cutting, thread production, broaching, grinding, lapping, honing, super finishing; mechanics of machining – geometry of cutting tools, chip formation, cutting forces and power requirements, Merchant's analysis; selection of machining parameters; tool materials, tool wear and tool life, economics of machining, thermal aspects of machining, cutting fluids, machinability; principles and applications of nontraditional machining processes – USM, AJM, WJM, EDM and Wire cut EDM, LBM, EBM, PAM, CHM, ECM.

Metrology and Inspection: Limits, fits, and tolerances, interchangeability, selective assembly; linear and angular measurements by mechanical and optical methods, comparators; design of limit gauges; interferometry; measurement of straightness, flatness, roundness, squareness and symmetry; surface finish measurement; inspection of screw threads and gears; alignment testing of machine tools, Computer aided inspection.

Powder Metallurgy: Production of metal powders, compaction and sintering.

Manufacturing system modeling and Analysis: Operations research, Sources of errors in manufacturing; process capability; tolerance analysis in manufacturing and assembly; process

planning; parameter selection and comparison of production alternatives; time and cost analysis; manufacturing technologies – strategies and selection.

Computer Integrated Manufacturing: *CAD, CAM, CAPP, CNC, DNC, Robotics, and CIM.*

Advances in Manufacturing : *Additive manufacturing,   cellular manufacturing, FMS, JIT, Lean manufacturing, Agile Manufacturing*

MME124   Mechatronics

Micro controller, PLC and Embedded systems: Architecture - CISC and RISC - Addressing modes - Programming - Timer/counting - Interrupts - Server com of 8081, PIC forming and interaction of 8081, PIC and PLC - Embedded processor - ARM - SHARC - Design and Development - Real time models, languages and operating systems - Task and scheduling - Real time kernel - Communication and synchronization. Robotics, MEMS and Machine Vision Systems: Definitions - Types - Classification - Configuration and control loops - co-ordinate system - kinematics - End effectors - Design - Robot programming - Expert systems - Robotic work cells and applications. Fundamentals - Design and fabrication micro-system - Materials - Fabrication process and micro-system packaging - Micro Devices and materials - classification of nano-structures - Characterization of Nano-materials - Image Acquisition

- Image processing - Image Analysis - Machine Vision Applications. CNC and Automation Techniques: Mechatronic elements in CNC Machine tools - CNC measurement system and tooling - CNC programming

- Testing and maintenance of CNC machines - Fundamentals and concepts in metrology - Inspection and general measurements - Opto electronics in engineering inspection - co-ordinate metrology and quality control - Fluid Power generating / utilizing elements - Control and Regulation elements - Circuit Design - Electro pneumatics and Electronic control of Hydraulic and pneumatic circuits. Sensors, Actuators and Control Systems: Definition - Measurement Techniques - Inductance, capacitance transducer - Piezo electric and magnetic sensors - Radiations and Electro Chemical sensors and Applications - Recent Trends in sensor and Applications - Actuators - Types -Constructions and working principles - Systems and their Representation - Time and Frequency Response - stability of control systems - State variable Analysis and Design - Control system components.

Syllabus for Ph.D. Programme

PAP6011   Digital Architecture

PAP6012   Landscape Architecture

PAP6013   General Architecture

Evolution and principles of city planning; types of cities & new towns; planning regulations and building byelaws; eco-city concept; Concept of housing and neighborhood ; housing standards ,policies and typology , housing infrastructure; housing programs in India; selfhelp housing. settlement system planning; growth of cities & metropolises; rural-urban migration; urban conservation; urban renewal; Traffic and Transportation Planning. Indian architecture from Indus civilization to Modern contemporary period. European architecture from Egyptian modern architectural styles to contemporary period. Vernacular and traditional architecture. Principles of landscape design and site planning; history of landscape styles, elements and materials, plant characteristics. environmental considerations in landscape planning. Application of computers in architecture and planning; understanding elements of hardware and software; computer graphics; programming languages and usage of software packages. Components of Ecosystem and environment, climate responsive and energy efficient building design. Principles of Building Science - lighting, architectural acoustics etc. Building Services on Water supply, sewerage and drainage systems, electrification of buildings, air-conditioning intelligent buildings; fire fighting systems, building safety and security systems -principles, types, standards and uses; Infrastructure, Services and Amenities in city level planning. Behavioral characteristics of all types of building materials ;principles of strength of materials; design of structural and principles of disaster resistant structures. Building Construction and Management: Building construction techniques, methods and details; professional practice; project management techniques. Development Administration and Management: Planning laws; development control and zoning regulations.

PAP6021   Town and Country Planning

Process of evolution of human settlement planning - Planning systems in India - Type of planning surveys - Sociological and Economic concepts and frameworks - Social and economic Impacts of urban growth and expansion - City-region, urban sprawl, and urban fringe - Current trends in the traffic and transportation development sector in India.- Pedestrian planning- Parking and Public Transport Surveys - Inventory of Transport facilities - Different modes - Private transport - Scope and function of statistics in planning analysis - Distribution and structure of population - Population projection methods - Research processes and planning

processes - Access to Information: nature, types and sources - Hypothesis - Housing character and its information with reference to culture and technological changes and development -Impact of industrialization and urbanization on housing and built environment - Green house and eco friendly housing - Housing market and housing finance -Gated community-emergence and management system - Contemporary theories and concepts in city planning - Concept and need for regional planning and regional development - Multi-level planning, block and District planning. Environmental concerns at local, regional and global levels - environmental impact assessment practice in India - Sustainability and environmental - Legislative requirements, public awareness and community participation - Evolution, scope and significance of planning legislation - Review of Town and Country Planning Act of Tamil Nadu

- Professional role responsibility and planning consultancy service - project cycle - Planning process and project planning - Funding options for urban development projects - Planning Norms and standards - Basic concepts of government and governance - Governance and urban governance - Urban and rural administration in developed, and developing countries - e-Governance-concepts, theories and practices - e-Readiness indices - Approaches to understanding organizations - Human resource planning and management - Participatory governance - Public relations- Introduction to real property ownership - Real estate investment analysis and portfolio management - Classification of spatial and non-spatial data application of spatial data in urban and regional plans - Ecotourism - Leisure, recreation and society - Tourist and local community - Tourist site planning- processes and sustainability - Urban development through Five Year Plans - Budgetary allocation from central and state governments for urban development

- Asset management - Disaster cycle - Disaster-types, causes and consequences - Disaster preparedness

and rehabilitation - Spatial planning and technology interface - Socio-economic and environmental Impact of techno cities - communities and people in building smart cities and smart communities - Information need and the role of web in planning - Web sites and information sources in urban and regional planning.

PCE1021   Structural Engineering

PCE1022   Computer Aided Structural Engineering

PCE1023   Computer Methods and Applications in Structural Engineering

Concrete Structures - Concrete Mix design, Special concrete, Design of reinforced concrete elements, Flat slabs and yield line based design, Inelastic behaviour of concrete structures, Ductile detailing. Dynamics of Structures - Dynamic response of single, two and multi degree freedom systems, Dynamic response of continuous systems, Direct integration methods for dynamic response. Theory of Elasticity and Plasticity - Elasticity solution, Torsion of non - circular sections, Beams on elastic foundations, Plasticity. Finite Element Analysis Axial deformation of bars, Analysis of framed structures, Plates and shells, Applications of finite

element for elastic stability, Dynamic analysis, Non-linear vibrational and thermal problems. Experimental Techniques and Instrumentation - Forces and strain measurement, Measurement of vibration and wind flow, Distress measurement, Non destructive testing methods, Model analysis. Steel Structures - Design of members subjected to combined forces, Design of connections, Analysis and design of industrial buildings, Plastic analysis of structures, Design of light gauge steel structures. Earthquake Analysis and Design of Structures - Effects of earthquake on structures, Earthquake resistant design of masonry and RC structures, Vibration control techniques. Design of Bridges - Design of short span and long span bridges, Prestressed concrete bridges, Steel bridges, Bearings and sub-structures. Analysis and Design of Tall Buildings - Behaviour of various structural systems, Analysis and design of structural elements, Stability of tall buildings, wind effects on structures. Maintenance and Rehabilitation of Structures - Building cracks, Moisture penetration, Distresses and remedies, Strengthening of existing structures. Pre-stressed Concrete - Design of flextural members, Design of continuous and cantilever beams, Design of tension and compression members, Design of composite members. Stability of Structures - Buckling of columns, Beam-columns and frames, Torsional and Lateral buckling, Buckling of plates, Inelastic buckling.

PCE1031   *Construction Engineering*
PCE1032   *Construction Engineering and Management*
PCE1033   *Infrastructure Engineering*
PCE1034   *Advanced Construction Technology*
PCE1035   *Architectural Construction*

Construction Equipment - Construction equipment and management, Equipment for earthwork, Asphalt and Concrete plants, Materials handling equipment. Modern Construction Materials - Special Concretes, Metals, Composites, Waterproofing compounds, Non-weathering materials, Flooring materials and façade materials, Smart and intelligent materials. Project Formulation and Appraisal - Project Formulation, Project Costing, Project Appraisal, Project Financing, Private Sector Participation. Advanced Construction Techniques - Construction of special structures, Cooling towers, Silos, Rehabilitation and strengthening techniques, Demolition techniques. Computer Applications in Construction Engineering and Planning - Optimization techniques, Inventory models, Scheduling application - Sequencing problems - Simulation - Enterprises. Construction Planning, Scheduling And Control - Construction planning, Scheduling procedures and techniques, Cost control, Quality control and safety during construction, Organization and use of project information. Contract Laws and Regulations - Construction contracts, Indian contract act, Torts, Contractual problems, Tamilnadu transparency in tenders act, E-tenders, Arbitration, Legal requirements, Insurance and bonding, Labour acts. Construction Personnel and Project Management - Manpower planning, Organization,

Human relations and Organisational behaviour, Welfare measures, Management and development methods, Design and Construction Process, Cost Estimation. Design of Energy Efficient Buildings - Heat Transfer, Thermal Storage, Passive Solar Heating and Cooling, Day lighting and Electrical Lighting, Design for Climatic Zones. Project Safety Management - Construction Accidents, Safety Programmes, Contractual Obligations, Designing for Safety, Owners' and Designers' Outlook. Quality Control and Assurance In Construction - Quality management, Quality systems, Quality planning, Quality assurance and control, Quality improvement techniques. Quantitative Techniques in Management - Operations research, Production management, Financial management, Decision theory, Managerial economics. Resource Management and Control in Construction - Resource planning, Labour management, Materials and equipment, Time management, Resource allocation and levelling. Shoring, Scaffolding and Formwork - Planning, Site equipment and plant for form work, Pressures on Forms, Design of forms and shores, Forms for domes and tunnels, Slip forms and Scaffolds.

PCE1041   Soil Mechanics and Foundation Engineering
PCE1042   Geotechnical Engineering

PCE1043   Rock Engineering and Underground Structures
PCE1044   Environmental Geotechnology

Stresses in elastic half-space medium by external loads - fundamental solutions -Boussinesq. Flow through porous media - Darcy's law - General equation of flow - steady state condition - solution by flow net - fully saturated conditions. Shear strength of granular sols - Direct shear - Triaxial Testing- Drained and untrained Stress-strain behaviour - Dilation, contraction and critical states - Formation of soils - various soil deposits and their engineering suitability - Genesis of clay minerals - classification and identification - Anion and Cation exchange capacity of clays - specific surface area - bonding in clays. Bearing capacity of shallow foundations - Homogeneous - Layered soils - Soft and Hard Rocks - Evaluation of bearing capacity from insitu tests Function - classification of piles - Factors governing choice of pile foundation - Load transfer principles - piling equipment and methods. Insitu compaction of granular and cohesive soils, Shallow and Deep compaction methods - sand piles - concept, design, factors influencing compaction. Blasting and dynamic consolidation - Preloading with sand drains, fabric drains, wick drains etc. State of stress in retained soil mass - Earth pressure theories - Classical and graphical techniques - Active and passive cases - Earth pressure due to external loads. Introduction to Geoenvironmental engineering - environmental cycle - sources, production and classification of waste - causes of soil pollution - factors governing soil-pollutant interaction - failures of foundations due to pollutants. Pavements types - Approaches to pavement design - vehicle and traffic considerations - behaviour of road materials under repeated loading - Stresses and deflections in layered systems. Scope

and objectives, planning and exploration program, methods of exploration, exploration for preliminary and detailed design, spacing and depth of bores, data presentation. Geophysical exploration and interpretation, seismic and electrical methods.

PCE1051   Environmental Engineering

Environmental chemistry-aquatic chemistry, atmospheric chemistry, soil chemistry-environmental chemicals; Environmental Microbiology - classification and characteristics of Microorganisms-microbes and nutrient cycles- metabolism of microorganisms- pathogens in wastewater- toxicology Fluid flow-continuity principle, energy principle and momentum principle; frictional head loss in free and pressure flow, minor heads losses- Planning of water system - selection of pipe materials, water transmission main design. Design of sanitary sewer; economics of sewer design-sewer appurtenances; material, construction, inspection and maintenance of sewers. Pollution in wastewaters - physical and chemical treatment of waste water- Biological treatment of wastewater - sludge treatment and disposal. Design of water and wastewater treatment systems-Principles of treatment-Design of water treatment plants-Design of wastewater treatment plants-Residual management-construction operation and maintenance aspects; Industrial wastewater management, treatment & disposal-Industrial pollution prevention & waste minimization-Industrial wastewater treatment-Wastewater reuse and residual management. Air pollution & control-Meteorology-Control of particulate contaminants-Control of gaseous contaminants-Indoor air quality management-Noise Pollution and Control; Solid and hazardous waste management-Sources, classification and regulatory framework-Waste characterization and source reduction-Storage, collection and transport of wastes-Waste processing technologies-Waste disposal. Industrial wastewater treatment - Impacts of industrial wastewater-classification of industries- industrial pollution, prevention - wastewater reuse and residue management - zero discharge concepts

PCE1061   Environmental Management

Environmental chemistry-aquatic chemistry, atmospheric chemistry, soil chemistry-environmental chemicals; Environmental Microbiology- classification and characteristics of Microorganisms-microbes and nutrient cycles- metabolism of microorganisms- pathogens in wastewater- toxicology. Sustainability and Development Challenges Principles and Frame Work-Sustainable Lively Hood-Sustainable Socio-Economic Systems-Assessing Progress and Way Forward; Environmental Policies and Legislation-Water (P&CP) Act, 1974-Air (P&CP) Act, 1981-Environment (Protection) Act 1986; Environmental Economics-Valuation of Environmental Costs and Benefits-Economics of Pollution Prevention-Economic Instruments for Environmental Protection-Natural Resource Economics. Design of water and wastewater

treatment systems-Principles of treatment-Design of water treatment plants-Design of wastewater treatment plants-Residual management- construction operation and maintenance aspects; Industrial wastewater management, treatment & disposal-Industrial pollution prevention & waste minimization-Industrial wastewater treatment-Wastewater reuse and residual management. Air pollution & control-Meteorology-Control of particulate contaminants-Control of gaseous contaminants-Indoor air quality management-Noise Pollution and Control; Solid and hazardous waste management-Sources, classification and regulatory framework- Waste characterization and source reduction-Storage, collection and transport of wastes-Waste processing technologies-Waste disposal. Environmental and socio-economic impact assessment-Components and methods - Socio-economic impact assessment-Environmental management plan-Sectoral EIA; Environmental risk assessment and management-Elements of environmental risk assessment-Tools and methods for risk assessment-Risk management; Environmental management systems and auditing - Environmental management standards Preventive environmental management-environmental management system-Environmental audit

PCE1081   Water Resources Engineering
PCE1082   Irrigation Water Management

Fluid mechanics - Conservation laws and dimensional analysis - boundary layers and turbulence. Open channel hydraulics. Water supply systems - network analysis. Hydrometeorology - stream flow measurements- hydrographs - Time series analysis - Flood estimation - Flood modeling and management - Droughts and impacts - Drought assessments and management. Hydrogeology - groundwater hydraulics - pumping test analysis - well design and construction - methods of artificial groundwater recharge -

regional groundwater modeling and sea water intrusion. Water Resources Systems - optimization techniques. Computational methods in water resources -simulation models - water requirements for crops

- soil water relationship - cropping pattern and production practices - Irrigation methods -Irrigation efficiencies - Remote sensing and GIS applications in water resources - digital image processing, basic components of GIS - spatial analysis. Climate change and its impact on water resources and irrigation. Water pollution - water quality management. Principles, design and management of drainage systems. Water shed concepts - soil conservation measures - water harvesting and water conservation. Environmental impact assessment - Types and limitations - Methods of EIA - Environmental management plan. Water and ecosystems - ecological principles - blue, green and gray water concepts - water access and equity - ecosystems management. Linkage between water and health, water and agriculture - legal and regulatory settings- National water policy - IWRM Concepts - Understanding farmers participation - farm economics - financial analysis. - Gender and Water-gender empowerment - gender in development sectors

- gender and IWRM - mainstreaming gender in water management - Techniques of data collection analysis and reporting - participatory field research - methods of field research - RRA, PRA tools etc. - participatory tools - SPQR and statistical analysis.

PCE1101   Geoinformatics

PCE1102   Geomatics

PCE1103   Remote Sensing

PSH7201   Spatial Information Technology

Physics of Remote Sensing - Data Acquisition - Scattering System - Thermal and Hyper Spectral Remote Sensing - Data Analysis - Basics of Photogrammetry - Geometry of Aerial Photographs - Project Planning, Ground Control and Mosaic - Analogue, Analytical and Digital Photogrammetry - Aero-Triangulation and Terrestrial Photogrammetry - Basics of Cartography - Earth - Sources of Data - Perception and Design - Cartography Abstraction - Basics of GIS - Data Model and Input - Data Analysis and Output - Spatial Modeling - Data Quality and Miscellaneous Topics - Basics of Electronic Surveying - Electromagnetic Waves - Electronic Total Station - Survey Error Analysis and Adjustment - Field Work - Natural Resource Management Applications - Disaster Management & Facility Management Applications - Location Based Services Application - Land Information System & Web GIS Applications - Business, Health and other Applications - Fundamentals and Radiometry - Radar Remote Sensing - Airborne and Spaceborne Radar Systems - Application Of Radar Remote Sensing - Special Topics In Radar Remote Sensing - Basics of Airborne Laser Terrain Mapping - Lidar - Lidar Data Processing - Lidar Mapping and Modeling - Lidargrammetry - Study of different GPS - GPS Data Processing - Basics of Hydrology - Drainage Basin - Areal Assessment - Ground Water and Water Quality - Irrigation and Watershed Management - Ocean Engineering - Ocean General Studies - Coastal Engineering - Remote Sensing Application - Coastal Zone Management - Introduction to Urban Planning - Settlement Mapping - Analysis and Planning - Transportation Planning - Current Trends in Urban Planning.

PEE3011   Power Systems Engineering

PEE3012   Electrical and Electronics Engineering

PEE3013   Electrical Energy System

Advanced Power System Analysis, Power System Operation and Control, Analysis of electrical Machines, Power System Dynamics, Flexible AC Transmission Systems, Advanced Power System Protection, Restructured Power System, HVDC Transmission

PEE3021　　High Voltage Engineering

Electromagnetic fields - Computation and modeling, Transients in Power Systems, High Voltage Generation and measurement, Insulation Technology, High Voltage Testing Techniques, Insulation design, EHV Power Transmission, High Voltage Direct Current Transmission

PEE3031　　Power Electronics and Drives
PEE3032　　Electrical Machines

Analysis of Electrical Machines, Analysis of Power Converters, Analysis and Design of Inverters, Electromagnetic Field Computation and modelling , Solid State DC Drives, Solid State AC Drives, Special Electrical Machines, Microcontroller and DSP based System Design, Power Electronics for Renewable Energy systems, Power Quality

PEE3041　　Embedded Systems Technology

Introduction to Embedded Systems - Case Study: Digital -Basics of building Digital circuits, Asynchronous &Clocked Synchronous circuits, FPGA, Case Study: 8051 Architecture - Architecture of 8 bit microcontroller - memory organization - addressing modes - instruction set Timers - Interrupts - I/O ports, Interfacing I/O Devices- The build process for embedded systems using microcontrollers, Building Embedded Systems-Structural units in Embedded processor , selection of building blocks for embedded processors- memory devices- DMA - Memory management methods- Timer and Counting devices, Watchdog Timer, Real Time Clock- Software Development tools-IDE, assembler, compiler, linker, simulator, debugger, Incircuit emulator, Target Hardware Debugging, Digital Signal-Processing-Introduction to Digital Signal-Processing , Linear Time-Invariant Systems, Decimation and Interpolation The Sampling Process, Discrete Time Sequences, Frequency domain analysis -Discrete Fourier Transform (DFT) and Fast Fourier Transform (FFT), Digital Filters, FIR Filters, IIR Filters, Basics of DS Processor Embedded Networking And Interrupts Service Mechanism-Embedded Networking: Introduction, Microprocessor based system design -Peripheral Interfaces, I/O Device Ports & Buses-Serial Bus communication protocols -RS232 standard - RS485 - CAN Bus - Inter Integrated Circuits (I2C) Device Driver - Introduction to Basic Concept of Parallel port & Serial port Device Drivers, Interrupt sources ,Programmed-I/O busy-wait approach without interrupt service mechanism-ISR concept-- multiple interrupts - context and periods for context switching, interrupt latency and deadline, Data communication for Embedded Systems-Overview of A/D converter, types and characteristics - Sampling , Errors; Building blocks of Automation systems -Calibration, Resolution, Data acquisition

interface requirements.-Counters - Modes of operation- Frequency, Period, Time interval measurements, Data Modulation &transmission systems- Time Division Multiplexing (TDM) -Pulse Modulation - Pulse Code Format -Single and Multi channel systems, Introduction to Wired & Wireless communication - IEEE 802.xx Standard-OSI Architecture - Services - basics of AdHoc Network

PEE3051   Control System

PEE3052   Electronics and Control

PEE3053   Instrumentation Engineering

PEE3054   Sensor System Technology

Measurements and Transduction: Principle of Transduction - Error and uncertainty analysis - Static and dynamic characteristics of Sensors / Transducers - Resistive, Capacitive, Inductive, Piezoelectric, Magneto-strictive and Hall effect sensors - Smart sensors - Measurement of Flow, Level, Temperature and Pressure - Measurements in Thermal Power plant and Petroleum Refineries. Mathematical Modeling and System Analysis: Lumped and distributed parameter models - Nonlinear system elements - Linearization of nonlinear systems - Transfer functions and state space models - Stability analysis - Controllability and observability - Transfer Function matrix and state space representation of multivariable systems - Poles and Zeros of MIMO System - Multivariable frequency response analysis - Directions in multivariable systems - Singular value decomposition - Relative Gain Array - System identification - Models for linear time invariant Systems - Least square estimation - Recursive least square method - Models for time-varying and nonlinear systems. Process Control: Basics of process control - Continuous and batch processes - Interacting and non-interacting systems - Servo and regulatory operations - Characteristic of ON-OFF, P, P+I, P+D and P+I+D control modes - Reset windup - PID Controller tuning - Cascade control - Feed-forward control - Adaptive Control Schemes - Multi-loop PID Controller:- Biggest Log Modulus Tuning Method - Decoupling Control - Multivariable PID Controller - Model Predictive Control Schemes.

PIC4011   VLSI Design

PIC4012   Applied Electronics Engineering

PIC4013   Electronics and Communication Engineering

Electronic Circuits, Semiconductor Devices, Integrated Circuits, Communication Theory, Digital CMOS VLSI, Analog ICs, Embedded Systems, Advanced Digital Signal Processing, Digital Image Processing, Low Power VLSI

PIC4021   Medical Electronics

PIC4022   Biomedical Engineering

Electronic Circuits, Semiconductor Devices, Integrated Circuits, Communication Theory Biomedical Instrumentation, Biomedical Equipment, Digital Image Processing, Radiological Equipment, Human Assist Devices

PIC4031   Advanced Communication System

PIC4032   Digital Communication and Network Engineering

PIC4033   Optical Communication

PIC4034   Wireless Communication

PIC4035   Communication Systems

PIC4036   Networking Technology

PIC4037   Electronics Engineering

PIC4038   Computer and Communication

Electronic Circuits, Semiconductor Devices, Integrated Circuits, Communication Theory Advanced Digital Communication, Wireless Communication, Antenna and Microwave, Fibre Optic Communication, Communication Networks, DSP

PIC4041   Computer Science and Engineering

PIC4042   Software Engineering

PIC4043   Information Technology

PIC4044   Distributed Computing System

PIC4045   Advanced Computing

PIC4046   Pervasive Computing

PIC4047   Main Frame Technology

PIC4048   System Engineering and Operations Research

Data Structures and Algorithms, Basics of Probability, Operating Systems, Databases, Computer Architecture, Networking, System Software, Theory of Computation, Web Technology, Programming languages, Software Engineering.

PIC4051   Multimedia Technology

Probability and Statistics: Random Variables, Probability distributions, Correlation, Regression and Testing of Hypothesis. Data Structures and Algorithms: Arrays, Lists, Stacks, Queues, trees, Graphs, Searching and Sorting Algorithms. Graphics and Multimedia: Graphics - Input , Output Devices, Scan

conversion - Line Drawing and Circle Drawing algorithms - Clipping, 2 - D and 3-D Transformation - Hidden surface elimination - Text - audio - Image and Video processing - Multimedia Tools. Databases: Relational Databases - Architecture - Query Language - E- R Modeling - Normalization - Query Processing, Transaction Processing - Integrity and Security - Multimedia Data Structures - Queries for Multimedia Databases. Networking: Computer Networks - TCP / IP Model - Physical Layer - Data Link Layer - MAC Protocols - Network Layer - Routing - Addressing - Congestion Control - Transport Layer - Application Layer - Multimedia Communication. Software Development: Programming in C, Object oriented Programming, Software Engineering - Analysis, Design, Coding, Testing and Maintenance, Metrics, Object Oriented Analysis and Design - Operating Systems, Process Management - Scheduling - Deadlocks, Memory Management and File Systems.

PME2011   Mechanical Engineering

PME2012   CAD

PME2013   CAM

PME2014   Product Design and Development

PME2015   Machine Design

PME2016   Engineering Design

PME2017   Mechanical Systems

Design concepts: Design fundamentals, methods and material selection; Design for Quality; Failure mode effect analysis and design for six sigma; Design of experiments; Statistical consideration and reliability; Introduction to computer graphics fundamentals; Curves and surfaces modeling; Concepts of Solid modeling; Visual realism; Assembly of parts and product data Exchange. Basic concepts of material behavior: Elasticity and plastic behavior of metallic and non-metallic materials. Metallurgical aspects of Materials. Effect of temperature, strain and strain rate on plastic behavior - Super plasticity -Ductile, brittle transition in steel - High temperature fracture, creep - Larson Miller parameter - Deformation and fracture mechanism maps. Selection of metals based on mechanical properties- Selection for surface durability corrosion and wear resistance - Relationship between materials selection and processing - Case studies in materials selection with relevance to aero, auto, marine, machinery and nuclear applications. Non-metallic materials: Polymeric materials - Formation of polymer structure - Production techniques of fibers, foams, adhesives and coating - structure, properties and applications of engineering polymers; Elasticity: Stress-Strain relations-Equations of equilibrium-compatibility-boundary conditions-three-dimensional stress of a tension generalized hook's law - St. Venant's principle - plane stress - Airy's stress function; Applications of fatigue and fracture mechanics. Mechanics of composite materials and

laminated composites. Design of components - Shafts, Gears and Gear Boxes, Brakes, Cam & Follower, flywheel etc. Integrated Design of mechanical systems, for example Elevators, Escalators, Gear Box, Valve gear Mechanisms, Machine Tools. Kinematic and dynamic analysis of mechanisms. Fundamentals of vibration - Harmonic and periodic excitations. Finite Element Analysis related to 1D and 2D problems. Problems of static and dynamic analysis using Finite Element Analysis.

PME2021   Energy Engineering

PME2022   Thermal Engineering

PME2023   Refrigeration and Air Conditioning

PME2024   Internal Combustion Engineering

Conductive Heat Transfer: General 3D heat conduction and its special cases, Extended surfaces, Fin efficiency and effectiveness, Moving Boundary problems, Porous media Heat Transfer. Convective Heat Transfer: Newton's Law of cooling, Forced and Natural Convection, Boundary layer, External and Internal flows, High speed flows. Radiation Heat Transfer: Radiation between black and gray bodies, Shape Factor, Network analogy, Radiation shields, Gas Radiation. Heat Exchangers: Recuperative and regenerative heat exchangers, Compact Heat Exchangers, LMTD Method, NTU Method, Effectiveness, Boiling and condensation, Convective and Diffusion Mass Transfer. Concepts of Energy, Entropy and Exergy - Reversibility and Irreversibility - Principle of increase in Entropy - Entropy Generation - Availability analysis of simple cycles. Thermodynamic property relations - Maxwell relations, Clausis Clayperon equation, Joule - Thomson efficient. Real Gas behaviour and Multi-Component Systems - Fugacity - Compressibility - Principle of corresponding States. Real gas mixtures, equilibrium in multiphase systems - Gibbs phase rule for non - reactive components. Chemical Thermodynamics and Equilibrium - Thermo chemistry - Adiabatic flame temperature, Criterion for reaction equilibrium, Evaluation of equilibrium composition. Statistical Thermodynamics - Degeneracy of energy levels, Maxwell - Boltzman, Fermi - Diarc and Bose - Einstein statistics. Mass, Momentum and Energy equations and their applications. Potential flow theory - Circulation and Vorticity, Stream and Potential functions, Magnus effect, Kutta - Zhukovsky theorem, Thin Airfoil theory. Viscous flow theory - Laminar and turbulent flow, Poiseuille's equation,Darcy Weisbach equation, Moody diagram. Boundary layer concept - Flow over flat plates, Displacement - Momentum thickness. Compressible fluid flow - Variable area passage, Fanno and Rayleigh Flow - Normal and oblique shock.

PME2031   Manufacturing Systems Management

PME2032   Lean Manufacturing

PME2033   Project Management

Human Resource Management - Management Accounting & Financial Management - Decision Support Systems. Supply Chain Management - Project Management - Six Sigma and Lean Manufacturing. Computer Integrated Manufacturing Systems - Design and Analysis of Experiments - Maintainability Engineering. Design of Cellular Manufacturing System - Flexible Competitive Manufacturing Systems - Manufacturing Planning and Control. Rapid Prototyping - Design for Manufacturing - Advances in Manufacturing Technology

PME2041   Welding Engineering

Phase diagrams - Iron - Iron carbide diagram-TTT and CCT diagrams- Heat Treatment Techniques-Formation of different microstructural zones in welding of plain carbon steels-heat flow in welding. Welding processes, Weld joints, Weld Symbols, Codes and Standards, Design of Weldments for various loads. Welding of - plain carbon steels-low alloy steels-HSLA steels-Stainless steels and Cast Irons-problems encountered and solutions. Welding of -Aluminium and its alloys-Magnesium and its alloys-Nickel and its alloys-Titanium and its alloys-problems encountered and solutions. Weld defects, Testing of Welds, Failure analysis.

PME2051   Materials Engineering

PME2052   Metallurgy Engineering

Diffusion in solids, , Strengthening Mechanisms, Phase diagrams, TTT diagrams, CCT diagrams, Heat Treatment of Ferrous and Non-ferrous materials, Surface Hardening. Different Casting Processes, melting, casting design, Gating & Riser calculations, Directional Solidification, Casting Defects. Different Welding processes, Welding Metallurgy of Ferrous and non- ferrous materials. Theory of plasticity, Fundamentals of Metal forming Cold working & Hot working, Forging & Rolling, Extrusion & Drawing. Metallurgy of Iron and Steel Making, Powder Metallurgy, Ceramics and Composites. Optical Microscopy, X-ray Spectroscopy, Electron Microscopy, Surface Analysis techniques, Atomic force microscopy, Scanning Probe microscopy, Field ion microscopy. Non-Destructive testing - VE, LPT, MPT, IR & Thermal Methods, EDT, Radiography, UT & AE. Failure Analysis - Corrosion failures, Fatigue failures, Wear failures, Creep failure.

PME2061   Industrial Engineering

Basic Statistics - Probability, LP - TP- Net Works - Queuing - Replacement - Simulation. Work Design:

Methods Study - Work Measurement - Ergonomics. Forecasting - Planning - Controlling - Inventory - Layout - Scheduling. SPC - Sampling - TQM - Six Sigma - DOE - Reliability - Maintenance. Programming : Concepts - Logic Development – Syntax

PME2081   Computer Integrated Manufacturing

PME2082   Advanced Manufacturing Engineering

Theory of metal cutting, tool materials, conventional and unconventional machining processes, super finishing processes, high speed machining, tool condition monitoring, tool based micromachining, mechanical micromachining, MEMS based micro-machining, Additive Manufacturing Techniques (rapid prototyping). Plastic deformation, stress strain curves for different materials, work hardening, strain hardening, fatigue, failure analysis, material selection, creep, wear resistance, heat treatment. MMC, PMC, CMC, reinforcements, matrix, interface, volume fraction, weight fraction, processing techniques of different composites, hybrid composites. Measurements, errors, accuracy, precision, calibration, surface roughness, interferometers, Laser metrology, Co-ordinate Measuring Machine(CMM) , in-process inspection, vision system, image processing, Robot classification, end effectors, robot vision, robot programming languages Sensors, transducers, actuators. PLC and artificial intelligence. CNC machines, Automation in Manufacturing, adaptive control, Group Technology, Computer Aided Design /Computer Aided Manufacturing, Flexible Manufacturing System, Lean manufacturing, RDBMS, Just In Time, Total Quality Management. Finite Element Analysis and Discrete System Simulation. Welding types, HAZ, defects, special casting processes, casting defects, powder metallurgy, metal forming, Electronics manufacturing technology- surface mount technology. Optical microscopy, specimen preparation techniques, TEM, SEM, AFM, Hardness, micro hardness, Impact test. Synthesis of nano materials - Top down and bottom-up approach.

PME2091   Printing and Packaging Technology

Fundamentals of packaging - FMCG packaging, Bulk Packaging, package design - development, creativity in design, graphic and structural design - software for designing, Brand Management, package performance and testing - Hazards, shock, vibration, compression, cushioning and protective packaging. Package printing processes and security printing, converting & finishing processes; Printing inks and coatings - raw materials, ink types, coating types and specialty coatings, Packaging Materials - Flexible & Rigid polymers, Paper & Board - Manufacturing & Appearance and Performance Properties, Types, Conversion Process & Corrugated Board, Glass, raw materials, types, manufacturing, metals, wood,

cloth; Packaging machineries; Testing - mechanical, physical, performance testing, barrier properties, Polymer film - Extrusion - types, properties. Food packaging - aseptic packaging - sterilization - Modified atmosphere packaging - intelligent packaging - active packaging; Healthcare packaging - Packaging line engineering - barcodes - RFID - composite tubes - toxicological investigations; Package designing & shelflife; Closures; Packaging laws & Regulations; Package Cost Estimation; Supply Chain Management & Packaging Environment.

PME2101   Mechatronics

Micro controller, PLC and Embedded systems: Architecture - CISC and RISC - Addressing modes - Programming - Timer/counting - Interrupts - Server com of 8081, PIC forming and interaction of 8081, PIC and PLC - Embedded processor - ARM - SHARC - Design and Development - Real time models, languages and operating systems - Task and scheduling - Real time kernel - Communication and synchronization. Robotics, MEMS and Machine Vision Systems: Definitions - Types - Classification - Configuration and control loops - co-ordinate system - kinematics - End effectors - Design - Robot programming - Expert systems - Robotic work cells and applications. Fundamentals - Design and fabrication micro-system - Materials - Fabrication process and micro-system packaging - Micro Devices and materials - classification of nano-structures - Characterization of Nano-materials - Image Acquisition

- Image processing - Image Analysis - Machine Vision Applications. CNC and Automation Techniques: Mechatronic elements in CNC Machine tools - CNC measurement system and tooling - CNC programming

- Testing and maintenance of CNC machines - Fundamentals and concepts in metrology - Inspection and general measurements - Opto electronics in engineering inspection - co-ordinate metrology and quality control - Fluid Power generating / utilizing elements - Control and Regulation elements - Circuit Design - Electro pneumatics and Electronic control of Hydraulic and pneumatic circuits. Sensors, Actuators and Control Systems: Definition - Measurement Techniques - Inductance, capacitance transducer - Piezo electric and magnetic sensors - Radiations and Electro Chemical sensors and Applications - Recent Trends in sensor and Applications - Actuators - Types -Constructions and working principles - Systems and their Representation - Time and Frequency Response - stability of control systems - State variable Analysis and Design - Control system components.

PME2111   Production Engineering
PME2112   Manufacturing Engineering

Engineering Mechanics, Solid Mechanics, Kinematics of Machines - Design of machine elements - Computer Aided Product Design - Jig fixture and tool designs. Theory of metal cutting - Basic Machining

Processes - Special purpose machines - Unconventional/Advanced Machining processes - NC/CNC Machineries. Casting, Welding and metal forming processes - Powder metallurgy - Engineering Materials and metallurgy - Composite materials - NDT methods, casting and welding metallurgy. Inventory management - Plant location and layout - Materials handling - Method, study - work measurement - Break even analysis - Cost accounting - Quality control 0 Control charts acceptances sampling - TQM, TPM. Fluid power automation - Metrology - GT - Automated process planning - FMS - CIM - Robotics - Mechatronics

PME2121   Aeronautical Engineering

PME2122   Aircraft Maintenance Engineering

Aerodynamics: Introduction to Aerodynamics - Incompressible Flow Theory - Compressible Flow Theory - Airfoils, Wings and Airplane Configuration in High Speed Flows - Viscous Flow and Flow Measurements. Aircraft Structural Mechanics: Bending of Beams - Shear Flow in Open Sections - Shear Flow in Closed Sections - Stability Problems - Analysis of Aircraft Structural Components. Aerospace Propulsion: Elements of Aerospace Propulsion - Propeller Theory - Inlets, Nozzles and Combustion Chambers - Axial Flow Compressors, Fans and Turbines - Rocket and Electric Propulsion. Flight Mechanics: Principles of Flight - Aircraft Performance in Level, Climbing and Gliding Flights - Accelerated Flight - Longitudinal Stability and Control - Lateral, Directional Stability and Control. Finite Element Methods: Introduction - Discrete Elements - Continuum Elements - Isoparametric Elements - Solution Scheme. Computational Fluid Dynamics In Aerospace Engineering: Numerical Solutions of Some Fluid Dynamical Problems - Grid Generation - Transonic Relaxation Techniques - Time Dependent Methods - Panel Methods.

PME2151   Automobile Engineering

PME2152   Automotive Engineering

PME2153   Automotive Materials And Manufacturing

Front axle types, Front wheel geometry. Condition for true rolling motion. Steering geometry. Ackermann and Davis steering. Types of steering gear box. Propeller shaft. Universal joints. Final drive. Differential- types. Type of brakes and constructional details. Types of suspension. Independent suspension- front and rear. Rubber, pneumatic, hydro- elastic suspension. Construction and operation of friction clutches. Different types of gear boxes. Fluid couplings and torque converters. Wilson gear box. Hydrostatic drive systems. Electric drive. Continuously Variable Transmission (CVT). Types of car bodies. Classification of bus bodies. Body optimization techniques for minimum drag. Wind tunnel technology. Classification of vibration, definitions. Single degree of freedom, free, forced and damped vibrations. Rolling resistance,

cornering properties of tyres. Directional stability of vehicle. Choice of suspension spring rate. Calculation of effective spring rate. Vehicle suspension in fore and aft. Vehicle ride model. Load distribution. Types of Batteries - Principle, Construction. Starting System, D.C. Generators and Alternators. Regulations for charging. Electronic ignition systems. Types of sensors and actuators for automobiles. Microprocessor controlled devices in automobiles. Components for electronic engine management system. PID control. Types of solid state ignition systems and their operation. Fuel control maps, open loop control of fuel injection and closed loop lambda control - Integrated engine control system. Onboard diagnosis system. Emission formation in SI and CI Engines. Effects of design and operating variables. Controlling techniques. Constant Volume Sampling Systems. Measurement techniques of HC, CO, NOx and Smoke emissions. Dilution Tunnel and Sound level meters. Properties of alcohols, vegetable oils, biogas, natural gas, LPG and hydrogen as engine fuels. Methods of using all the fuels in SI and CI engines. Performance, emission and combustion behavior of the fuels in S.I. and CI engines.

PME2161   *Solar Energy*

Concepts of Energy, Entropy and Exergy - Thermodynamic property relations -Real Gas behaviour and Multi-Component Systems - Chemical Thermodynamics and Equilibrium-Conservation laws – Mechanical Energy equation -Stream and Potential functions - Boundary layer concept - Viscous flow theory - Compressible fluid flow – Variable area passage-Conductive Heat Transfer - Extended surfaces - Conduction with moving boundaries – Transient conduction – Convective and Radiation Heat transfer - Turbulence theory – Phase change heat transfer -Heat Exchanger - Flat plate - Materials for flat plate collector and their properties - Thermal Analysis - Evacuated tube - Concentrated Collector Design, tracking and control systems - Performance study, site selection - Techno-economic analysis of solar thermal power plants - Solar Cooking - Solar Desalination - Solar Ponds – Solar Drying - Solar thermal power plant- Vapour cycles - Organic cycles - Combined cycles - Binary Cycles -Striling and other cycles – Solar PV power plant - Grid-Connected Systems - Principle of operation: line commutated converters (inversion-mode) - array sizing - DC-AC converters: uncontrolled rectifiers - synchronization and power evacuation - Site selection and land requirements –Solar Hybrid system - Plant Economy - Life Cycle Cost -Payback Period - Economic Analysis for the Selection of Alternative Decisions and the future of the Power Plants - SPV basics - Formation of a pn – junction - Structure of a solar cell - solar cell equation - Fill factor and maximum power -Various electron - hole-pair recombination mechanisms – Types - Crystalline silicon solar cells - Thin film solar cells: CIGS, Tandem solar cells - Dye - sensitized solar cells - Organic solar cells, Concentrating Photovoltaics (CPV) - Electrical properties and Behavior

of Solar Cells – PV Cell Interconnection and Module Fabrication and arrays - Standalone PV system design -Basics of Load Estimation - Components, Batteries, Charge Conditioners - Need for passive architecture - Building form and functions – Sun's motion - Building orientation and design – Heat transfer in buildings - Passive heating concept - Thermal modeling of passive concepts – Thermal storage wall and roof – Sunspace – Prediction of heating loads in a building - Passive cooling concept - Solarium Passive cooling - Ventilation cooling - Nocturnal radiation cooling -Evaporative cooling - Roof surface evaporative cooling (RSEC) - Direct evaporative cooling using drip-type (desert) coolers – Radiation cooling - Earth coupling - Basic principles and systems - Principles of energy conscious design - Building materials - Zero energy building concept and rating systems.

PMS8011   Master of Business Administration with any specialisation

General Management and Business Research : Evolution of Management Thought - Managing globally - Planning - MBO - Decision making - Organizing - Departmentation - Directing - Controlling. Types of Research - Research Process - Research Problem - Research objectives - Research hypotheses - Research Design - Measurement and scaling - Types of data - Data collection - Construction of questionnaire and instrument - Validation of questionnaire - Sampling - Data Preparation - Data Analyses - Statistical techniques - Research report - ethics in research. Marketing Management : Marketing Environment - Marketing Planning Process - Marketing Mix Elements - Segmentation, Targeting, Positioning - Strategic marketing - Customer Relationship Management - Marketing Information System - Marketing Research - Recent Marketing Trends. Organizational Behaviour and Human Resource Management : Organizational behaviour - Behaviour modification - Personality -Misbehaviour management - Emotions - Emotional intelligence - Perception - attitudes - values - Motivation - Communication - Group behaviour - interpersonal relations - Power - politics - Teams - leadership -Organizational development - Gender sensitive workplace - Organizational climate - change - Culture - Stress - Organizational effectiveness. Evolution of Human Resource Management -- sources of HR - Recruitment - Induction - Socialisation - HR Planning - Selection - Training & Executive development - Performance measurement - Career management - worklife balance - Grievance - redressal mechanism -Inclusive growth - Affirmative action. Operations Management: Demand forecasting - Capacity planning - Aggregate Planning - Product Design Vendor rating and Value analysis. Project Management - Scheduling Technique, PERT, CPM; Scheduling shop floor control; Flow shop scheduling - Quality - Vision, mission and policy statements. Customer Focus - customer perception of quality, dimensions of product and service quality. Cost of quality. Concepts of quality circle, Japanese 5S principles. Six sigma - concepts of process capability - Quality functions development (QFD) - Benefit, Voice of customer, information organization, House of

Quality (HOQ), building a HOQ, QFD process, Failure mode effect analysis (FMEA) - FMEA stages, design, process and documentation. Seven Tools, Bench marking and POKA YOKE. Systems Management : Introduction - Information Technology, Information system, evolution, types based on functions and hierarchy, System development methodologies, SAD Tools, DBMS - Functional Information Systems, DSS, EIS, KMS, GIS, International Information, ERP, System Data warehousing and Data Mart. Security, Testing, Error detection, Controls, IS Vulnerability, Disaster Management, Computer Crimes, Securing the Web, Intranets and Wireless Networks, Software Audit, Ethics in IT, User Interface and reporting, Cloud computing. Financial Management: Time value of Money, Risk and return concept - Capital Budgeting - Evaluation Techniques - Capital rationing, Cost of Capital, Measurement of specific cost and overall cost of capital, Capital Structure, Designing capital structure, Financial and operating leverages - Dividend Policy, Forms of dividends, Share splits, Working capital Management, Determinants, working capital finance. Export and Import Finance - FOREX Management - Documentation in Exports and Imports - Corporate Governance - Provision of Company's Act - SERA - FEMA-SEBI guidelines.

PSH7011   Environment Science

Structure and composition of Atmosphere - Sources and classification of air pollutants - Greenhouse effect-Acid rain- Ozone layer depletion - Effects of air pollutants-Ambient air sampling systems, Indoor Air quality - Air quality modeling-Equipments air pollution control - Gravity separators - cyclones - Wet Collectors - Adsorption tower - ESP - Fabric filters. Noise pollution - Sources - control measures.EIA - components, Project Cycle - Types and limitations of EIA - Documentation and Report preparation - Environmental Management Plan. Classification of microorganisms - Microbial physiology - Energy production,Distribution of microorganisms -Microbial growth kinetics - Degradation of toxic pollutants- biofertilizer-bio-control agents - Bioremediation - Toxicity assessment - Biochemical-Genetic and Industrial toxicology Risk assessment. Ecology and Ecosystem - Productivity models - food chain and food web. Environmental Chemistry - Stoichiometry - thermodynamics - Oxidation and reduction - kinetics - Hydrophobic interactions - chemical speciation. Photochemical reactions in the atmosphere - ozone formation and depletion. Soil classification - inorganic and organic components - Green chemistry - Principles and applications. Concept of sustainable development - Sustainable livelihood - quality of life, Demographic dynamics of sustainability - Role of Non-Governmental organization and industry. Socio-Economic systems urbanization and sustainable cities - Green buildings. Pollution of water and land - Principles of water treatment - unit operations and unit processes - Mixing - Flocculation - Sedimentation - Filtration - Disinfection - Residue management - Advances in water treatment - Operation and Maintenance Issues - Wastewater treatment - Characteristics of sewage and industrial

effluents - Types of reactors - Kinetics - aerobic and anaerobic treatment systems - ASP- Trickling filters-Oxidation Ditch - WSP - UASB-AOPs - Self purification process - Oxygen sag curve - sludge management - sludge digestion - biogas generation - sludge disposal. Solid waste management - Sources of solid and hazardous wastes - Waste characterization transport of solid wastes - Waste processing technologies - biological and chemical conversion technologies - composting - Thermal conversion technologies and energy recovery. Treatment of biomedical wastes - landfill and landfill remediation. Climate change and climate variability- IPCC - Global climate model - advantages - Climate model - examples. Environmental management system - concept - policy - training awareness - documentation - management review. Environmental Impact Assessment - Prediction tools - Documentation and report preparation - Environmental management plan. Environmental law - Indian constitution and environmental protection - National policies - Multilateral environmental agreements - Water (Prevention and Control of Pollution) Act 1974, Air (Prevention and Control of Pollution) Act 1981, Environmental (Protection) Act 1986 - Role of Central Government - Responsibilities of Central and State pollution control boards.

PSH7041   *Master of Computer Applications (MCA)*

Probability and Statistics: Random Variables, Probability distributions, Correlation, Regression and Testing of Hypothesis. Data Structures and Algorithms: Arrays, Lists, Stacks, Queues, trees, Graphs, Searching and Sorting Algorithms. Web Technology and Cloud Computing: Socket Programming, Scripting Languages, Client Server Applications, Database Connectivity - Cloud Computing-Virtualization - Big Data Analytics - NOSQL Data - Data Mining. Databases: Relational Databases - Architecture - Query Language - E- R Modeling - Normalization - Query Processing, Transaction Processing - Integrity and Security. Distributed Databases, Object Oriented Databases - Spatio-Temporal Databases. Networking: Computer Networks - TCP / IP Model - Physical Layer - Data Link Layer - MAC Protocols - Network Layer - Routing - Addressing - Congestion Control - Transport Layer - Application Layer. Security, Cryptography, Symmetric Key and Public Key Algorithms. Software Development: Programming in C, Object oriented Programming, Software Engineering - Analysis, Design, Coding, Testing and Maintenance, Metrics, Object Oriented Analysis and Design - Operating Systems Process Management - Scheduling - Deadlocks Memory Management, File Systems. Computer Architecture: CPU - Main Memory - Control Unit - I/O Unit - Parallel Processing.

PTE5101   *Biotechnology/ Industrial Biotechnology*
PTE5102   *Microbial Technology*
PTE5103   *Pharmaceutical Technology*

PTE5104   ***Biopharmaceutical Technology***

PTE5105   ***Bioinformatics***

PSH7061   ***Biotechnology***

PSH7062   ***Bio Engineering***

PSH7063   ***Molecular Biology***

PSH7064   ***Human Genetic***

PSH7065   ***Genomics***

PSH7066   ***Biomedical Science***

PSH7067   ***Biomedical Instrumentation Science***

PSH7068   ***Biochemistry***

PSH7069   ***Molecular Virology***

PSH70610   ***Bioinformatics***

PSH70611   ***Pharmaceutical Technology***

Molecular principles of life, Chemistry of Biomolecules, Aqueous chemistry. Properties and features of enzymes. Thermodynamic concepts in biology: Metabolism and free energy. Carbohydrate, Protein, Lipid and Nucleic acid metabolism. Photosynthesis and Oxidative phosphorylation. DNA repair, replication, transcription and translation and its regulation. Anatomy of a cell, Cell components-organelles, Membrane, Membrane transport and protein sorting, signal transduction, Structure and function of cytoskeleton, Tissue and their cellular interactions, Cell cycle and cancer. Overview of immunity. Cells, tissues and organs of the immune system. Antigens, epitopes and antibody reactivity. Structure of antibodies, Classification and functions. Complement system. Hybridomas and its applications. Arrangement of lg genes and their expression and diversity, B- and T- cells development and cytokines. Major histocompatibility complex and their importance. Immune response to infections. Hypersensitivity and its types.

Prokaryotic and eukaryotic cell structure ; Microbial nutrition, growth and control; Microbial metabolism (aerobic and anaerobic respiration , photosynthesis); Nitrogen fixation ; Chemical basis of mutations and mutagens; Microbial genetics (plasmids, transformation, transduction, conjugation); Microbial diversity and characteristic features; Viruses. Molecular analysis of UV/visible , florescence, circular dichroism, NMR and ESR spectroscopy , Electron microscopy - transmission and scanning electron microscopy - scanning tunnelling and atomic force microscopy, Molecular structure determination using X-ray diffraction and NMR; mass spectrometry, Analytical Ultracentrifugation : Sedimentation velocity and equilibrium, determination of molecular weights, Theory and principles of Chromatography. Media Design and requirements for fermentation processes, medium optimization methods, Stoichiometry of cell growth and product formation, Kinetics of microbial growth, substrate

utilization and product formation, Simple structured models, Sterilization of air and media, Thermal death kinetics of microorganisms, batch and continuous heat sterilization of liquid media ,filter sterilization of liquid media, air sterilization and design of sterilization equipment, Batch , fed - batch and continuous processes, Bioreactor Scale - up, Various types of microbial and enzyme reactors, STR , packed bed reactor, airlift reactor, fluidized bed reactor and bubble column reactors, Online monitoring of bioprocess parameters such pH, redox potential , DO, DCO2, temperature , cell density and vent gas analysis. Biological sequences analysis, Algorithms for local and global alignment of sequences, Multiple sequences alignment and applications, Phylogenetics ; Character and Distance based methods, Protein secondary structure and tertiary structure prediction, Biological databases and tools, Microarray analysis, Basics of Systems Biology, Basics of PERL programming language and Linux Operation System.

PSH7081   Electronic Media

PSH7082   Visual Communication

PSH7083   Communication

PSH7084   Mass Communication

PSH7085   Journalism

PSH7086   Media Arts

Current Affairs: General awareness - Aptitude and mental make-up - Reasoning ability - Divergent thinking - Politics and the nation - Finance and economy - Culture - Famous people - General topics - Major inventions - Poems - Sports - Tourism - Universe - Books and authors - Awards and honours. Media Studies: Nature and process of human communication - Functions of communication - Landmarks in mass communication - Communication theories - Press in India - Films - Television - Advertising - Brand awareness and recall - Public relations - Awareness of Public debates on Matters (polity and economy) - General knowledge - Influencing power equations in the world and their impact on India - International developments - Social history - Understanding of social dynamics. Basic Sciences: Life sciences: Understanding different species - Physical sciences: Understanding of basics of sound, light and motion, etc - Applied sciences: Development in space technologies, etc - Environmental science: understanding of ecology and ecological issues - Health sciences - Scientific discoveries and inventors. Information Technology: Developments in computers - Convergence in technology - Fundamentals of computer hardware and software - Problem-solving and program design - Applications of Information and Communication Technologies (ICTs) - New media - Social Media - Computer graphics and animation. Research Methodology: Research Problem - Objectives - Variables - Sampling - Population - Qualitative Research Methods: Field Observation - Focus Groups - Interviews - Case Studies -

Quantitative Methods: Content analysis - Survey Research - Questionnaire - Statistics.

PSH7091   Mathematics
PSH7092   Applied Mathematics

Linear Algebra - Real Analysis - Complex Analysis - Topology - Functional Analysis - Algebra - Mechanics - Ordinary and Partial Differential Equations - Graph theory - Numerical Analysis - Calculus of Variation and Integral Equations - Probability and Statistics

PSH7101   Computer Science
PSH7102   Information Technology

Discrete Structures - Computability - Graph - Groups - Computer Arithmetic - Logic Families - Representation of Integers - Programming in C and C++ - Programming in C - Object Oriented Programming Concepts - Relational Database Design and SQL - Data and File Structures - Analysis and Design of Algorithms - Computer Networks - Data Communication - Internetworking - Routing - Network Security - System Software and Compilers - Operating Systems - UNIX - Software Engineering - Current Trends and Technologies - Parallel Computing - Mobile Computing - E-Technologies - Electronic Commerce - Electronic Payment Systems (EPS) - Electronic Data Interchange (EDI) - Digital Libraries and Data Warehousing - Software Agents - Broadband Telecommunications - Main concepts in Geographical Information System (GIS), E-Cash, E-Business, ERP packages - Data Warehousing - Data Mining

PSH7111   Physics
PSH7112   Astrophysics

Vectors and tensors - Second order differential equations and special functions - Partial differential equations - Complex variables - Fourier series, Fourier transform, Laplace transform and Green functions Group theory - Numerical differentiation and integration - Interpolation - Fixed point analysis of linear and nonlinear differential equations. Numerical solutions of ordinary and partial differential equations. Mechanics of a particle and system of particles - Conservation of laws - Rutherford's scattering formula - Special theory of relativity - Dynamical systems. The Schrodinger equation - Particle in a infinite and finite square well - Harmonic oscillator - Barrier penetration - Hydrogen atom - Perturbation theory and scattering theory. Laws of Thermodynamics - Thermodynamic functions - Maxwell's laws - Phase transitions - Canonical ensembles - Specific heat of ideal gas - Bose - Einstein and Fermi-Dirac statistics

- Specific heat of solids. Atomic spectra - Quantum numbers - Fine, Hyperfine structure - LS coupling -

Bonding in molecules - Molecular spectra - X-ray spectra - Spontaneous and Stimulated Transitions - Lasers. Nuclear binding energy - Nuclear models - Radioactivity - Decay processes - Nuclear reactions - NMR and MRI - Radiation damage - Radiation detectors - Uses of ionizing radiation - Classification of particles - Particle accelerators - Interaction of radiation with matter. Electrostatics - Gauss's Law - Electric potential - Capacitance and dielectric s- Hall effect - Biot-Savart Law - Ampere's law - Faraday's law - Lenz's law - Eddy currents -Maxwell's equation - Poyntings theorem - Wave equation - Polarization - Diffraction - Interferometry - Optical activity. PN junction diode - MOSFET - LED and LCD -semiconductor laser - Op-amp mathematical operation circuits - analog simulation - oscillators - multivibrators -Digital logic circuits - CMOS logic gates - Combinational and Sequential logic circuits - Memory - Clock circuits - Modulation and demodulation - Transducers and electronic instruments. Crystal structures - crystallography - Chemical bonding - crystal imperfections - Electron theory of solids - Band theory of solids - Dielectric properties and materials - Clausius - Mosotti equation - Dielectric loss and breakdown - Magnetic materials - Weiss theory - Ferrimagnetism - Superconductivity - Photoconductivity-Ceramic and biomaterials - Nonlinear materials - Shape memory alloys.

PSH7121   Materials Science

Atomic Structure and Interatomic Bonding- Structure of Crystalline Solids- Crystal structures - Crystallographic points, directions, and planes - crystal symmetry - point groups and space groups - single crystal and powder X-ray diffraction - theory and experimental techniques - crystal growth - theory and technique - nucleation theory - melt growth - solution growth - vapour growth - Imperfections in Solids - point and line defects. Mechanical Properties of Materials- elastic deformation- dislocations and plastic deformation- Strengthening Mechanisms - Recovery , recrystallization, and grain growth - Failure - ductile fracture - brittle fracture - mechanisms - tensile test - fatigue fracture - creep fracture - mechanisms - hardness - harness testing techniques - Dielectric properties -magnetic properties - optical properties. Characterization of materials - thermal analysis - TGA - DTA , DSC - Microscopic techniques- optical microscopy - electron microscopy - SEM and TEM - Spectroscopy principles and instrumentation. Phase Diagrams -Gibbs phase rule - binary systems - lever rule and its applications - invariant reactions - The Iron-Iron Carbide Phase Diagram - Development of Microstructures - The Influence of Other Alloying Elements - Isothermal Transformation Diagrams - Continuous Cooling Transformation Diagrams - Ferrous Alloys - Nonferrous Alloys - Fabrication of Metals - Heat Treatment of Steels. Structures and Properties of Ceramics- Ceramic structures - ceramic phase diagrams - fabrication and processing of ceramics - Glasses - Glass - Ceramics - Refractories - Advanced Ceramics. Polymers - classification - molecular weight - synthesis - glass transition temperature - viscoelasticity - polymer processing - applications. Composites - types - matrix and reinforcement materials - fabrication of polymer-, metal- , and ceramic-matrix composites. Semiconducting materials: Intrinsic and extrinsic

materials, energy band gap - density of states and dimension of materials - formation of PN junctions - recombination - superconducting materials. Nanoparticles - basic properties - nanotubes, nanowies and nanofibers - synthesis of nanostructure material - nanomaterial characterization.

PSH7151   Chemistry

PSH7152   Applied Chemistry Organic Chemistry

PSH7153   Industrial Chemistry

PSH7154   Polymer Chemistry

Stereochemistry - Addition, Substitution and elimination reactions - rearrangements - aromaticity - photochemistry - name reactions - organic qualitative analyses. Atomic structure - hybridization - non-valence forces - Chemistry of d and f block elements - crystal structure - chemistry of co-ordination, organomettalic and bio-inorganic compounds. Thermodynamics - free energy - kinetics - molecular symmetry and group theory - quantum chemistry - electrochemistry - phase equilibria - molecular spectroscopy. Wet chemical methods of analysis -spectral methods - electro analytical techniques - separation techniques - thermal methods of analysis - organic and inorganic quantitative analysis. Polymers - catalysis - corrosion and its control- coatings - fuel/solar cells - membranes - pollution and its control - fibres - Nano chemistry and technology - Polymer Chemistry applications.

PSH7171   Geology

PSH7172   Applied Geology

Geomorphology and Remote Sensing. Basic principles. Weathering and soils. Influence of climate on processes. Geomorphology of fluvial tracts, arid zones, coastal regions, 'Karst' landscape and glaciated ranges. Geomorphology of India. Concepts and principles of aerial photography and photogrammetry, satellite remote sensing - data products and their interpretation. Digital image processing. Global and Indian space missions. Geographic Information System (GIS) - principles and applications. Structural Geology and Geotectonics: Principles of geological mapping and map reading, projection diagrams. Stress-strain relationship of materials. Folds, cleavages, lineations, joints and faults and unconformities. Structural behaviour of igneous rocks, diapers and salt domes. Introduction to petrofabrics. Sea floor spreading and plate tectonics. Geodynamics of Indian plates. Stratigraphy and Palaeontology: Nomenclature and modern stratigraphic code. Geological time scale. Stratigraphic procedures of correlation of unfossiliferous rocks. Precambrian stratigraphy of India. Stratigraphy of Palaeozoic, Mesozoic and Ceinozoic formations of India. Fossil record and geological time scale. Morphology and time ranges of fossil groups. Different microfossil groups and their distribution. Mineralogy and

Petrology: Physical, chemical, crystallographic and optical characteristics of common rock forming silicate mineral groups. Structural classification of silicates. The U-stage. Forms, textures and structures of igneous rocks. Binary and ternary phase diagrams. Petrology and geotectonic evolution of granites, basalts, andesites, etc. Origin of magmas. Textures and structures of metamorphic rocks. Metamorphic grades and facies. Metamorphic zones. Sedimentology: Provenance and diagenesis of sediments. Sedimentary textures. Sedimentary structures, palaeocurrent analysis. Sedimentary environment and facies. Tectonics and sedimentation. Classification and definition of sedimentary basins. Sedimentary basins of India. Seismic and sequence stratigraphy. Basin analysis. Geochemistry: Earth in relation to the solar system and universe, cosmic abundance of elements. Composition of planets and meteorites. Structure and composition of earth and distribute of elements. Trace elements. Introduction to isotope geochemistry. Geochemistry of hydrosphere, biosphere and atmosphere. Geochemical cycles and principles of geochemical prospecting. Environmental Geology. Concepts and principles. Natural hazards - preventive/precautionary measures - floods, landslides, earthquakes, river and coastal erosion. Impact assessment of anthropogenic activities. Economic Geology: Indian mineral deposits and mineral economics. Different theories of Ore genesis, Mineral exploration, fundamentals of coal petrology. Indian coal deposits. Origin, migration and entrapment of natural hydrocarbons. Character of source and reservoir rocks. Structural, stratigraphic and mixed traps. Techniques of exploration. Geographical and geological distribution of onshore and offshore petroliferous basins of India. Engineering Geology: Mechanical properties of rocks and soils. Geological investigations for Dams and reservoirs, tunnels, Bridges. Shoreline engineering. Hydrgeology: Origin, Occurrence and Distribution of Water, Well Hydraulics and Well Designing, Groundwater Chemistry, Groundwater Exploration, Groundwater Problems and Management.

PSH7181   English
PSH7182   Linguistics

Chaucer and The Elizabethan Age: Poetry: Chaucer, Spenser (Allegory), Donne (Metaphysical poetry), Wyatt, Surrey, Sydney. Drama: The Elizabethan world view, Elizabethan theatre, Kyd, Webster, Marlowe, The University. Wits (Lyly, Nash, Peele, Greene, Lodge), Ben Jonson (Comedy of Humours), Middleton, Fletcher, Prose: Bacon, Sir Thomas More; Shakespeare - The Comedies: Much Ado about Nothing, Midsummer Night's Dream, As You Like It, The Merchant of Venice, The Great Tragedies: Macbeth, Hamlet, Othello, King Lear, The Chronicle Histories: Julius Caesar, Henry IV, The Later Comedies: The Winter's Tale, The Tempest, The Sonnets, The Neo Classical Age; Poetry: Milton, Dryden, Pope, Marvell, Goldsmith, Drama: Restoration drama, Goldsmith, Congreve, Sheridan, Novel: Bunyan (Allegorical

novel), Richardson, Fielding, Defoe, Swift, Sterne, Smollett, Prose: Addison, Steele, Milton, Swift; Romantic and Victorian Age, Poetry: Wordsworth, Coleridge, Byron, Shelley, Keats, Blake, Arnold, Tennyson, Browning (Dramatic Monologue), Rosetti (Pre-Raphaelite poetry), Burns, Collins, Drama: Shelley, Oscar Wilde, Novel: Austen, Scott, Brontes, George Eliot, Dickens, Hardy, Prose: De Quincey, Lamb, Hazlitt, Ruskin, Carlyle; Twentieth Century Literature, Poetry: Hopkins, Eliot (Modernism), Yeats, Dylan Thomas, Owen (War poetry), Seamus Heaney, Ted Hughes, Thom Gunn, Drama: Shaw, Eliot, Beckett, Synge, Osborne, Ibsen, Brecht, Novel: Joyce (Modernism), Woolf (Stream of consciousness), Conrad, Greene, Lawrence, Prose: Orwell, C.P. Snow; American Literature - Poetry: Whitman, Frost, Emily Dickinson, Sylvia Plath, Stevens, Cummings, Brooks, Drama: O'Neill, Tennessee Williams, Arthur Miller, Sam Shepard, Novel: Poe, Twain, Hawthorne, Melville, Faulkner, Hemingway, Henry James, Alice Walker, Prose: Emerson, Thoreau; Post Colonial Literatures in English, Canadian Literature: Atwood, F.R. Scott, Australian Literature: Patrick White, A.D.Hope, Judith Wright, African Literature: Ngugi, Soyinka, Achebe, Gordimer, West Indian Literature: Derek Walcott, V.S. Naipaul; Indian Literature in English, Poetry: Sarojini Naidu, Toru Dutt, Derozio, Tagore, Ezekiel, Ramanujan, Kamala Das, Parthasarathy, Pritish Nandy, Kolatkar, Eunice d'Souza, Gauri Deshpande, Mahapatra, Drama: Tagore, Karnad, Tendulkar, Badal Sircar, Dattani, Manjula Padmanabhan, Novel: R.K.Narayan, Raja Rao, Mulk Raj Anand, Anita Desai, Shashi Deshpande, Bhabani, Bhattacharya, Anil Joshi, Manohar Malgonkar, Khushwant Singh, Amitav Ghosh, Shashi, Tharoor, Vikram Seth, Arundhati Roy, Prose: Vivekananda, Tagore, Gandhi, Nehru, Aurobindo, Radhakrishnan, Meenakshi Mukherjee, Coomaraswamy; English Language, Linguistics and ELT, History of English Language, Features of Natural Language, Levels of Linguistic Analysis: Phonetics, Phonology, Morphology, Syntax, Semantics, Discourse Analysis, Pragmatics, Phrase Structure Grammar, Transformational Generative Grammar, Deep and Surface Structure, Sociolinguistics: Language Varieties, Language and Society, Language and Culture, ELT: Methods and Approaches, Grammar Translation Method, Audiolingual Method, Community, Language Teaching, Silent Way, Suggestopedia, Total Physical Response, Communicative Language Teaching, Behaviourism, Cognitivism, Humanism, Learning theories, Second language Acquisition theories, Language Testing; Literary Criticism and Literary Theory - Classical Criticism: Plato, Aristotle, Longinus, Horace, Criticism before 20th century: Sydney, Dequincey, Dryden, Keats, Arnold, Modern Criticism: Structuralism, Deconstruction, Cultural Criticism, Post-Marxism, Cultural Materialism and New Historicism, Post-colonialism, Hermeneutics and Reader-Oriented Criticism, Feminist Criticism, Ecocriticism, Indian Poetics: Rasa and Dhvani, Tamil poetics, Tholkappiyam

PTE5011   Chemical Engineering

PTE5012   Petroleum Refining and Petrochemicals Engineering

Process Calculations and Thermodynamics - Fluid Mechanics and Mechanical Operations - Heat Transfer - Mass Transfer - Chemical Reaction Engineering - Instrumentation and Process Control - Plant Design and Economics - Chemical Technology - Process Modeling

PTE5031   Environmental Science and Technology

Process Calculations and Thermodynamics - Fluid Mechanics and Mechanical Operations - Heat Transfer - Mass Transfer - Chemical Reaction Engineering - Instrumentation and Process Control - Plant Design and Economics - Chemical Technology. Environmental Science - Unit operations and processes in Environmental Technology - Biological Wastewater Treatment - Separation Processes in Environmental Applications - Air Pollution Control - Solid and Hazardous Waste Management - Modeling of Environmental Systems

PTE5041   Industrial Safety Engineering

PTE5042   Fire Engineering and Safety Management

Probability and Reliability - random variable, special distributions, sampling, curve fitting, time series analysis, reliability, computer programming and software, safety in chemical industry - concept of safety and safety auditing, hazardous chemicals - precautions in handling, tolerance limits of industrial emissions, carcinogens-health hazards of insecticides, drinking water standards - computer aided hazards analysis, hazard, risk issues and hazard assessment, instrumentation, testing, risk analysis - environmental pollution control and industrial hygiene, EIA, impact assessment and documentation - industrial safety and hazards management - fire and explosion, relief systems, toxicology, leaks and leakages - process simulators - safety in engineering industry - metals and wood working machines, guarding, welding and gas cutting, cold forming and hot working, finishing, inspection and testing - regulations for health, safety and environment - safety management - construction - safety in material handling - noise and vibration controls - electrical safety - air pollution control - fire and explosive control and transport phenomena.

PTE5051   Textile Technology

PTE5052   Textile Chemistry

Fibre Manufacturing - Advances in Man Made Fibres - Fibre Structure Analysis - Frictional Properties - Heat Setting - Mass Variation of Textile Strands - Variance Length Curves and Spectgrogram of Textile Strands - Tensile Properties of Yarn - Mechanism of Fabric Failure - Comfort and Low Stress

Mechanical Properties - Fabric Appearance and Other Properties - Dyeing and Finishing - Probability Distribution and Estimations - Analysis of Variance - Process Control and Capability Analysis - Design and Analysis of Experiments

PTE5061   Apparel Technology

PTE5062   Fashion Technology

Measures of Central tendency, Measures of variation and Skewness, Curve fitting, Rank Correlation Sampling and sampling Distribution - AQL Methods, 't' distribution, F distribution, Chi-square distribution Process Control Charts. Production Preplanning Production Systems - Section production systems, UNIT production system, Production scheduling, Network representations. Spreading Machine - Working principle, Features and Technical Specifications of Spreading machines Automatic Cutting Machine Sewing Machine - Special Machines - Button holing, Button fixing, Flat lock, Chain lock, Over lock, Embroidery Sewing machine- Working principle, Special features and attachments Pressing machine Computer Integrated Manufacturing - 3D scanning Technique, Unit Production System. Pattern Engineering - Pattern making, Types of pattern making, Drafting, Standardization of size charts, Pattern details and seam allowances Draping - Dress forms, techniques of draping - Development of basic blocks by the draping method -front, back, sleeves and trouser Flat Pattern Techniques - Dart Manipulation - basic techniques, Applications of dart manipulation Pattern Alteration, /Grading and Layout Planning - Pattern alteration - definition and techniques, Grading -Definition, Principles and types - manual grading and computerized grading. Introduction to Comfort, Thermal Comfort, Body ad Tactile Sensations, Comfort Perception and Preferences, Evaluation of Moisture Comfort and Thermal Comfort, Low stress Mechanical Characteristics

PTE5071   Ceramic Technology

Materials Science - Structure of solids - imperfections - point, line, surface, volume - phase diagrams - Gibbs Phase Rule, single component system , two component system - Diffusion - Fick's Law and its applications - Properties - Physical, mechanical, electrical, thermal and optical. Traditional Ceramics - Plastic and non plastic raw materials - clay and its types - properties of clay water mixture - size reduction - forming -pressing, extrusion, slip casting - firing. Processing - Powder preparation - powder characterization - modern ceramic processing - sintering Glass- Raw Material - manufacturing - melting - forming - annealing - properties - special glasses. Refractories - Types - acidic, basic, neutral - classification - properties - applications - refractories for special application. Electronic Ceramics- Insulators - dielectric polarization, dielectric strength, dielectric loss, types, properties - capacitors -

barium titanate and its types , film capacitors, multilayer capacitors - Piezoelectric - PZT, PLZT, properties - Magnetic - classification, types and properties - fuel cells - sensors. Advanced Ceramic Materials-Properties and Applications - silica, alumina, zirconia, carbides, nitrides Composites- Types - CMC, PMC, MMC, Reinforcements - fibers, whiskers, particles - properties – applications

PTE5081   Leather Technology

Advanced Leather Process Technology and Chemistry - Hides, Skins and Preservation, Structure of Skin and Collagen, Chemistry and Principles involved in Pretanning, Tanning, Post Tanning and Finishing Processes. Specialty Leathers, Cleaner Processing of Leathers, Newer Concepts in Leather Manufacture, Advanced Chemistry and Technology of Leather Chemicals, Science and Technology of Leather Supplements and Synthetics, Colloid and Surface Chemistry of Leather like Surface Tension, Interfacial Tension and Surface Activity, Chemistry and Physics of Collagen, Nano Technology and its Applications in Leather, Engineering Economics in Leather Production, Industrial Safety and Occupational Health in Leather Industries, Energy Management in Leather Industries. Advanced organic and Inorganic Chemistry - Bonding Models, Reaction Mechanisms of Organic Compounds, Different organic reaction types, Chemistry of Transition Metals, Reaction mechanisms of Metal Complexes, Advanced Co-Ordination Chemistry, Concepts in Chemical bonding. Advanced Leather Biotechnology - Microbial Biotechnology, Protein and enzyme chemistry, Molecular Biology, Biochemical Engineering, By-Product Utilisation. Instrumental Methods in Leather Science - Analysis of various Spectroscopic Techniques, Chromatographic Techniques, Applications of Spectroscopic and Chromatographic methods in Leather Science, Electro-analytical Methods, Principles of Microscopic and other Testing Methods in Leather Science. Treatment and disposal of Tannery Waste - Physico-Chemical treatment of Wastewater, Introduction to Biological Treatment of wastewater, Biological Treatment of wastewater, Advanced Wastewater Treatment for the Removal of refractory Organic Compounds, Solid waste Disposal. Environmental Management Systems, Legislations on Environmental Pollution Control and Management, Clean Development Mechanism (CDM), Occupational Health Hazards and Industries, Environmental Impact Assessment (EIA), Environmental Audit (AE).

PTE5111   Food Technology
PTE5112   Food Processing
PTE5113   Food And Nutritional Biotechnology
PTE5114   Agricultural Processing and Food Engineering

PSH7191   Food Chemistry and Food Processing

Food Chemistry - Composition of foods Nutrient and non-nutrient components of foods, water activity, lipid, carbohydrates, proteins, bioactive components, functional foods, analytical methods in food analyses; food additives, their functions and applications - Food microbiology - microbial spoilage of foods, food pathogens, food poisoning, food borne infections, microbes in food fermentation. Bioreactor and upstream processing, fermentation processes - batch, continuous, fedbatch, enzymes in food technology, microbial productions of aminoacids, proteins, lipids, flavor components, colouring agents. Types of processing - aseptic processing, drying and ultrafiltration, canning, radiation processing, CAP, MAP, Hurdle technology, newer methods- ohmic heating PEF, High pressure processing, food packaging technology. Cereal, Pulse and oilseed technology, meat, fish and poultry technology, dairy product technology, fruit and vegetable technology, flavours, spices, coffee, tea, cocoa. Heat Transfer, mass transfer, fluid mechanics, mass and energy balance, mechanical operations Engineering materials, pumps, principles of refrigeration, Equipment used for milling, extrusion, mixing, blending, filling, heat processing and cooling. Sensory evaluation of foods, consumer testing, food product development, Assessment of food safety, GHP, GMP, HACCP, sanitation and hygiene in food industry, food safety management systems, ISO. GM foods, use of biotechnology in enhancing food production and safety assessment. Food Laws and regulations - National and international, Codex, JECFA, USFDA, EFSA, FFSAi, BIS. Food economics and Trade, public distribution, food security.

PTE5121   Nano Science and Nano Technology

Physics and Chemistry of Materials - Synthesis of Nanomaterials - Physicochemical Methods For Characterization of Nanomaterials - Imaging Techniques For Nanotechnology - Nanotechnology In Health Care - Lithography and Nanofabrication - Top Down Manufacturing Methods - Nanoelectronics and Sensors - MEMS and Bio MEMS - Advanced Drug Delivery Systems - Biosensors - Nanocomposites

PTE5131   Plastic Technology

PTE5132   Rubber and Plastics Technology

PTE5133   Polymer Technology

Polymers-Classification of polymers - Functionality - Polymerization mechanism - Industrial polymerization techniques - Molecular weight of polymers and their significance - States of aggregation in polymers - Tg - Factors affecting Tg - Crystal nucleation and growth - Spherulite formation - Factors affecting crystallinity. Preparation, Structure - Property relationship and applications of General Purpose Rubbers, Special Purpose Rubbers, Polyurethanes and Thermoplastic Elastomers. Preparation,

Structure Property relationship and applications of Commodity Plastics, Engineering Plastics and Specialty polymers. Test for Processability - Viscosity - Flow characteristics - Vulcanization Tests for rubber. MFI - Gelation and Gel time, Test for Mechanical, Electrical and Optical Properties, Test for durability; Thermal analysis, Molecular weight studies, Spectroscopic and Morphological studies. Flow behavior of Polymers Compounding and Mixing process, Forming Operations - Extrusion, Injection molding, Blow molding, Compression and Transfer molding, Rotational molding, Thermoforming, Calendaring, Reaction Injection Molding; Latex processing and applications; Composite materials and Fabrication; Polymer recycling. Simple geometries - Spring rates - Creep - Stress relaxation - Design to Specific Spring rates, Rubber under complex loading, Rubber products under dynamic conditions, Property considerations in designing of Plastics Parts, Design of moulds and dies for Rubber and Plastics products.