Syllabus for Ph.D. Programme

PCE1001 Transportation Engineering

UNIT - I *Traffic Engineering and Management*

***Traffic Characteristics**: Urban Road user characteristics- Vehicle and Traffic Stream Characteristics.*

***Traffic Studies**: Volume, speed, travel time and delay, O-D, Accident and parking studies –LOS concept, factors affecting capacity and LOS, capacity of different types of facilities.*

***Traffic Control and Management**: Signs, markings, islands and signals; At-grade and grade separated Intersections; Rotaries; Basic principles of intersection signalization; Signal Design.Traffic Regulation,– Traffic Systems Management and Travel Demand Management - Congestion Management, Traffic Calming and Pricing-Design of Cycle Tracks, Pedestrian Facilities and parking design.*

***Intersection Design and Analysis:**Design of Intersection – At grade intersection – Uncontrolled, Channelisation, Rotary, Traffic Signal Control, Signal Co-ordination, Grade Separated Intersection - Types Design and Analysis.*

***Traffic Flow Fundamentals and Characteristics:** Flow Parameters - Approaches to Traffic Flow - Spacing, Gap and Headway Characteristics –Macroscopic and Microscopic Traffic Flow Models-Vehicular Stream Models- Queuing Theory-Delay at Intersections-Concepts and application of Intelligent Transportation Systems (ITS) -Traffic Enforcement.*

UNIT - II *Urban and Transportation Planning*

***Urban Planning:**Classification of urban settlements, Urban infrastructure developmentZoning Regulation, Layout and Building Regulations.Economic and social concepts in urban and regional planning-Financing of Urban Developments projects and planning.Town and Country planning act.*

***Urban Transportation Planning Process:**systems approach to planning process, problem definition, solution generation, solution analysis, evaluation and choice. Environmental and social Impat Assesment of Transport Projects.*

***Transportation Systems Planning:**Stages in Transportation Planning-TravelForecasting Process-Modal split models – Mode choice behavior-Traffic assignment and methods-Land Use*

Transport Model.Urban Transport System-Bus Transit Planning And Scheduling-Rail Transit Terminals And Performance Evaluation-Policies and Strategies for Mass Transport.

Transport Economics: *Principles of Economic Analysis-Factors affecting vehicle operating cost-Transport demand and supply concepts-Public and Private Transport Financing and Pricing.*

Transportation Surveys*: Transportation surveys – definition of study area, zoning, home-interview survey, cordon-line and screen line surveys, traffic surveys, inventory of transport facilities, inventory of land-use and economic activities.*

UNIT - III *Highway Design*

Highway alignment*: Horizontal: Theoretical, general and design considerations; Super elevation; Simple, compound, reverse and transition curves; Guidelines for design; Vertical: Terrain; Grades; Climbing lanes; General considerations in vertical curves; Crest and sag vertical curves; Coordination of horizontal and vertical curves; Guidelines for design of hill roads.*

Design controls and criteria*: Vehicle, driver and traffic characteristics and their influence on geometric design of highways; Access control -At grade intersectiononflict points,channelization.*

Cross section elements*: Considerations with regard to cross section elements such as, carriageway width, right-of-way, camber, shoulders, kerbs, footpaths, drainage elements, traffic barriers and medians; Frontage roads- Pedestrian crossings- Bicycle facilities-Bus bays.*

Sight distances*: Stopping, decision, overtaking and intermediate sight distances- Sight distances on horizontal curves and at intersections- Applications of sight distances for various situations*

UNIT - IV *Pavement Materials, Design and Evaluation*

Pavement Materials and Construction*: subgrade soils - aggregates- Bituminous binders and modified binders- Bituminous paving mixtures – Mix Design, Material testing and evaluation-Construction of gravel and stabilized bases-Cement concrete for highway construction- Types of pavements-Stresses in bituminous pavements and concrete pavements- Various design methods for Flexible and rigid pavements.*

Pavement Evaluation and Maintenance: *Failures in pavements- evaluation and equipments-structural stability assessment of pavements- repair and maintenance-ovelays-Pavement serviceability rating and index.*

PCE1002 Computer methods and applications in Structural Engineering / Structural Engineering

UNIT - I *Reinforced Cement Concrete Structures and Prestressed Concrete Structures*

Concrete structures –Design of reinforced concrete elements, flat slabs and yield line theory based design, design of water tanks, retaining walls, inelastic behavior of concrete structures, ductile detailing. Design of long and short span bridges, analysis and design of tall buildings, stability of tall buildings, wind effects on structures. Prestressed concrete -Design of flexural members-continuous and cantilever beams, design of tension and compression members, composite members ,losses of prestress, design of prestressed bridges, chimneys, poles, sleepers.

UNIT - II *Advanced Steel Structures*

Design of members subjected to combined forces - Design of connections - Riveted, Bolted and Welded - Analysis and design of industrial buildings - Sway and Non-sway frames - Plastic analysis of structures - Design of light gauge steel structures.

UNIT - III *Dynamics and Earthquake Engineering*

Dynamics and Earthquake Engineering - Free and Forced Vibration of Single, Two and Multi Degree of Freedom Systems; Normal modes of vibration of Two Degree of Freedom Systems; Orthogonality of modes; Mode superposition techniques; Dynamic response of Single, Two and Multi degree freedom systems, Mode superposition techniques, Dynamic response of continuous systems, Free and forced vibration of continuous systems, Rayleigh-Ritz method, Formulation using conservation of energy , virtual work, Direct integration methods for dynamic response; Nonlinear MDOF systems, Numerical Integration Algorithms, Substructure technique. Earthquake Ground motion, Engineering Seismology, Characteristics of earthquakes, Estimation of earthquake parameters - Effects of earthquake on structures, Response spectra, Evaluation of earthquake forces, Earthquake resistant design of masonry and RC structures, Capacity based design and detailing, Structural systems, Shear walls, Rigid Frames, Principles and guidelines

for earthquake resistant design, Design guidelines for earthquake resistant masonry buildings, Vibration control techniques, Tuned Mass Dampers, Seismic base isolation.

UNIT - IV *Concrete Technology and Repair and Rehabilitation Of Structures*

Concrete making materials - Mix Design - Special Concretes - High strength Concrete - High Performance Concrete - High density Concrete - Fibre Reinforced Concrete - Geopolymer Concrete - Bacterial Concrete - Nano Concrete - Ready mixed Concrete - Self compacting Concrete - Concrete made out of Industrial Wastes - Fresh and hardened concrete properties- Concreting Techniques - Life cycle behaviour of Structures - Different forms of cracks - factors responsible for deterioration of concrete - Defects in steel ,masonry and concrete structures - causes - effects-Damage assessment - strength and durability parameters - NDT - Repair Techniques-Strengthening of structural elements - Engineered Demolition.

UNIT - V *Structural Analysis and Finite Element Analysis*

Axial deformation of bars, Analysis of framed structures, Plates and shells, Applications of finite element for elastic stability, Dynamic analysis.

PCE1003 Advanced Construction Technology / Construction Engineering and Management / Infrastructure Engineering

UNIT - I *Construction Planning, Scheduling and Control*

Defining Work Tasks - Estimating Activity Durations - Construction Schedules - Critical Path Method – Scheduling Calculations- Use of Advanced Scheduling Techniques- Crashing and Time/Cost Tradeoffs- The Project Budget- Schedule and Budget Updates- Relating Cost and Schedule Information- Total Quality Control - Quality Control by Statistical Methods- Safety- Types of Project Information-- Computerized Organization and Use of Information.

UNIT - II *Project Formulation and Appraisal and Contract Laws and Regulations*

Project Formulation, Project Costing, Project Appraisal, Project Financing, Private Sector Participation- 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.

UNIT - III ***Resource Management and Control and Quantitative Techniques In Management***

Resource planning, Labour management, Materials and equipment, Time management, Resource allocation and leveling .Operations research, Production management, Working capital Management, Decision theory, Managerial economics.

UNIT - IV ***Concrete Technology and Repair and Rehabilitation of Structures***

Concrete making materials - Mix Design - Special Concretes - High strength Concrete - High Performance Concrete - High density Concrete - Fibre Reinforced Concrete - Geopolymer Concrete - Bacterial Concrete - Nano Concrete - Ready mixed Concrete - Self compacting Concrete - Concrete made out of Industrial Wastes - Fresh and hardened concrete properties- Concreting Techniques - Life cycle behaviour of Structures - Different forms of cracks - factors responsible for deterioration of concrete - Defects in steel ,masonry and concrete structures - causes - effects-Damage assessment - strength and durability parameters - NDT - Repair Techniques-Strengthening of structural elements - Engineered Demolition.

UNIT - V ***Construction Techniques and Equipment***

Equipment for earthwork, asphalt and concrete plants and materials handling - Equipment for dredging, trenching, tunneling, drilling, blasting, pile driving, demolition, dewatering and grouting - Cranes- Modern equipment- Construction Equipment Management - Construction techniques for sub structure construction - Super structure construction techniques for buildings including tall buildings, prestressing and post tensioning – Construction techniques for the construction of special structures like towers, silos, chimneys, TLT, skyscrapers, bridges, domes, jetties, breakwater structures, support structure for heavy machinery, articulated structures and space decks – Demolition Techniques.

PCE1004 Geotechnical Engineering / Soil Mechanics and Foundation Engineering

UNIT - I ***Soil Properties and Strength Behaviour***

Different soil deposits — classification and identification — clay minerals — diffused double layer — swelling and shrinkage behavior — liquefaction potential — factors affecting compressibility, permeability, shear strength -— conduction phenomena-Factors affecting stress-

strain characteristics — triaxial testing and stress path — pore pressure parameters — failure theories — constitutive law for soil — limitations of model — critical state line — dilation effect.

UNIT - II *Subsurface Investigation and Instrumentation*

Method of exploration for preliminary and detailed design —- Geophysical methods — Drilling in difficult subsoil conditions — bore logs — factor influencing sampling and samplers in onshore and offshore — field tests — interpretation of test results — instrumentation methods.

UNIT - III *Shallow and Deep Foundations*

Types of shallow foundations — conceptual design principles — ultimate safe bearing capacity under axial and eccentric loading — components of settlement of soil — stress path method — allowable settlement and bearing capacity — raft foundation — soil structure interaction — structural design of shallow foundation — foundation for tower and offshore environment — machine foundation- Classification of piles based on usage, function, and material — vertical and lateral load carrying capacity of piles and pile group — settlement of piles — structural design of pile and pile caps — settlement of caisson.

UNIT - IV *Earth and earth retaining structures*

Earth pressure theories — active and passive cases — stability of retaining structures both for regular and earthquake forces — design of cantilever and anchored sheet pile walls — lateral pressure on sheeting in braced excavation — earth pressure around tunnel lining, shafts and silos — soil anchors and soil pinning — diaphragm walls — stability of infinite and finite slopes — stability charts — slope stabilization.

UNIT - V *Ground Improvement and Geoenvironmental Engineering*

Need for ground improvement — column methods — sand, stone and lime columns — soil nailing — root piles — soil reinforcement — functions of geosynthetics in soil — soil grouting — electro- chemical stabilization- Consequence of waste on the behaviour of soil — soil-pollutant interaction — remediation of contaminated sites — stabilization of waste with soil

PCE1005 Environmental Engineering / Environmental Management

Environmental chemistry

Aquatic chemistry, atmospheric chemistry, soil chemistry-environmental chemicals and their fate

Environmental Microbiology

Classification and characteristics of Microorganisms-microbes and nutrient cycles- metabolism of microorganisms- pathogens in wastewater- toxicology

Design of water and wastewater treatment systems

Sources and types of water pollutants, water quality standards- conventional and advances in water treatment. Physical and chemical treatment of waste water- sludge treatment and disposal-Principles of biological treatment-Design of water and wastewater treatment plant units-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, Zero liquid Discharge Systems

Air pollution and control

Air Pollutants-Types-NAAQS-Emission and Ambient Air sampling and Analysis-Effect of Meteorological Parameters-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

Sustainable Development and Climate Change

Sustainability and Development, Principles and Frame Work - Climate Change-Adaptation and Mitigation

PCE1006 Water Resources Engineering

UNIT - I

Continuum hypothesis, fluid properties, basic thermodynamic relations, perfect gas, scalars and vectors, cartesian tensors, Gauss' theorem, Stokes theorem. Lagrangian and Eulerian description, material derivative and stream function.Control volume concepts, Reynolds transport theorem, conservation of mass, momentum and energy, Navier-Stokes equation, non-dimensional parameters determined from differential equations, Buckingham's Pi theorem, similitude and model testing.Stream function and velocity potential, Laplace equation, application of complex variables, flow at a wall angle, source, sink, doublet, flow past Rankine half-body, flow past a circular cylinder with circulation, source near a wall, method of images, conformal mapping and applications.Basic concepts of uniform flow – characteristics of open channel flows - computations. Specific energy – transitions – weirs - specific force concepts – hydraulic jump – stilling basins.Sharp-Crested weirs, broad-crested weirs, critical depth flumes.Physical modeling in hydraulics. Dimensional analysis. Modeling closed flows and free surface flows. Distorted models. Design of physical models.Chezy and Manning formulae – turbulence and flow resistance – channels with composite roughness – uniform flow computations. Spatially varied flows and rapidly varied flows.Governing equations – classification of water surface profiles – sketching water surface profiles – computation of varied flow profiles – direct step method – standard step method – simultaneous solution procedure – Spatially varied flows

UNIT - II

Hydro meteorology – Groundwater in Hydrologic Cycle –Occurrence of groundwater – zone of Aeration and Saturation – Hydrogeology — Types of aquifers soil sample analysis - Water bearing materials – Aquifer parameters and its determination. Groundwater Movement - Darcy's law and its limitations - Stream lines and flow net analysis – Potential flow theory – Discharge and draw down for various condition of groundwater flow - Principles of groundwater flow and its equation – Dupuit – Forchheimer assumptions – Influent and Effluent streams - Evaluation of well loss parameters – Partial penetration of wells – Interference of

wells Determining aquifer parameters for unconfined, leaky and non-leaky aquifers – steady and transient conditions - Slug test – Locating hydro geological boundaries – Image well theory – Determination of well characteristics and specific capacity of wells – Well characteristics of large diameter wells.

UNIT - III

Well design criteria – Construction of wells – Well drilling methods – Filter design – Artificial and natural packing – Well casings and screens – Production test – Maintenance of production wells – Pumping Equipment – protection of wells and Rehabilitation – Horizontal wells - Collector wells and Infiltration galleries Methods of artificial groundwater recharge – Groundwater Basin Management and conjunctive use - Groundwater assessment and balancing – Seawater intrusion in coastal aquifers – Land Subsidence – Groundwater flow in Hard Rock System: conceptual models –structure and hydrodynamic properties of hard rock aquifers.

UNIT - IV

Hydrologic cycle – System concept – Hydrologic system Model – Classification of HydrologicModels – Statistical, Stochastic and Deterministic Approaches – Statistical characteristics ofHydrological Data – Probability distribution of Hydrologic Variables Correlation Analysis –Developing Prediction Equation by Simple and Multiple Linear Regression – Reliability of theModel. Stochastic Process – Classification – Stationary Process – Time series – Classification –Component of Time series – Method of Investigation – Auto Correlation coefficient – MovingAverage Process – Auto Regressive Process - Auto Regressive Moving Average Process -Auto Regressive Integrated Moving Average Process – Thomas Fiering Model – BoxJenkins Model – Model formulation – Parameter Estimation – Calibration and Validation – Application to hydrologic data Generation and Forecasting.

UNIT - V

Classification of Deterministic Model – Black Box, Conceptual and Physically based Models– Rational method - Models of IUH, Nash and Chow-Kulandaiswamy Models – Lumped and Distributed Conceptual Models – Single event and Continuous Conceptual Models Hydrologic Design Scale – Estimating Limiting Value – Hydrologic Design level – Hydrologic Design Data - Hydraulic structure Design methods - Estimation of PMP - Computation of Design Storm - IDF Relationships - Design Flows - Hydrologic Risk, Reliability and Safety Factor.

PCE1007 Irrigation Water Management

Water Resources of India - Irrigation- Need, Advantages and Disadvantages- Crop and Cropping seasons in India and Tamil Nadu-National Water Policy- Inadequacy of Irrigation Management-Criteria for good Irrigation management. Soil physical properties influencing Soil-water relationship-Forms and occurrence of Soil Water-Classification of Soil Water- Soil Water Constants- Energy concept of Soil Water-Forces acting on Soil Water- Soil Water Potential concept- Soil Water retention- Soil Moisture Measurement. Water requirement of crops - Evapotranspiration and Consumptive use- Methods of estimating Evapotranspiration- Effective Rainfall- Irrigation Requirement-Duty of Water- Irrigation Efficiencies-Irrigation Scheduling-Irrigation measurement. Canal network and canal design- Surface irrigation methods- Types-Border irrigation, Furrow irrigation, Basin Irrigation and Micro irrigation - Specifications, Hydraulics and Design. Irrigation Management systems in India - Warabhandi, Shejpali and Localisation - Diagnostic Analysis of Irrigation systems - Performance Indicators - Main system management - Command area Development - OFD - Irrigation policies - Irrigation institution - Irrigation Management Transfer.

PCE1008 Coastal Engineering and Management

Wind and waves - Sea and Swell -Introduction to small amplitude wave theory - use of wave tables- Mechanics of water waves - Linear (Airy) wave theory, Introduction to Tsunami Behaviour of waves in shallow waters, Introduction to non-linear waves and their properties - Waves in shallow waters - Wave Refraction, Diffraction and Shoaling -Hindcast wave generation models, wave shoaling; wave refraction; wave breaking; wave diffraction random and 3D waves- Short term wave analysis - wave spectra and its utilities - Long term wave analysis- Statistics analysis of grouped wave data. Dynamic beach profile; cross-shore transport; along shore transport (Littoral transport), sediment movement Field measurement; models, groins, sea walls, offshore breakwaters, artificial nourishment - planning of coast protection works - Design of shore defense structures -Case studies. Physical modeling in Coastal Engineering - Limitations and advantages - Role of physical modeling in coastal engineering - Numerical modeling - Modeling aspects - limitations - Case studies using public domain models, Tsunami mitigation measures

PCE1009 Geomatics / Geo Informatics / Remote Sensing / Spatial Information Technology

UNIT - I

Physics of remote sensing- Data Acquisition - Scattering System - Thermal and Hyper Spectral Remote Sensing - Data Analysis – Microwave Remote Sensing - Spaceborne SAR Systems - Concepts and Application of Microwave Remote Sensing – Passive Microwave Remote Sensing – Altimeter and Scatterometer Concepts.

UNIT - II

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 Airborne Laser Terrain Mapping - Lidar - Lidar data processing - Lidargrammetry - Study of Different GPS - GPS Data Processing.

UNIT - III

Basics of Cartography Earth - Sources of Data - Perception and Design - Cartography Abstraction - Map projection -Map reproduction - Basics of GIS -Data Model and Input - Data Analysis and Output - Spatial Modeling Data Quality. GIS Application -Location Based analysis - route analysis – Land Information System.

UNIT - IV

Plane and Geodetic surveying basics. Basics of Electronic Surveying - Electromagnetic Waves - Electronic Total Station - Survey Error Analysis and Adjustment - Geodesy geoid Ellipsoid Geometric, Physical and Space Geodesy Geodetic astronomy.

UNIT - V

Basics of Hydrology - Drainage Basin - Area! Assessment - Ground Water and Water Quality - Remote Sensing Application to Coastal Zone Management, Urban Planning, Agriculture, Forestry, Transportation Engineering – Ocean Applications.

PME2001 CAD / Engineering Design / Machine Design

UNIT - I

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.

UNIT - II

Introduction to computer graphics fundamentals; Curves and surfaces modeling; Concepts of Solid modeling; Visual realism; Assembly of parts and product data Exchange.Finite Element Analysis related to 1D and 2D problems. Problems of static and dynamic analysis using Finite Element Analysis.

UNIT - III

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.

UNIT - IV

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

UNIT - V

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.

PME2002 CAM

UNIT - I

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.

UNIT - II

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UNIT - IV

NC, CNC and DNC –CNC Programming Basics - Computer Aided Process Planning- Group technology - Part families - classification and coding - Production flow analysis - Machine cell design - Benefits. Components of FMS- Characteristics of JIT-Kanban system- lean production system.

UNIT - V

Engineering Data Management (EDM), Product Data Management (PDM), Collaborative Product Definition Management (cPDm), Collaborative Product Commerce (CPC), Product Lifecycle Management (PLM) - Additive manufacturing processes-Benefits Applications – rapid tooling - Reverse Engineering – Digitizing technique.

PME2003 Product Design and Development

UNIT - I

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.

UNIT - II

Introduction to computer graphics fundamentals; Curves and surfaces modeling; Concepts of Solid modeling; Visual realism; Assembly of parts and product data Exchange. Finite Element Analysis related to 1D and 2D problems. Problems of static and dynamic analysis using Finite Element Analysis.

UNIT - III

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.

UNIT - IV

Introduction to Product Development, Customer Need Analysis, Product Specification, Concept Generation, Selection, and Testing, Product Architecture and Industrial Design, DFM and Prototyping, Product Development Economics and Managing Projects.

UNIT - V

Introduction to marketing research, exploratory research design, measurement and scaling, frequency distribution and data analysis, Additive manufacturing processes-Benefits Applications – rapid tooling - Reverse Engineering – Digitizing techniques.

PME2004 Energy Engineering

UNIT - I

Conduction: General heat Conduction equation, initial and boundary conditions, Extended surfaces, Lumped system analysis, Heisler charts-semi infinite solid, Moving Boundary problems. Convective Heat Transfer: SteadyLaminar and Turbulent Heat Transfer in External and Internal Flows – HeatTransfer at High Speeds – Unsteady Laminar and Turbulent Forced Convection in Ducts and on Plates. Radiation Heat Transfer: Radiation in Enclosures, Network analogy, Radiation shields, Gas Radiation. Boiling, Condensation& Heat exchangers.

UNIT - II

Laws of Thermodynamics, Concepts of Energy, Entropy and Exergy - Reversibility and Irreversibility - Principle of increase in Entropy - Entropy Generation - Availability analysis of simple cycles. Thermodynamic property relations. Real Gas behavior, I & II Law Efficiency - 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.

UNIT - III

Mass, Momentum and Energy equations and their applications. Potential flow theory - Stream, Potential functions and Vorticity. Viscous flow theory - flow between parallel plates and flow through pipes. Major and minor head losses. Boundary layer theory. Compressible fluid flow in variable area passage. Types of sensors, error and uncertainty analysis. Measurements of Density, Temperature, Pressure, Flow, heat flux and thermo - physical properties (thermal conductivity, viscosity and specific heat). Calibration methods. Data logging and acquisition.

UNIT - IV

Plant analysis - Bio Energy, Wind Energy, Solar Energy, Geo thermal, Tidal energy, Small hydro and OTEC – Fuel cell – Hydrogen production and storage - Analysis of Carnot, Rankine, Stirling, Ericsson, Otto, Diesel, Dual, Lenoir, Atkinson and Brayton, Binary and IGCC cycles - Thermoelectric Converters –Thermionic converters – MHD - Design aspects of Fluidized bed combustion – Analysis of Nuclear reactors – Power plant load curves – Proximate and Ultimate analysis and utilization of coal - Biomethanation, Gasification, Pyrolysis, Carbonisation and Combustion – Production of Biofuels.

UNIT - V

Boiler basics and performance analysis, combustion principles and heat loss analysis - Thermic Fluid Heaters – Furnaces – Insulation and Refractories - Cogeneration types, principles and

economic analysis - Energy conservation in Fans, Pumps, Compressors, Transformers, Motors and Refrigeration and Air Conditioning systems – DG set and Cooling tower performance analysis – Energy conservation measures in buildings - Waste disposal and recycling.

PME2005 Thermal Engineering spl. in Refrigeration and Air Conditioning

UNIT - I

Conduction: General heat Conduction equation, initial and boundary conditions, Extended surfaces, Lumped system analysis, Heisler charts-semi infinite solid, Moving Boundary problems. Convective Heat Transfer: SteadyLaminar and Turbulent Heat Transfer in External and Internal Flows – HeatTransfer at High Speeds – Unsteady Laminar and Turbulent Forced Convection in Ducts and on Plates. Radiation Heat Transfer: Radiation in Enclosures, Network analogy, Radiation shields, Gas Radiation. Boiling, Condensation& Heat exchangers.

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UNIT - III

Mass, Momentum and Energy equations and their applications. Potential flow theory - Stream, Potential functions and Vorticity. Viscous flow theory - flow between parallel plates and flow through pipes. Major and minor head losses. Boundary layer theory. Compressible fluid flow in variable area passage. Types of sensors, error and uncertainty analysis. Measurements of Density, Temperature, Pressure, Flow, heat flux and thermo - physical properties (thermal conductivity, viscosity and specific heat). Calibration methods. Data logging and acquisition.

UNIT - IV

Refrigeration Cycles - vapor compression cycle, Multi pressure System, Cascade Systems-Analysis. Vapor Absorption Systems - Aqua Ammonia & Li-Br Systems, Steam Jet Refrigeration, Thermo Electric Refrigeration, Air Refrigeration cycles, Refrigeration System Components.

Refrigerants - Desirable properties- Designation of refrigerants - Secondary refrigerants - Heat pumps.

UNIT - V

Air conditioning systems and psychometrics, Head load calculation, Design of air conditioning ducts, Evaporative, Winter and all Year Air Conditioning Systems. Air Conditioning in Automobiles, Railway Wagons, Marine Vessels, Aircraft and Other Commercial Applications. Indoor air quality and measurements. Heating and Ventilation systems.

PME2006 Internal Combustion Engineering

UNIT - I

Conduction: General heat Conduction equation, initial and boundary conditions, Extended surfaces, Lumped system analysis, Heisler charts-semi infinite solid, Moving Boundary problems. Convective Heat Transfer: SteadyLaminar and Turbulent Heat Transfer in External and Internal Flows – HeatTransfer at High Speeds – Unsteady Laminar and Turbulent Forced Convection in Ducts and on Plates. Radiation Heat Transfer: Radiation in Enclosures, Network analogy, Radiation shields, Gas Radiation. Boiling, Condensation& Heat exchangers.

UNIT - II

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UNIT - III

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UNIT - IV

Combustion in SI and CI engines, Heat release correlations, Emission formation in SI and CI engines, Advanced fuel injection and boosting systems, Emission control – In-cylinder and after treatment methods, Emission measurement techniques, Engine sensors and actuators.

UNIT - V

Supercharging, Scavenging, Turbocharging, Materials, Engine components – functions, Design of engine components, Simulation of SI and CI engine processes, Alternative fuels and utilisation methods in IC engines, Low temperature combustion concepts.

PME2007 Manufacturing Systems Management and Lean Manufacturing

UNIT - I *Advanced Manufacturing Processes*

Advances in manufacturing processes – Casting, Welding, forming, Unconventional machining processes, Additive manufacturing, Micro and nano-machining processes, Metrology for quality control.

UNIT - II *Manufacturing Management and Operations Research*

Facility, capacity & layout planning, Forecasting, Scheduling, Project Management, Production planning and control, Inventory control, Maintenance strategies. Linear programming, Sequencing, Replacement.

UNIT - III *Quality Control*

Statistical process control, online/offline quality control, Process capability, Design of experiments, Reliability, Maintainability

UNIT - IV *Lean Manufacturing*

Seven wastes, Lean Tools to eliminate Muda – 5S, TPM, Standardised work, Poka-Yoke, SMED, Kanban, JIT, Value stream mapping, Six Sigma – Methodology, tools.

UNIT - V *Manufacturing Automation*

Automation and control techniques, Numerical control, Robotics, Material handling, FMS, Cellular manufacturing.

PME2008 Welding Engineering

UNIT - I *Phase Diagrams and Heat Treatment*

Diffusion in solids, Strengthening mechanisms, Phase diagrams - Iron - Iron carbide diagram- TTT and CCT diagrams- Heat Treatment processes – Effect of Heat various heat treatment processes on the properties of materials, Surface Hardening.

UNIT - II *Welding Processes and Design*

Welding processes, Weld joints, Weld Symbols, Codes and Standards, Design of Weldments for various loads. Thermal cycles in welding: basic heat transfer equations, temperature distributions and cooling curves.

UNIT - III *Welding of Ferrous Materials*

Welding of plain carbon steels-low alloy steels-HSLA steels-Stainless steels and Cast Irons-problems encountered and solutions. Formation of different microstructural zones in welding of plain carbon steels-heat flow in welding.

UNIT - I V *Welding of Non-Ferrous Materials*

Welding of Aluminium and its alloys-Magnesium and its alloys-Copper and its alloys -Nickel and its alloys-Titanium and its alloys-problems encountered and solutions.

UNIT - V *Defects, Weldability and Standards*

Weld defects, Remedies-Joining of dissimilar materials, weldability and testing of weldments, Failure analysis, Introduction to International Standards and Codes.

PME2009 Materials and Metallurgical Engineering

UNIT - I *Phase Diagrams and Heat Treatment*

Diffusion in solids, Strengthening mechanisms, Phase diagrams - Iron - Iron carbide diagram- TTT and CCT diagrams- Heat Treatment processes – Effect of Heat various heat treatment processes on the properties of materials, Surface Hardening.

UNIT - II *Phase Diagrams and Heat Treatment*

Diffusion in solids, Strengthening mechanisms, Phase diagrams - Iron - Iron carbide diagram- TTT and CCT diagrams- Heat Treatment processes – Effect of Heat various heat treatment processes on the properties of materials, Surface Hardening.

UNIT - III *Metal Forming*

Theory of plasticity, Fundamentals of Metal forming Cold working & Hot working, Forging & Rolling, Extrusion & Drawing. Powder Metallurgy, Different Casting Processes, melting,casting design, Directional Solidification, Casting Defects. Different Welding processes, Welding Metallurgy of Ferrous and non- ferrous materials.

UNIT - IV *Metallic and Non-Metallic Materials*

Metallurgy of Iron and Steel Making, Alloy steels, Cast irons,Non-Ferrous Metallurgy- Cu, Al, Ni, mg, Ti, Pb, Zn,Sn And their alloys. Precious metals, Ceramics, Composites and Polymers.

UNIT - V *Characterisation and Inspection*

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.

PME2010 Industrial Engineering and Quality Engineering and Management

Unit - I *Probability and statistics*

One dimensional random variables - two dimensional random variables - multivariate methods- testing of hypotheses -factor analysis- discriminate analysis- cluster analysis.

Unit - II *Operations Research and Simulation*

Linear Programming - Network Analysis- Decision And Game Theory- Queuing Theory – Random Numbers And Random Variates - Simulation Experiment.

Unit - III *Work Design and Facility layout*

Method study- Work measurement - Applied work measurement- Physical ergonomics - environmental factors - Plant location - Facilities layout - Group technology and line balancing - Materials handling

Unit - IV *Operations Management*

Demand forecasting - Production planning - Inventory planning and control - Capacity analysis and operational control - single machine scheduling - parallel machine scheduling - job shop scheduling

Unit - V *Quality control and Reliability*

Control charts - Statistical process control - Sampling -TQM principles - Implementation of TQM - Single factor experiments - Multifactor experiments - Taguchi methods - Reliability concepts - Reliability assessment.

PME2011 Advanced Manufacturing Engineering / Computer Integrated Manufacturing

UNIT - I

Theory of metal cutting, tool materials, conventional and unconventional machining processes, super finishing processes, high speed machining, tool condition monitoring, tool based micromachining, MEMS based micro-machining.

UNIT - II

Additive manufacturing techniques, processing techniques of different composites, hybrid composites, Optical microscopy, TEM, SEM, AFM, Hardness, micro hardness, Impact test, Synthesis of nano materials, Top down and bottom up approaches, surface mount technology.

UNIT - III

Measurements, errors, accuracy, precision, calibration, surface roughness, interferometers, laser metrology, co-ordinate measuring machine, in-process inspection, vision system, image processing, lean manufacturing, Just In Time, Total Quality Management, Smart manufacturing, machine learning and IoT.

UNIT - IV

Finite Element Analysis, welding types, HAZ, defects, special casting processes, casting defects, metal forming, plastic deformation, stress strain curves for different materials, work hardening, strain hardening, fatigue, failure analysis, material selection, creep, wear resistance, heat treatment, powder metallurgy.

UNIT - V

Robot classification, end effectors, robot vision, robot programming languages, sensors, transducers, actuators, PLC, artificial intelligence. CNC machines, Automation in manufacturing, adaptive control, Group technology, Computer Aided Design, Computer Aided Manufacturing, flexible manufacturing system, Discrete System Simulation.

PME2012 Printing and Packaging Technology

UNIT - I *Fundamentals of Printing and Packaging*

Fundamentals of Graphic Design, Colour theory, Halftone screening, Prepress workflow, Package Design and Development, Brand Management, Anticounterfeiting, Cost estimating, Sustainable packaging.

UNIT - II *Printing Processes*

Offset, Flexo, Gravure, Screen, Digital - Principle, Image carrier preparation, Machine configuration.

UNIT - III *Printing and Packaging Materials*

Paper and Board, Plastics, Glass, Wood, Metal, Printing Inks and Coatings, Adhesives, Cushioning materials, Ancillary materials for printing and packaging.

UNIT - IV *Packaging Technologies*

Paper and Board Conversion, Plastic Conversion, Closures, Packaging Machineries, Automotive and Industrial Packaging, Food Packaging, Healthcare Packaging

UNIT - V *Testing and Quality Control*

Printing and Packaging Materials - Testing and Standards, Quality control and ISO standards for printing processes, Packaging Performance and Testing, Shelf life, Packaging Laws and Regulations.

PME2013 Mechatronics

UNIT - I *Mechanics*

Kinematic Link, Pair and Chain and Classification, Constraints and Motions, Degrees of Freedom, Mechanism - Slider Crank, Single and Double, Crank Rocker Mechanisms-Inversions and its Applications- Kinematic Analysis of Mechanisms- Velocity and Acceleration Consideration - Gears – Gear Train – Speed and Torque Relations –Belt Drives – Screws Drives - Nuts – Bearing – Friction – Power Transmission- Spring - Vibration – Damped and Undammed System.

UNIT - II *Electronics*

Resistor, Inductor, Capacitor, Diodes, MOSFET, Transistor, SCR Family, LED, and LCD – Operating Amplifiers and its Applications – Digital Electronics –Logic Gates, Arithmetic and Logic Circuits - Sequential and Combination Circuits, Flip Flop – Memory – Power Supply – Measurements of Voltage, Current, Frequency, and RLC Values– Oscilloscope- Signal Conditioning Circuits – Bridge Circuits – Sample and Hold Circuit, D/A and A/D Converter – Data Acquisition Cards.

UNIT - III *Sensors and Drives*

Sensor and Transducer Classification, Characteristics –Signals Types - Displacement, Proximity and Ranging Sensors - Force, Magnetic and Heading Sensors - Optical, Pressure, Temperature-Chemical Sensors.Electrical Drives – Types and Working of DC Motors – Types and Working of Single Phase and Three Phase AC Motors- Stepper Motors – Servomotors – BLDC Motors – Piezomotors – Protection and Switching Circuits – Relays – Solenoids – DC Drives – AC Drives – VFD. Fluid Power Drives - Fluid Power System Generation Systems - Linear and Rotary Pneumatic and Hydraulic Actuators – Types of Pumps – Types of Valves – Regulating and Controlling Elements of Pneumatic and Hydraulics - Sequencing and combinational Logic Circuit Design - Cascade Method – KV Mapping.

UNIT - IV *Control Systems and Controllers*

System Modelling – Mathematical Modelling of Mechanical, Electrical, Thermal, Fluid Transportation, and Fluid Powered Systems– Block Diagram Reduction and Signal Flow Graph – First and Second Order System – Time and Frequency Domain Specification- Methods and Analysis - Design of Compensators and Controllers – PID Combination - Control and Analysis of Motor – State Space Model.8051 Microcontroller – Architecture – Addressing Modes – Instruction Set – Communication - Working and its Applications – PLC Architecture – Types of Programming – Ladder Logic – Timer and Counter – Applications - Industrial Communication Protocols.

UNIT - V *Robotics, Machine Vision and Cnc Machines*

Mechatronic System Integration - Industrial Serial Manipulators – Configuration - Classification – Forward and Inverse Kinematics – Dynamics – Trajectory Planning - End Effectors – Programming –Work cell and Safety Systems - Machine Vision System – Sensors –

Lighting Techniques – Lens and Mounting Selections – Image Processing - CNC and Automation Techniques - Subsystems - Mechatronic Elements in CNC Machine - CNC Measurement System and Tooling - CNC Programming.

PME2014 Manufacturing Engineering / Production Engineering

UNIT - I

Engineering Mechanics, Solid Mechanics, Kinematics of Machines - Design of machine elements - Jig fixture and tool designs.

UNIT - II

NC/CNC Machineries - GT - Automated process planning - FMS -Computer Aided Product Design-CIM - Robotics – Mechatronics - Fluid power automation

UNIT - III

Engineering Materials and metallurgy - Machining Processes - Special purpose machine tools - Unconventional/Advanced Machining processes

UNIT - IV

Powder metallurgy - Composite materials - Casting, Welding and forming processes –Non Destructive Evaluation, Material Characterization – Metrology

UNIT - V

Inventory management - Plant location and layout - Materials handling - Method, study - work measurement - Break even analysis - Cost accounting - Quality control - Control chartsacceptances sampling – TQM- TPM –Operational Research - Design of Experiments

PME2015 Automobile Engineering / Automotive Engineering / Automotive Materials and Manufacturing

UNIT - I *Automotive Chassis*

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.

UNIT - II ***Automotive Transmission***

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.

UNIT - III ***Vehicle Body Engineering and Vehicle Dynamics***

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.

UNIT - IV ***Automotive Electrical and Electronics***

Automotive Batteries, Electrical systems for Automobiles. Automotive sensors and actuators, Vehicle networking, Vehicle Control system, PID control, Different control schemes. Components for electronic engine management system. 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.

UNIT - V ***Engines Emission Control, Alternative Fuels and Hybridelectric Vehicles***

Emission formation in SI and CI Engines. Controlling techniques. CVS 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. Methods of using all the fuels in SI and CI engines. Design requirement for electric vehicles. Batteries and Motors for Electric vehicles, Power Split devices for Hybrid Vehicles - Operation modes - Control Strategies for Hybrid Vehicle- Economy of hybrid Vehicles.

PME2016 Aeronautical Engineering / Aerospace Technology

UNIT - I

Aerodynamics: Introduction to Aerodynamics - Incompressible Flow Theory - Compressible Flow Theory - Airfoils, Wings and Airplane Configuration in High Speed Flows - Viscous Flow and Flow Measurements.

UNIT - II

Aircraft Structural Mechanics: Bending of Beams - Shear Flow in Open Sections - Shear Flow in Closed Sections - Stability Problems - Analysis of Aircraft Structural Components.

UNIT - III

Aerospace Propulsion: Elements of Aerospace Propulsion - Propeller Theory - Inlets, Nozzles and Combustion Chambers - Axial Flow Compressors, Fans and Turbines - Rocket and Electric Propulsion.

UNIT - IV

Flight Mechanics: Principles of Flight - Aircraft Performance in Level, Climbing and Gliding Flights - Accelerated Flight - Longitudinal Stability and Control - Lateral, Directional Stability and Control.

UNIT - V

Aircraft system instruments: Fuel System Jet Engine, Ignition systems Jet engine,Pitot static systems, Altimeter Mach meter and Gyroscopic instruments.

PME2017 Avionics

UNIT - I

Digital Avionics: Introduction to Avionics - Avionics System Data Buses, Design and Integration - Avionics System Essentials: Displays, I/O Devices and Power - Packaging - System Assessment, Validation and Certification - Maintenance and Costs of Avionics.

UNIT - II

Electro Optic System: Introduction - Laser Systems - Infrared Systems - Imaging Devices and Tracking Systems - Fiber Optic Systems. Flight Instrumentation: Measurements Science and Displays - Air Data Instruments and Synchro Transmission Systems.

UNIT - III

Gyroscopic Instruments - Aircraft Compass Systems & Flight Management System - Power Plant Instruments. NAVIGATION SYSTEM: Navigation System & Inertial Sensors - Inertial Navigation Systems - Radio Navigation - Approach and Landing Aids - Satellite Navigation & Hybrid Navigation.

UNIT - IV

Aerospace Guidance And Control : Introduction - Augmentation Systems - Longitudinal Autopilot - Lateral Autopilot - Missile and Launch Vehicle Guidance.

UNIT - V

Mathematical Modeling And Simulation: System Models and Simulation - Probability, Concepts in Simulation - System Simulation - System Dynamics and Mathematical Models for Flight Simulation - Flight Simulators as a Training Device and Research Tool. Rocketry And Space Mechanics: Orbital Mechanics - Satellite Dynamics - Rocket Motion - Rocket Aerodynamics - Staging and Control of Rocket Vehicles.

PME2018 Solar Energy

UNIT - I

Conduction: General heat Conduction equation, initial and boundary conditions, Extended surfaces, Lumped system analysis, Heisler charts-semi infinite solid, Moving Boundary problems. Convective Heat Transfer: SteadyLaminar and Turbulent Heat Transfer in External and Internal Flows – HeatTransfer at High Speeds – Unsteady Laminar and Turbulent Forced Convection in Ducts and on Plates. Radiation Heat Transfer: Radiation in Enclosures, Network analogy, Radiation shields, Gas Radiation. Boiling, Condensation& Heat exchangers.

UNIT - II

Laws of Thermodynamics, Concepts of Energy, Entropy and Exergy - Reversibility and Irreversibility - Principle of increase in Entropy - Entropy Generation - Availability analysis of simple cycles. Thermodynamic property relations. Real Gas behavior, I & II Law Efficiency - 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.

UNIT - III

Mass, Momentum and Energy equations and their applications. Potential flow theory - Stream, Potential functions and Vorticity. Viscous flow theory - flow between parallel plates and flow through pipes. Major and minor head losses. Boundary layer theory. Compressible fluid flow in variable area passage. Types of sensors, error and uncertainty analysis. Measurements of

Density, Temperature, Pressure, Flow, heat flux and thermo - physical properties (thermal conductivity, viscosity and specific heat). Calibration methods. Data logging and acquisition.

UNIT - IV

Solar Radiation - Solar angles - Thermal analysis of solar collectors–Flat plate, Evacuated tube,Concentrated collector - Tracking and control systems for Concentrated collectors - Techno-economic analysis of solar thermal power plants, performance study, site selection.Vapour cycles - Organic cycles - Combined cycles - Binary Cycles -Stirling and other cycles- Solar Cooking - Solar Desalination - Solar Ponds – Solar Drying – Solar Refrigeration and air conditioning - Solar Thermal Energy Storage.

UNIT - V

Solar PV basics - Solar PV material types – Solar PV Modules and Arrays -Standalone PV system – GridConnected SPV Systems –Load Estimation -– Balance of system components – DC to AC converter, Batteries, Charge controller, and MPPT - Hybrid SPV system – Net metering– Building materials - Solar heating and cooling of buildings - Zero energy building.

PEE3001 High Voltage Engineering

UNIT - I *High Voltage Generation and Measurment*

Voltage stress, testing voltages,AC to DC conversion, analysis of single phase rectifier, voltage multiplier, Cockcroft-Walton, Electrostatic generators, analysis of cascaded transformer and resonant circuit, Marx generator circuit analysis, generation of switching surges, non-standard impulse and VFTO, analysis of impulse current generator circuits, measurement of High AC,DC and Impulse voltages, Field sensors, voltage divider, impulse current measurement, fast digital transient recorders

UNIT - II *Insulation Technology*

Properties of dielectrics in static fields, behaviour of dielectrics in alternating fields, breakdown mechanisms in gaseous, solid and liquid dielectrics, thermal modelling, Application of insulating materials in power equipment

UNIT - III *Electromagnetic Field Computation and Insulation Design*

Review of basic field theory – Maxwell's equations – Laplace, Poisson and Helmholtz equations for EM field analyses, governing equations , problem definition, boundary conditions, circuit parameters from the EM field solutions-Electrical field distribution and breakdown strength of insulating materials - factors affecting the breakdown strength - electric field distribution in homogenous and multi-dielectric isotropic materials- electrical field control techniques-insulation design and electric stress control in insulators, bushings, transformers and surge arresters

UNIT - IV *High Voltage Testing Techniques*

Classification of testing methods,IS/IEC/IEEE standards,measurement techniques,diagnostic techniques and online measurement, Determination of probability values, Distribution function, confidence limits, 'Up and Down' method,multi stress ageing, life data analysis,Testing of insulators, bushings, air break switches, isolators, circuit breakers, power transformers, voltage transformers, current transformers, surge arresters ,cable testing methodology,non-destructive insulation test techniques,pollution tests and design of high voltage lab.

UNIT - V *Transients In Power Sysytems and Ehvtransmission*

Lightning overvoltage's, switching and temporary overvoltage's, travelling waves on transmission line, insulation co-ordination,Standard transmission voltages- Calculation of line parameters, voltage gradients of conductors,design concepts of EHV and HVDC lines

PEE3002 Embedded Systems Technology

UNIT - I *Microprocessor and Microcontroller Based System Design*

8051, PIC and ARM architecture, Peripherals, interfacing, applications and programming.

UNIT - II *Embedded System Design*

Basic components, Embedded System design flow, Hardware/Software co-design, selection of processor and memory devices- Memory management methods- Timers and counting devices-sensors, actuators- Nyquist *criterion-sampling for signals-RTOS Based Embedded System Design- Embedded System Application Development*

UNIT - III *Software For Embedded Systems*

Assembly language, C, Embedded C and Python programming, Distributed embedded computing concepts, Android OS concepts, Software development tools,IDE- Applications.

UNIT - IV *Communication For Embedded System*

Embedded Networking design and concepts- Network topologies- OSI -USB -UART – Inter Integrated Circuits (I2C)-CAN BUS- wireless communication-Blue tooth-Zigbee-Wifi- IoT Applications.

UNIT - V Digital Design and Vlsi

Digital systems-Combinational and sequential design- CMOS design-FPGA technologies-HDL - SoC

PEE3003 Electrical Machines / Power Electronics And Drives

UNIT - I *Electrical Machines*

Principles of Electromagnetic energy conversion - Dc machines- reference frame theory- induction machines- synchronous machines

UNIT - II *Power Converters*

Switched mode DC-DC converters; buck, boost, sepic and cuk topologies-single phase and three phase controlled converters- single phase and three phase vsi and csi - performance parameters- pwm techniques-modern inverters- control techniques

UNIT - III DC, AC and Special Electrical Drives

Mechanical systems fundamental- converter and chopper control of dc drives- closed loop anddigital control of d.c drive- stator and rotor controlled induction motor - field oriented control of induction machines- synchronous motor drives- permanent magnet brushless dc motors- permanent magnet synchronous motors- switched reluctance motors- stepper motors

UNIT - IV *Microcontroller and DSP Based System Design*

8051 architecture and programming- pic microcontroller- peripheral of pic microcontroller- motor control signal processors- assembly language programming- peripherals of signal processors- event manager and drive control- applications

UNIT - V ***Power Electronics For Power Systems***

Electrical machines for renewable energy conversion- analysis of wind and pv systems- hybrid renewable energy systems – power quality analysis of single phase and three phase system- conventional load compensation methods- load compensation using dstatcom-series compensation of power distribution system-analysis of hvdc converters and hvdc systems control – thyristor and vsc based facts controllers

PEE3004 Power Engineering and Management

UNIT - I ***Deregulation In Power Systems***

Deregulation of various power systems- Market models- Comparison of various market models- Market Architecture-Importance of Congestion management, Features of congestion management- Classification of congestion Management methods – Calculation of ATC- Locational marginal pricing- Financial Transmission rights-Types of Ancillary servicesMarginal transmission pricing– Framework of Indian power sector -Reform initiatives -Open access issues – Power exchange.

UNIT - II ***Power Business Management***

Emerging Trends in Metering Technology-Power scenario in India- Load management in power sector, Grid Management - Electricity Act 2003–Tamil Nadu Solar Energy Policy -Tariff policy, Tariff regulations, Tariff structure, Fixed Tariff, Availability Based Tariff (ABT), Time Of the Day (TOD) Tariff, Multi Year Tariff - Power Purchase Agreement, Desirable Principles of Power Purchase Agreements- ***Case Study:*** *Power demand study and Load management study in Tamil Nadu*

UNIT - III ***Grid Integration of Renewable Energy Systems***

Concept of Micro Grids and their types, Different types of grid interfaces, Issues related to grid integration - Interconnection standards and grid code requirements for integration-Network Integration of Wind Power -Influence of Wind Farms on Network Dynamic Performance-Power Systems Stabilizers and Network Damping capability of Wind Farms - Stand Alone and Grid Connected PV System

UNIT - IV ***SMART GRIDS and SCADA***

Evolution of Electric Grid, Concept, Definitions and Need for Smart Grid -Smart Grid drivers, functions, opportunities, challenges and benefits-Smart Grid Technologies (Transmission) - Smart Grid Technologies (Distribution) -Smart Meters and Advanced Metering Infrastructure (AMI) -Local Area Network (LAN), House Area Network (HAN), Wide Area Network (WAN),Broadband over Power line (BPL) -CLOUD Computing to make Smart Grids smarter, Cyber Security for Smart Grid

UNIT - V ***Energy Management and Auditing***

*Need for Energy Management - Energy Accounting -Energy Monitoring -Economic models-Load management and Demand control techniques-Utility monitoring- Energy Management for Motors andTransformers-Metering techniques and practical examples- Concept of lighting systems and lighting controls- Optimizing lighting energy-Power factor and effect of harmonics on power quality - Cogeneration - Forms of cogeneration –**Case Study:** Feasibility of Cogeneration*

PEE3005 Electrical and Electronics Engineering / Electrical Energy System / Power System Engineering

UNIT - I ***Power System Analysis, Operation and Control***

State Estimation - Power System Security - Hydrothermal Scheduling Problem - Unit Commitment And Economic Dispatch - Power Flow Analysis - Optimal Power Flow - Short Circuit Analysis – Stability Analysis

UNIT - II ***Power System Protection***

Over Current And Earth Fault Protection - Transformer Protection - Busbar Protection - Distance And Carrier Protection Of Transmission Lines - Generator Protection And Motor Protection - Substation Automation

UNIT - III ***Power System Dynamics***

Synchronous Machine Modelling - Modelling Of Excitation And Speed Governing Systems – Small Signal Stability Analysis - Enhancement Of Small Signal Stability - Transient Stability Analysis - Subsysnchronous Resonance And Oscillations

UNIT - IV ***Power Converters And Facts Devices***

Single Phase Ac-Dc Converter - Three Phase Ac-Dc Converter - Single Phase Inverters - Three Phase Inverters - Multilevel Inverters - Static Var Compensator - Thyristor And Gto Thyristor Controlled Series Capacitors - Voltage Source Converter Based Facts Controllers - Controllers And Their Coordination – Hvdc Transmission

UNIT - V ***Restructured Power System***

Introduction To Restructuring Of Power Industry - Transmission Congestion Management - Locational Marginal Prices And Financial Transmission Rights - Ancillary Service Management And Pricing Of Transmission Network - Reforms In Indian Power Sector

PEE3006 Control System / Control and Instrumentation / Electronics and Control / Instrumentation Engineering / Process Control Instrumentation

UNIT - I ***Measurement and Instrumentation***

Principle of Transduction - Error and uncertainty analysis -Static and dynamic characteristics of Sensors / Transducers - Resistive, Capacitive, Inductive, Piezoelectric, Magnetostrictive and Hall effect sensors - HART and FF Enabled Smart Transmitter - Measurement of Flow, Level, Temperature and Pressure - Design of signal conditioning circuits for sensors.

UNIT - II ***Control System***

Mathematical Modeling and System Analysis: Lumped and distributed parameter models - Nonlinear systern elements - Linearization of nonlinear systems - Transfer functions and state space models - Stability analysis - Lyapunov's method - Controllability and Observability - Transfer Function matrix and state space representation of multivariable systems - Poles and Zeros of MIMO System - Directions in multivariable systems -Singular value decomposition - Relative Gain Array - State Feedback Control - Observer.

UNIT - III ***Process Control***

Basics of process control - Degrees of Freedom - lnteracting and non-interacting systems - Characteristic of ON-OFF, P, P+1, P+D and P+l+D control modes - Reset windup - PID Controller tuning - Cascade control - Feed forward control - Multi-loop PID Controller:-

Decoupling Control - Multivariable PID Controller - DCS - SCADA - PLC programming - Realization of PID Controller using OPAMPs and Embedded system

UNIT - IV *Advanced Control Schemes*

Smith predictor control - Control, Model Reference LOR, LQG,DMC, GPC. IMC - IMC PID Adaptive Control Adaptive control:- Gain Scheduled Adaptive and Self Tuning Controller - Optimal Control.

UNIT - V *State and Parameter Estimation and Soft Computing Techniques*

System identification: Models for Linear and Nonlinear Systems - Prediction Error Method (PEM) - Maximum Likelihood Estimation - Recursive Estimation. State Estimation: Kalman filter. Soft computing Techniques: Artificial Neural Networks: BPN, RNN, RBF- Fuzzy Logic Control - SVM - ANFIS - Genetic Algorithm and Hybrid control schemes.

PIC4001 Applied Electronics Engineering / Electronics and Communication Engineering / Vlsi Design

UNIT - I *Semiconductor Devices, Electronic Circuits*

Biasing , BJTs and MOSFETs, Amplifiers, Low & High frequency analysis, IC MOSFET, Oscillators; ***Analog ICs*** *- A-D & D-A Convertors, Applications of Analog ICs;* ***Digital Electronics*** *- Combinatorial circuits and Sequential circuits*

UNIT - II *Communication*

Line coding, amplitude modulation and demodulation, spectra of AM and FM, PCM, DPCM, digital modulation schemes: amplitude, phase and frequency shift keying (ASK, PSK, FSK), QAM, MAP and ML decoding, TDMA, FDMA and CDMA

UNIT - III *Basics Of Signals And Systems , Digital Signal Processing*

Fourier series and Fourier transform, DFT, FFT, Z-transform, digital filter design techniques; Digital image Processing- Spatial and Frequency domain techniques, image enhancement, Segmentation, Restoration, Compression techniques, Laplace transforms, Zeros, Poles, Stability, Gain Margin, Phase Margin

UNIT - IV *Microprocessor and Micro Controller*

8085 & 8086 Microprocessor architectures - Memory Interfacing and I/O interfacing; ***Embedded Systems*** *- 8051& PIC Microcontroller- Special Function Registers, Interfacing, PIC Development Tools And Programming;* ***VLSI*** *- FPGA architectures*

UNIT - V *Low Power Vlsi*

Power Dissipation, Power Optimization, Low Power CMOS Circuits, Power Estimation, Synthesis and Software Design For Low Power

PIC4002 Biomedical Engineering / Medical Electronics

UNIT - I *Semiconductor Devices, Electronic Circuits*

Biasing , BJTs and MOSFETs, Amplifiers, Low & High frequency analysis, IC MOSFET, Oscillators; ***Analog ICs*** *- A-D & D-A Convertors, Applications of Analog ICs;* ***Digital Electronics*** *- Combinatorial circuits and Sequential circuits*

UNIT - II *Communication*

Line coding, amplitude modulation and demodulation, spectra of AM and FM, PCM, DPCM, digital modulation schemes, amplitude, phase and frequency shift keying (ASK, PSK, FSK), QAM, MAP and ML decoding, TDMA, FDMA and CDMA

UNIT - III *Basics Of Signals And Systems, Digital Signal Processing*

Fourier series and Fourier transform, DFT, FFT, Z-transform, digital filter design techniques, Adaptive Filter Structures; ***Digital image Processing****- Spatial and Frequency domain techniques, image enhancement, Segmentation, Restoration, Compression techniques, Laplace transforms, Zeros, Poles, Stability, Gain Margin, Phase Margin*

UNIT - IV *Biomedical Instrumentation*

Bio Potential Recording, Biomedical Transducers And Amplifiers, Non Electrical Parameter Measurements , Diathermy and Stimulator

UNIT - V *Human Assist Devices*

Scanning Techniques- Heart Lung Machine and Artificial Heart, Cardiac Assist Devices, Artificial Kidney, Prosthetic and Orthotic Devices, Respiratory and Hearing Aids.

PIC4003 Advanced Communication System / Computer And Communication / Communication Systems / Digital Communication and Networking Engineering / Electronics Engineering / Networking Technology / Optical Communication / Wireless Communication

UNIT - I ***Semiconductor Devices, Electronic Circuits***

Biasing , BJTs and MOSFETs, Amplifiers, Low & High frequency analysis, IC MOSFET, Oscillators; ***Analog ICs*** *- A-D & D-A Convertors, Applications of Analog ICs;* ***Digital Electronics*** *- Combinatorial circuits and Sequential circuits*

UNIT - II ***Communication***

Line coding, amplitude modulation and demodulation, spectra of AM and FM, PCM, DPCM, digital modulation schemes, amplitude, phase and frequency shift keying (ASK, PSK, FSK), QAM, MAP and ML decoding, TDMA, FDMA and CDMA

UNIT - III ***Basics Of Signals and Systems, Digital Signal Processing***

Fourier series and Fourier transform, DFT, FFT, Z-transform, digital filter design techniques, Adaptive Filter Structures; ***Digital image Processing*** *- Spatial and Frequency domain techniques, image enhancement, Segmentation, Restoration, Compression techniques, Laplace transforms, Zeros, Poles, Stability, Gain Margin, Phase Margin*

UNIT - IV ***Electromagnetic Theory***

Static Electric & Magnetic Field, Time Varying Electric And Magnetic Fields, Plane EM Waves in Isotropic Media; ***Transmission Line & Wave Guide*** *- Impedence Matching And Transformation, Network Components, Rectangular & Cylindrical Wave Guides; RF- Antennas, antenna types, radiation pattern, gain and directivity, return loss, antenna arrays*

UNIT - V ***Optical Communication***

Optical sources and detectors, fiber types, Dispersion Compensation Schemes; ***Microwave*** *- Passive Microwave Devices And Circuits, Microwave Generation, Microwave Measurements;* ***Wireless communication*** *- Channel Models , Digital Modulation , Multi antenna Communication , Cellular Concepts ; Communication networks - Internet Routing Protocols , Mobile & Adhoc Networks.*

PIC4004 Advanced Computing / Computer Science and Engineering / Distributed Computing System / Information Technology / Main Frame Technology / Multimedia Technology / Pervasive Computing / Software Engineering / System Engineering and Operations Research / Master of Computer Applications (MCA)

UNIT - I *Probability and Statistics*

Random Variables, Probability Distributions, Correlation, Regression, Testing of hypothesis; ***Theory of Computation*** *- Finite State Machine, Pushdown Automata, Context Free Grammar, Turing Machine*

UNIT - II *Data Structures and Algorithms*

Arrays, Lists, Stacks, Queues, Trees, Graphs, Searching and Sorting Algorithms; ***Programming*** *– C, Object Oriented Programming*

UNIT - III *Databases*

Relational Databases, Query Language, E-R modeling, Normalization, Query Processing, Transaction Processing, Integrity and Security; ***Operating Systems*** *– Process Management, Scheduling, Deadlocks, Memory Management, File Systems*

UNIT - IV *Networking*

TCP/IP model, Layers, Functions and Protocols; ***Security*** *– Cryptography, Symmetric Key and Public Key Algorithms;* ***Computer Architecture*** *– Instruction Set Architectures, Arithmetic Operations, Pipelines and Hazards, Caches*

UNIT - V *Software Engineering*

Analysis, Design, Coding, Testing and Maintenance, Metrics, Object Oriented Analysis and Design; ***Web Technology*** *– Scripting Languages, Client-Server Applications, Database Connectivity;* ***Cloud Computing*** *– Virtualization; Big Data Analytics, NoSQL.*

PTE5001 Textile Technology

UNIT - 1 *Fibre Science*

Physical and chemical properties, moisture, tensile, frictional, optical, thermal, electrical properties of fibres; structure investigation techniques; different methods of fibre production, electrospinning; post spinning operations- spin finish application, drawing and heat setting

UNIT - II *Yarn Formation*

Principles of opening and cleaning; theory of carding, drafting and twisting; mechanisms - opening, cleaning and carding; drawing, combing, roving formation and yarn formation; alternative spinning systems; calculations; yarn defects; process control in spinning; structural mechanics of yarn.

UNIT - III *Fabric Formation*

Principles of winding, winding defects and control; warping, sizing, beam preparation; principles of weaving, settings, calculations; fabric defects, process control in weaving preparatory and weaving; fabric structure; principles of shuttleless weaving, mechanisms, calculations; principle and mechanism of weft and warp knitting; principles of non-woven fabric manufacturing.

UNIT - IV *Yarn and Fabric Quality Evaluation*

Fibre, yarn and fabric properties – measurement and analysis; low stress mechanical properties of fabrics – measurement and analysis

UNIT - V *Dyeing and Finishing*

Preparatory process for dyeing, dyeing and printing of different fibres; adsorption isotherms, thermo dynamics of dyeing – dye affinity, activity of dyes, heat of dyeing, entropy; rate of dyeing and half dyeing time; colour measurement and matching; finishes

PTE5002 Textile Chemistry

UNIT - 1 *Fibre Science*

Physical and chemical properties, moisture, tensile, frictional, optical, thermal, electrical properties of fibres; structure investigation techniques; different methods of fibre production, electrospinning; post spinning operations- spin finish application, drawing and heat setting.

UNIT - II Fabric and Garment Quality Evaluation

Fabric properties – measurement and analysis; low stress mechanical properties of fabrics – measurement and analysis

UNIT - III Dyeing

Preparatory for dyeing; basic characteristics of dyes and pigments; classification of dyes and principle of application of dyes; chemistry and technology of application of different dyes; determination of fastness properties; theory of dyeing

UNIT - IV Printing

Methods and styles of printing; printing machines; constituents of printing paste; printing with direct, reactive, acid and disperse dyes; printing with pigments; Instrumental colour assessment and matching.

UNIT - V Finishing

Water and soil repellent finishes; softening finish; antistatic finish; fire retardant finish; antibacterial finish; application of nanotechnology in finishing; assessment of finishes

PTE5003 Apparel Technology / Fashion Technology

UNIT - I *Quality Evaluation of Fabrics and Garments*

Yarn numbering, fabric specification, fabric structure, fabric properties- measurement and analysis, low stress mechanical properties of fabrics- measurement and analysis, fabric inspection-different systems, fabric defect-analysis and control; quality assessment of garments

UNIT - II *Apparel Manufacture*

Standardization of size charts, 3D body scanning; flat pattern techniques, dart manipulation; grading; marker planning- manual and computerised; cut order planning; garment production machinery and work-aids; influence of fabric characteristics on sewing parameters, sewing needle design, sewing thread, trims and accessories

UNIT - III *Clothing Comfort*

Role of wetting and wicking on comfort properties of garments, thermal comfort, body and tactile sensations, comfort perception and preferences, evaluation of moisture comfort, thermal comfort and physiological comfort

UNIT - IV *Speciality Textiles and Garments*

Intimate wear, protective wear and sportswear- selection of fibre and fabric parameters, testing; seamless apparel, stretch pattern development and garment construction; smart garments; garments for hygiene applications; home textiles

UNIT - V ***Production Planning and Control***

Productivity concepts; method study, work measurement; ergonomics; different production systems of garment industry; production planning, line balancing; apparel costing; application of statistics in process control

PTE5004 Nano Science and Nano Technology

UNIT - I

Quantum Mechanics: Basics of quantum mechanics - Time dependent and Time independent Schrödinger equation - Approximate methods - Quantum computation, Nanocomposites: Basics of nanocomposites - Metal based nanocomposites - Polymer based nanocomposites - Nanocomposite from biomaterials - Nanocomposite technology.

UNIT - II

Physics and Chemistry of Materials: Physics aspects - Chemistry aspects - Diffusion and surface defects – Nanostructures - Nanosystems. Synthesis and Processing of Nanomaterials : Mechanical alloying and milling - chemical approaches - physical approaches - nanoporous materials - application of nanomaterials - Deformation processing and metal forming - Microstructural properties - Processing of polymers - powders of metals and ceramics - Processing of functional nanomaterials.

UNIT - III

Physico-chemical and imaging techniques: Optical microscopy - Scanning electron microscopy - Transmission electron microscopy - Atomic force microscopy - Scanning tunneling microscopy - Spectroscopic techniques - Diffraction methods Thermal analysis methods Nanomechanical analysis.

UNIT - IV

Nanomaterials for Energy and Environment: Renewable energy technology- Nanomaterials in fuel cell and storage technology - Hydrogen storage and photocatalysis - Environmental applications & impacts of nanomaterial. Nanoelectronics, NEMS, Nano-sensors and Biosensors: Two-terminal junction transistors - Sensors and actuator characteristics - Memory

devices and sensors – MEMS – Microsystems - Materials for MEMS- Quantum confined materials - Plasmonics – Nanophotonics - Photonic crystals – Biophotonics – Nanofluids.

UNIT - V

Nanostructures in Biological systems and Toxicology: Cellular nanostructures - DNA nanotechnology - Protein and enzyme - Carbohydrates and GLYCO nanoparticles - Lipids and lipid based nanoparticles - Lipid based nanocarriers - Microbes and antibody based nanocarriers - Nanomaterials for drug delivery - Toxicology – Nanotoxicology - Protocols in toxicology studies - Risk assessment and execution

PTE5005 Leather Technology

UNIT - I *Chemistry and Physics of Collagen*

Molecular Structure of Collagen, Chemistry of Collagen and its Distribution, Collagen Crosslinks, Isolation and Characterisation of Collagen, Biosynthesis of Collagen, Collagen Degradation, Physico-Chemical Techniques for Collagenous Matrices.

UNIT - II *Instrumental Methods In Leather Science*

Spectroscopic Techniques, Chromatographic Techniques, Applications of Spectroscopic and Chromatographic methods in Leather Science, Electroanalytical Methods, Principles of Microscopic and other testing methods in Leather.

UNIT - III *Science of Leather Making*

Chemical Principles involved in Pre Tanning operations, Chemistry of Tanning materials, Mechanism of Tanning, Post Tanning and Finishing.

UNIT - IV *Leather and Leather Process Design Engineering*

Speciality Leathers, Cleaner Processing – Beamhouse, Tanning, Post Tanning and Finishing, Advanced Finishing Techniques, Property requirements of various leathers.

UNIT - V *Tannery Waste Management And Engineering*

Physico - Chemical treatment of waste water, Biological treatment of wastewater, Advanced wastewater treatment for the removal of Refractory Organic Compounds, Solid waste disposal, Utilization of tannery solid wastes.

Science and Technology of Leather Chemicals *– leather, auxiliaries, syntans, fatliquors, pigments, binders, plasticizers, feel modifiers*

PTE5006 Footwear Science and Engineering

UNIT - I *Anatomy and Solid Modelling of Foot*

Anatomy of Human Foot, Growth and Deformities, Bio Mechanics, Essentials of Therapeutic Footcare, Solid Modelling.

UNIT - II *Technology of Footwear Manufacturing*

Design and Pattern Development, Cutting, Pre-Closing and Closing, Lasting, Post Lasting and Finishing.

UNIT - III *Footwear Chemicals, Polymers, Components And Accessories*

Polymeric Materials for Footwear Industry, Chemistry & Technology involved in manufacturing of polymeric materials, Modifications of Polymeric Materials for different footwear components, Polymer materials- Properties, Specific uses and testing, Adhesives, Footwear Dressing Chemicals. Footwear - Components, Grinderies and Chemicals, Fasteners, Accessories, Reinforcements.

UNIT - IV *Modern Footwear Styling and Computer Applications In Footwear*

Historical Evaluation and International Trends, Fashion Considerations, Product Development, Presentation Techniques, Fashion Forecast. Computer Aided Design and Manufacture for Footwear - Computer Applications in Footwear Sector, Hardware in CAD, Pattern Engineering, Last Modelling, Advanced Computational Techniques in CAD, Rapid Prototyping

UNIT - V *Technology For Specialty and Non Leather Footwear*

Lasting, Good Year Welted Construction, Stitch down and other Constructions, Sports & Moulded Footwear, Orthopedic & Therapeutic Footwear

PTE5007 Ceramic Technology

UNIT - I *Material 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.

UNIT - II *Processing Ceramics*

Plastic and non plastic raw materials - clay and its types - properties of clay water mixture - size reduction - forming -pressing, extrusion, slip casting – firing. Powder preparation - powder characterization - modern ceramic processing - sintering.

UNIT - III *Glass and Refractory*

Glass- Raw Material - manufacturing - melting forming - annealing - properties - special glasses. Refractories - Types - acidic, basic, neutral - classification - properties - applications - refractories for special application.

UNIT - IV *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.

UNIT - V Advanced Ceramics

Properties and Applications - silica, alumina, zirconia, carbides, nitrides Composites- Types - CMC, PMC, MMC, Reinforcements - fibers, whiskers, particles - properties – applications

PTE5008 Plastic Technology / Polymer Technology / Rubber And Plastics Technology

UNIT - I Polymer Science

Polymers- Functionality of Monomers- Polymerization mechanisms-Industrial polymerization techniques - Molecular weight of polymers and their significance - States of aggregation in polymers - Amorphous polymers - Tg - Factors affecting Tg - Semicrystalline Polymers - Tm - Crystal nucleation and growth - Spherulite formation - Factors affecting crystallinity - Structure Property relationships in Polymers- Classification of Polymers.

UNIT - II *Plastics Materials*

Preparation, Properties and Applications of Polyolefin based plastics- Plastics based on Styrene and acrylates -PVC, Fluoroplastics - Polyamides and polyesters - Natural and synthetic fibers - Thermosets including epoxy and unsaturated poyester resins - Engineering Plastics - High performance and specialty polymers.

UNIT - III *Rubber Materials*

Natural Rubber - Rubber Latex - Synthetic Rubbers - BR, CR, IIR, SBR, NBR, EPM and EPDM - Structure Property relationship and applications of General Purpose Rubbers - Special Purpose Rubbers- Silicone Rubbers - Fluorocarbon and Fluorosilicone rubbers, Polyurethanes and Thermoplastic Elastomers.

UNIT - IV *Polymer Processing and Testing*

Test for Processability - Melt Viscosity - Melt Flow characteristics - Non-Newtonian behaviour -MFI - Gelation and Gel time - Molecular weight studies - Compounding and Mixing processes - Forming Operations - Extrusion, Injection molding, Blow molding, Compression and Transfer molding, Rotational molding, Thermoforming, Calendaring, Reaction Injection Molding - Vulcanization Tests for rubber - Test for Mechanical, Electrical and Optical Properties - Test for durability; Thermal analysis, Spectroscopic and Morphological studies.

UNIT - V *Product Design And Applications*

Effect of Temperature and time on mechanical properties of Polymers - Creep - Stress relaxation - Design of Simple geometries - Spring rates of rubber products - - 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, Applications of polymers in the field of civil, automobile, aeronautical, electronics and biomedical Engg.

PTE5009 Biotechnology / Bioengineering / Biomedical Engineering / Bioinformatics / Biopharmaceutical Technology / Industrial Biotechnology / Microbial technology

UNIT - I *Biochemistry, Cell Biology and Microbiology*

Bonding (covalent and non-covalent bonds), Water, Acid, Base, Buffer and pH, Stoichiometric calculations- Molarity, Molality, Normality etc., Basic thermodynamics, Laws of thermodynamics. Good laboratory practice, Biomolecules- structure and functions, metabolism of carbohydrates, proteins and lipids, Hormonal regulation of metabolism. Membrane structure and function, action potential and transport processes, Prokaryotic and eukaryotic cell structure, cell division , cell cycle and cell signaling and signal transduction. Microbial taxonomy and diversity (bacteria, fungi, virus), microbial nutrition, growth and metabolism, host-microbe interactions, mode of action and resistance to antibiotics, microbial genetics-Mutations – spontaneous and induced, DNA damage and repair mechanisms. Genetic recombination in bacteria – Conjugation, Transformation and Transduction, Principles of microscopy.

UNIT - II ***Molecular Biology and Immunology***

Nucleic acids, DNA Replication, Protein synthesis, regulation of gene expression in prokaryotes and eukaryotes. Recombinant DNA Technology, DNA libraries, PCR, Blotting, Gene sequencing, Gene silencing and genome editing techniques, Signal transduction pathways and their elucidation. Cells of Immune system, types of immunity, Hematopoiesis, Immunoglobulin structure, types and functions, Antigen-Antibody interaction, Hypersensitivity reactions, Autoimmune disorders and Immunology of infectious diseases, Structure and functions of MHC molecules. Monoclonal antibodies and vaccine technology. Cell culture technologies, Regenerative medicine & transplantation technology, Biosafety, Animal Ethics, Reduction in animal uses, Human experiments - basic clearances, Research methodology

UNIT - III ***Statistics and Bioinformatics***

Measures of central tendency and dispersion; Probabiity and Statistics: Mean, median, mode and standard deviation. Probability distributions (Binomial, Poisson and normal); Sampling distribution; parametric and non-parametric statistics; Confidence Interval; Errors; Levels of significance; Regression and Correlation; t-test; Analysis of variance and multiple range tests, chi-square test, experimental design, data transformation. Sequence analysis-types, algorithms, multiple sequence alignment and Phylogeny. Biological databases-DNA and protein. Structure prediction and visualization tools, docking and molecular modeling. Basics of Systems Biology and Linux Operation System. Data mining and analytical tools for genomics and proteomics studies.

UNIT - IV ***Bioprocess Technology and Analytical Techniques***

Enzyme kinetics, Enzyme immobilization, Types of bioreactors, bioreactor scale up, Transport phenomena in bioprocess. Media design and optimization for fermentation process, sterilization kinetics. Fermenter description, Engineering principles of bioprocessing- Upstream and Downstream processing, Bioprocess design and development- Scale-up operations, Microbial production of primary and secondary metabolites and various bioproducts etc. Environmental biotechnology-Pollution, Bioremediation and biodegradation. Theory and instrumentation, of the following: Spectroscopy- Beer Lambert's Law, stokes shift, IR, NMR and Mass Spectrometry, Optical Rotatory Dispersion, Chromatography- Principle, HPLC, HPTLC, GC and hyphenated techniques (LC-MS), TGA, DTA, DSC and XRD, Electrophoresis, Microarray.

UNIT - V Plant and Animal Biotechnology

Totipotency, Regeneration of plants, Plant growth regulators and elicitors, Tissue culture and Cell suspension culture system, Production of secondary metabolites by plant suspension cultures, transgenic plants. Animal cell culture, media composition and growth conditions, Animal cell and tissue preservation, Anchorage and non-anchorage dependent cell culture, Kinetics of cell grow th, Hybridoma technology, Stem cell technology

PSH7009 Applied Plant Science / Biochemistry / Bioinformatics / Botany / Biotechnology / Biomedical Science / Biomedical Instrumentation Science /Biological sciences / Immunology/Clinical Immunology / Genomics /Human Genetics / Life sciences / Microbiology / Molecular biology / Molecular virology / Plant Biology and Plant Biotechnology / Zoology

UNIT - I ***Basic Chemistry and Statistics***

Atoms, Molecules, Atomic number, Mass number, Isotopes, Molecular weight, Equivalent weight, Bonding (covalent and non-covalent bonds), Water, Acid, Base, Buffer and pH, Stoichiometric calculations- Molarity, Molality, Normality etc., Basic thermodynamics, Laws of thermodynamics. Good laboratory practice, Measures of central tendency and dispersion; Probability and Statistics: Mean, median, mode and standard deviation. Probability distributions (Binomial, Poisson and normal); Sampling distribution; parametric and non-

parametric statistics; Confidence Interval; Errors; Levels of significance; Regression and Correlation; t-test; Analysis of variance and multiple range tests, chi-square test, experimental design, data transformation.

UNIT - II *Fundamentals in Biology*

Biomolecules – Chemistry of Carbohydrates, Proteins, Lipids, Nucleic acids and Vitamins. Anatomy *of a cell, cellular organelles and their functions, Membrane properties, transport and protein targeting, hormones and signal transduction, Structure and function of cytoskeleton, tissue and their cellular interactions, Cell cycle and cancer, Prokaryotic cell structure; Central dogma and its regulation, DNA repair, post-transcriptional and –translational processing. Stem cell and their characteristics. Characterization, classification and identification of microbes. Morphology, cultivation and reproduction of microbes in relation to disease and health. Glycolysis, mitochondrial ETC and Oxidative phosphorylation. Carbohydrate, lipid, amino acids and nucleotides metabolism and their regulation. Photosynthesis - Emphasis on mechanisms of electron transport; photoprotective mechanisms; CO2 fixation, Respiration and Nitrogen metabolism - Nitrate and ammonium assimilation; amino acid biosynthesis. Plant hormones - physiological effects and mechanisms of action. Sensory photobiology - Structure, function and mechanisms of action of phytochromes, cryptochromes and phototropins; stomatal movement and biological clocks. Solute transport and photoassimilate translocation - transpiration; mechanisms of loading and unloading of photoassimilates.*

UNIT - III *Immunology*

Immunity-cell classification, tissues and organs of the immune systems, Antigens, epitopes and antibody reactivity, structure of antibodies, Classification and functions. Complement system. Arrangement of Ig genes and their expression and diversity, B - and T - cells development and cytokines. Major histocompatibility complex and their importance. Immune response to infections, classification of allergy, allergens.

UNIT - IV *Recombinant DNA Technology and Bioinformatics*

Restriction and modifying enzymes, Vectors, Selection and screening strategies, Southern, northern and western blot. PCR and its types. Real time PCR-SYBR green, Taqman and

molecular beacons strategies. Gene expression analysis – reverse transcriptase PCR and DNA microarray. DNA sequencing – Basic and next generation DNA sequencing. Gene editing – Zinc finger nuclease, TALEN, CRISPR/Cas nucleases. Reporter assays, Electrophoretic mobility shift assay/Gel shift assay. Sequence analysis-types, algorithms, multiple sequence alignment and Phylogeny. Biological databases-DNA and protein. Structure prediction and visualization tools, docking and molecular modeling. Basics of Systems Biology and Linux Operation System. Data mining and analytical tools for genomics and proteomics studies.

UNIT - V *Analytical Methods*

Spectroscopy techniques – Beer-Lambert's law, UV/visible, florescence, circular dichroism, NMR and ESR. Microscopy – Phase contrast, dark and bright field microscopy, transmission and scanning electron microscopy, Atomic force microscopy, Fundamentals of confocal imaging and flow cytometry. Molecular structure determination methods, mass spectrometry, Analytical Ultracentrifugation: Sedimentation velocity and equilibrium, determination of molecular weights, Theory and principles of Chromatography. Electrophoresis – Agarose, SDS-PAGE and 2D-PAGE.

PTE5010 Biopharmaceutical Technology / Biochemistry / Immunology/ Clinical Immunology/ Microbiology / Pharmaceutical technology / Pharmaceutical chemistry / Pharmacy / Pharmaceutics / Pharmaceutical analysis / Pharmacoinformatics / Pharmacology / Pharmacognosy

UNIT - I *Pharmaceutical Biotechnology*

Biomolecules and its metabolism, genetic code and protein synthesis. Metabolism of enzymes. Classification and identification of microbes, sterilization, Immunology-types of antigens, antigen-antibody interactions, immunization, monoclonal antibody production and vaccine technology. Recombinant DNA technology, Enzyme immobilization and fermentation methods. Production of penicillins and vitamin B12.

UNIT - II *Pharmaceutical Chemistry and Pharmacology*

Bonding (covalent and non-covalent bonds), Water, Acid, Base, Buffer and pH, Stoichiometric calculations- Molarity, Molality, Normality etc., Basic thermodynamics, Laws of thermodynamics. Good laboratory practice, Basics of stereochemistry, structure activity relationships, mechanism of action and synthesis of drugs:Anti-cancer,anti-tubercular,anti-diabetic,anti-hypertensive and anti-microbials. Computer aided drug design and molecular modeling. General pharmacological principles involving types of receptors and drug receptor interaction. Basic concepts of toxicology. Pharmacology of drugs acting on nervous system, cardiovascular, respiratory, gastrointestinal, hemotopoietic and endocrine system.

UNIT - III *Statistics, Pharmaceutical Analysis and Regulatory Affairs*

Measures of central tendency and dispersion; Probabiity and Statistics: Mean, median, mode and standard deviation. Probability distributions (Binomial, Poisson and normal); Sampling distribution; parametric and non-parametric statistics; Confidence Interval; Errors; Levels of significance; Regression and Correlation; t-test; Analysis of variance and multiple range tests, chi-square test, experimental design, data transformation

Principles, instrumentation and applications of spectroscopic methods, Thermal, Electrophoretic, chromatographic and hyphenated techniques. Drugs and cosmetics act, GMP, Schedule Y, Patent, Trademarks, Quality assurance, TQM and Validation. Regulation and dispensing of herbal drugs. Herbal drug standardization: WHO and AYUSH guidelines.

UNIT - IV *Pharmaceutics*

Importance of unit processes in manufacturing-Fluid flow, heat transfer, evaporation,distillation,drying,sizereduction,mixing,filtration,centrifugation,crytallisation,humidity control, refrigeration and air conditioning. ICH guidelines for Stability testing of various pharmaceutical products. Design, formulation, packaging and evaluation of liquid, semi-solid and solid dosage forms. Design, development, production and evaluation of controlled, sustained and targeted drug delivery systems. Conventional herbal formulations like syrups, mixtures and tablets and novel dosage forms like phytosomes.

UNIT - V *Biopharmaceutics and Pharmacokinetics*

Mechanism of drug absorption, Factors affecting drug absorption, distribution and biotransformation. Biopharmaceutical classification system, Invitro-invivo correlation, Comparison of dissolution profiles by model dependent and model independent methods. Bioavailability and bioequivalence studies. Basic concepts of Pharmacokinetics, determination of pharmacokinetic parameters from urine and plasma data after drug administration by Compartment and Non-compartment models, Non-linear Pharmacokinetics

PTE5011 Biochemistry / Food Technology / Food Process Engineering / Food and Nutritional Biotechnology / Food Safety and Quality Management / Food Safety and Quality Assurance / Food Science and Technology / Food Science and Nutrition / Microbiology

UNIT - I Food *Chemistry and Nutrition*

Bonding (covalent and non-covalent bonds), Water, Acid, Base, Buffer and pH, Stoichiometric calculations- Molarity, Molality, Normality etc., Basic thermodynamics, Laws of thermodynamics. Good laboratory practice, Composition of food, nutrient and non-nutrient components of food, water activity and water relations, lipid, carbohydrate, protein, pigments, food additives: their function and application,Food flavours, Enzymes: specificity, simple and inhibition kinetics, coenzymes, enzymatic and nonenzymatic browning. Nutrition: balanced diet, essential amino acids and essential fatty acids, protein efficiency ratio, water soluble and fat-soluble vitamins, role of minerals in nutrition, co-factors, anti-nutrients, nutraceuticals, nutrient deficiency diseases. Chemical and biochemical changes occur in foods during different processing. Food Analysis, Instrumental methods of Food analysis.

UNIT - II *Food Microbiology and Microbial Technology*

Characteristics of microorganisms: morphology of bacteria, yeast, mold and actinomycetes, spores and vegetative cells, gram-staining. Microbial growth kinetics. Food spoilage. Toxins from microbes,bioreactor and upstream processing, fermentation processes: batch, continuous and fed batch, fermented food products (plant and animal-based products), microbial production of food additives viz. preservatives, colorants, flavours. SCP, Food contaminants viz. aflatoxins. Food intoxication, infection.

UNIT - III ***Food Product Processing and Preservation***

Principles and methods of food preservation: thermal processing, canning, chilling, freezing, dehydration, addition of preservatives and food additives, microwave, irradiation, fermentation, hurdle technology, intermediate moisture foods, use of non-thermal technologies, alternate thermal technologies (ohmic heating, dielectric heating, infrared and induction heating), biological technologies (antibacterial enzymes, bacteriocins, proteins and peptides). Food grain processing and products,Fruits and vegetables processing and Preservation, Plantation crops processing and products: tea, coffee, cocoa, spice, extraction of essential oils and oleoresins from spices. Milk and milk products processing, Processing of animal products: Waste utilization: by-products from plant and animal food processing.

UNIT - IV ***Statistics, Food Engineering, Packaging and Labelling***

Measures of central tendency and dispersion; Probabiity and Statistics: Mean, median, mode and standard deviation. Probability distributions (Binomial, Poisson and normal); Sampling distribution; parametric and non-parametric statistics; Confidence Interval; Errors; Levels of significance; Regression and Correlation; t-test; Analysis of variance and multiple range tests, chi-square test, experimental design, data transformation.

Mass and energy balance, Momentum transfer, Heat transfer, Mass transfer, Mechanical operations: size reduction of solids, high pressure homogenization, filtration, centrifugation, settling, sieving, mixing & agitation of liquid. Thermal operations, Mass transfer operations.Principles of refrigeration, cold chain logistics, food plant equipment design Food packaging and storage: packaging materials, recent trends in packaging, principle of package design, nutritional requirements of labelling, aseptic packaging, controlled and modified atmosphere storage, traditional and advanced food storage unit.

UNIT - V ***Food Quality Management/ Safety Regulations***

Objectives and importance of quality control, quality systems and tools used for QA including control charts, acceptance and auditing inspections, CCP, reliability, safety, recall and liability. Food and hygiene regulations. Total quality management and good management practices, HACCP and codex in food. International and National Food laws. USFDA, ISO and FSSAI.

Food adulteration. Sensory evaluation, panel screening, selection methods. Sensory and instrumental analysis in quality control. Non-destructive quality evaluation methods. Food plant sanitation and cleaning in place (CIP).

PTE5012 Chemical Engineering

UNIT - I

Fluid Mechanics, Process Calculations, Chemical Technology, Mechanical Operations

UNIT - II

Thermodynamics, Heat Transfer, Mass Transfer

UNIT - III

Chemical Reaction Engineering , Process Instrumentation Dynamics and Control, Process Plant Safety and Risk Analysis

UNIT - IV

Modern control theory, Process Engineering Economics, Process Equipment Design, Analysis of Transport Phenomena

UNIT - V

Chemical Process Design , Process Modeling and Simulation, Process optimization, Computational methods

PTE5013 Petroleum Refining and Petrochemicals Engineering

UNIT - I

Fluid Mechanics, Process Calculations, Chemical Technology, Mechanical Operations

UNIT - II

Thermodynamics, Heat Transfer, Mass Transfer

UNIT - III

Chemical Reaction Engineering, Process Instrumentation Dynamics and Control, Process Plant Safety and Risk Analysis

UNIT - IV

Petroleum Exploration, Drilling technology, Petroleum Geology, Enhanced Oil Recovery, petroleum production operations, Petroleum refinery engineering, Petrochemicals, Natural Gas Engineering.

UNIT - V

Pipeline Engineering, Modeling and Simulation of Industrial Process, Multi component Distillation, Multiphase Flow, Petroleum Process Equipment Design.

PTE5014 Fire Engineering and Safety Management / Industrial Safety Engineering

UNIT - I *Probability and Reliability*

Probability – random variable, special distributions, sampling, curve fitting, time series analysis, reliability – concept, failure data analysis, prediction models, reliability management, risk assessment –Computer programming and software tools.

UNIT - II *Safety and Risk Assessment in Chemical Industries*

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 – computer aided hazards analysis, hazard, risk issues and hazard assessment, instrumentation, testing, risk analysis quantification and software, consequences analysis, dispersion model analysis and case studies – industrial safety and hazards management.

UNIT - III *Safety Management And Fire Engineering Explosion Control*

Safety, accident investigation and reporting, safety performance monitoring, safety education and training – physics & chemistry of fire, fire prevention and protection, industrial fire protection systems, building fire safety, explosion protection systems – relief systems, toxicology, leaks and leakages – process simulators – fire and explosive control and transport phenomena.

UNIT - IV *Safety in Engineering Industries*

Safety in engineering industry – metals and woodworking machines, guarding, welding and gas cutting, cold forming and hot working, finishing, inspection and testing – safety in material

handling – noise and vibration controls – electrical safety – Industrial safety – measurement and analysis of noise level & vibration, friction & impact sensitivity test – PPE – human factors in process safety.

UNIT - V *Safety Regulations and Fundamentals in Environmental Protection*

Regulations for health, safety and environment – safety management – construction – air pollution control – drinking water standards – environmental pollution control and industrial hygiene, EIA, impact assessment and documentation.

PTE5015 Environmental Science and Technology

UNIT - I

Fluid Mechanics, Process Calculations, Chemical Technology, Mechanical Operations

UNIT - II

Thermodynamics, Heat Transfer, Mass Transfer

UNIT - III

Chemical Reaction Engineering, Process Instrumentation Dynamics and Control, Process Plant Safety and Risk Analysis

UNIT - IV

Unit operations and processes in Environmental Technology , Biological Wastewater Treatment, Separation Processes in Environmental Applications

UNIT - V

Air Pollution Control, Environmental Impact Assessment, Solid and Hazardous Waste Management , Environmental Biotechnology, Modeling of Environmental Systems

PAP6001 Digital Architecture / General Architecture / Landscape 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.

PAP6002 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.

PSH7001 Media Science

UNIT - I *Mass Communication*

Evolution of Visual communication - Visual Elements - Visual analysis- Modern methods of Visual Communication –Films & Genres and their impact on society-Functions of mass media: Mass Society – Socialisation Process – Mass Culture - Landmarks in mass communication- Mass Concepts – Characteristics of Mass Audience- Advertising -PR- Ethics of PR- public broadcasting in India

UNIT - II *Journalism and Current Affairs*

Fundamental values and principles of journalism- different forms & genres- New trends- Duties and Responsibilities- Theoretical approaches & Ethics- Fundamentals of News Reporting -

Developing the news and news values –Press in India -Current Affairs - Aptitude and Reasoning ability

UNIT - III *Electronic Media*

Evolution and Growth of Media - Traditional media & new media -Types of Media: Radio, TV, Film, Print - Digital Media Revolution - Internet History & impacts-Applications of Information and Communication Technologies (ICTs) - Fundamentals of computer hardware and software - Mobile Application - Computer graphics and animation -2D and 3D animation- User interface and experience

UNIT - IV *Research in Communication*

Nature and process of communication- Functions of communication-Theories and Models of communication- Development communication: Role of media in Development communication- communication research: research problem - objectives - variables - sampling - population - qualitative research methods: field observation - focus groups - interviews - case studies - quantitative methods: content analysis - survey research - questionnaire - statistics.

UNIT - V *Trends In Media and Critical Issues*

Media Laws and Human Rights-Environmental science: understanding of ecology and ecological issues - Health and Children Rights in Media – Feministic theories-Media literacy-culture and Media

PSH7002 Applied Mathematics / Mathematics

UNIT - I *Algebra and Graph Theory*

Algebra: Groups, Subgroups, Normal subgroups – Homomorphism– Automorphism – Sylow's theorems with applications – Rings – Euclidean domains – Principal ideal domains - Unique factorization domains - Prime &maximal ideals in commutative rings – Fields – Finite fields. Graph Theory: Graphs and Subgraphs – Degree sequence - Graph representation - Isomorphism – Trees – Connectivity – Eulerian and Hamiltonian graphs – Matching – Independent sets and cliques – Vertex coloring – Planar graphs – Directed graphs.

UNIT - II *Real and Complex Analysis*

Real Analysis: Sequences and series – Uniform convergence – Compactness – Connectedness – Implicit functions – Taylor's theorem – Maxima and Minima for functions of two variables –

Lebesgue Theory. Complex Analysis: Analytic functions – Conformal mapping – Riemann mapping theorem – Homological version of Cauchy's theorem – Residue calculus – Complex Integration – Entire functions – Harmonic functions.

UNIT - III *Functional and Numerical Analysis*

Functional Analysis: Banach Spaces– Hahn Banach Theorem – Open mapping & closed graph theorem –Uniform Boundedness – Hilbert Spaces – Orthonormal bases – Riesz representation theorem – Bounded linear operators. Numerical Analysis: Iterative methods of Gauss Jacobi & Gauss Seidel – Convergence – Lagrange's interpolation and Error estimation – Newton's forward & Backward difference formulae for equidistant points – Numerical differentiation – Newton Cotes formulae, Taylor Series and Euler's Method, Runge-kutta method of 4^{th}order – Finite difference solution of one dimensional heat &wave equations using explicit, implicit methods – Solution of Laplace and Poisson equations in a rectangular region.

UNIT - IV *Mechanics, Calculus of Variations, Differential and Integral Equations*

Mechanics: Kinematics – Dynamics in space – Lagrangian mechanics – Hamiltonian methods – Tensors–Calculus of Variations: Variational problems with fixed boundaries – Sufficient conditions for extremum– Differential and Integral Equations: System of linear ODEs – Fundamental matrix – Strum Liouville problems – Stability for linear system - Bessel's and Legendre's differential equations - Linear first order PDEs – Method of Characteristics – Classification of Second order PDEs – Hyperbolic Equation – Diffusion Equation – Green's function for Laplace equation – Linear integral equations of Fredholm and Volterra type - their iterative solutions – Fredholm alternative.

UNIT - V *Probability and Random Variables*

Axioms of Probability – Conditional Probability – Total Probability – Baye's Theorem – Random variables (Discrete and Continuous) – Marginal and conditional distributions – Transformation of random variables – Central limit theorems –Binomial, Poisson, Normal and Exponential distributions – Moment Generating Functions.

PSH7003 Computer Science / Information Technology

UNIT - I *Discrete Mathematics and Theoretical Computer Science*

Mathematical Logic –Statement Calculus – Predicate Calculus – Normal Forms – Inference Theory – Mathematical Induction – Sets – Relations – Equivalence relations – Functions – Posets – Lattices – Boolean Algebra – Groups –Subgroups and Homeomorphism – Cosets – Normal subgroups – Groups codes – Graphs – Representation of Graphs – Trees – Digital Logic Circuits Gate Level Minimization – Stack – Queues and Lists – Searching – Finite State Automata – Context Free Languages – Pushdown Automata – Turing Machines Model – Sorting Algorithms – Graph Algorithms – NP Completeness.

UNIT - II *Programming Languages and Software Engineering*

Elementary Data Types - Programming in C - Object Oriented Programming - Programming in C++ - Web Programming, Software Process Models - Software Requirements - Software Design - Software Quality - Estimation and Scheduling of Software Projects - Software Testing - Software Configuration Management.

UNIT - III *Databases and System Software*

Database System Concepts and Architecture - Data Modeling – SQL - Normalization for Relational Databases - Enhanced Data Models - Data Warehousing and Data Mining - Big Data Systems – NOSQL-System Software - Basics of Operating Systems- Process Management – Threads - CPU Scheduling – Deadlocks - Memory Management - Storage Management - File and Input/Output Systems – UNIX/Linux Operating Systems.

UNIT - IV Data Communication and Networking

Data Communication - Computer Networks - Network Models - Functions of OSI and TCP/IP Layers - World Wide Web (WWW) - Network Security - Mobile Technology - Cloud Computing and IoT.

UNIT - V *E-Technologies*

E-commerce – Electronic Payment Systems(EPS) - Electronic Data Interchange(EDI – E-Cash E- Business – ERP – Digital Libraries – Geographical Information System (GIS).

PSH7004 Material Science / Physics

UNIT - I *Mathematical Physics*

Vector algebra and vector calculus – Tensor analysis. Linear algebra, matrices, Cayley-Hamilton theorem. Eigenvalues and eigen vectors. Linear ordinary differential equations of

first and second order. Partial differential equations - Special functions. Fourier series, Fourier and Laplace transformations. Green's function techniques and integral equations. Elements of complex analysis, analytic functions; Taylor & Laurent series; poles, residues and evaluation of integrals. Probability theory, random variables, binomial, Poisson and normal distributions. Central limit theorem. Numerical methods: root of functions, interpolation, extrapolation, curve fitting, integration and solving ODEs.

UNIT - II *Classical Physics*

Newtonian mechanics, dynamical systems, dynamics in phase-space – Lagrange's formulation – central force motion and rigid-body dynamics – Hamilton's formulation – Noether's theorem - small oscillations and classical field theory – relativistic mechanics - special relativity. Classical electromagnetism – charged particle in an electro-magnetic field. Thermodynamics and statistical mechanics: Equilibrium thermodynamics – ensembles – quantum statistics – Bose-Einstein condensation – phase transitions.

UNIT - III Quantum Mechanics

Wave-particle duality - Schrodinger equation and operator formalism – exactly solvable bound-state problems: Eigenvalues and eigenfunctions by solving the one dimensional Schrodinger¨ equation; Particle in a box – Rectangular barrier potential – Tunnel effect – harmonic oscillator - rigid rotator – angular momentum – time independent perturbation theory – variation method – WKB approximation – time dependent perturbation theory – many-electron atoms – scattering - relativistic quantum mechanics: Klein-Gordon and Dirac equations – Semi-classical theory of radiation.

UNIT - IV *Solid State Physics*

Structure of crystalline solids – imperfections in solids – diffusion. Mechanical properties of solids – dislocations and strengthening mechanisms – failure – phase diagrams – phase transformations – metal alloys – ceramics – polymer structures - composite materials – corrosion – electrical, magnetic, dielectric, thermal and optical properties of materials – characterization of materials – nanomaterials – nuclear materials. Lasers: emission of radiation – Einstein coefficients – optical resonators – modes and coherence length and types of lasers.

UNIT - V *Electronics And Instrumentation*

Semiconductor devices. Analog electronic circuits: op-amp, mathematical operations, analog computation, filters, oscillators. Voltage regulators. Digital electronics: Types of logic gates,

combinational and sequential circuits, flip-flops, shift-registers, counters, multiplexing and de-multiplexing – microprocessors. Transducers and bridge circuits, instrumentation amplifier, sample-and-hold circuits, impedance matching, signal conditioning and noise reduction, shielding and grounding, lock-in detector, box-car integrator and modulation techniques.

PSH7005 Medical Physics

UNIT- I Basics of Radiation Physics and Radiological Instruments

Atomic Structure - Nuclear Transformation - Radioactivity, radioactive decay - methods and radioactive equilibrium - production of radioisotopes - Interaction of electromagnetic radiation, charged particle and neutron with matter -radiation attenuation coefficients - Radiation dosimetric concepts, radiation quantities and units - Bragg gray cavity theories - Radiation generating equipments - telcobalt - linear accelerators - Brachytherapy units - Principles of radiation detection and measurements - radiation dosimeters and radiation monitors.

UNITS - II Radiation Therapy Physics

Radiation therapy with sealed and unsealed radionuclides -Physics of modern radiotherapy machines - 3D CRT, IMRT, SRS & SRT, IGRT, Cyber knife and proton beam therapy - Radiation dosimetry protocols (TRS 398), calibration of theletherapy equipments - quality assurance of radiotherapy machines - Treatment planning system in radiation therapy- Brachytherapy radionuclide and their ideal properties - LDR, MDR and HDR - pulsed dose rate brachytherapy - source specification and calibration - reference air kerma rate and air kerma strength - Interstitial , Intracavitary, intraluminal and surface mould brachytherapy - montecarlo based source dosimetry - quality assurance of brachytherapy equipments.

UNIT - III *Biological Effects of Radiation*

Physics of radiation absorption - cell survival curves - Fractionation in radiation therapy - dose rate effect - oxygen enhancement ratio (OER) - Relative biological effect (RBE) - Linear Energy Transfer (LET) - molecular mechanism of DNA & chromosomal damage due to radiation - 5 R's of Radiobiology - Bioeffect models - NSD, CRE, TDF and ERD - Hyperthermia - Radio sensitizers - Radio protectors - Effects of radiation on embryo and fetus - Acute and chronic radiation effect and syndrome.

UNIT - IV ***Radiation Hazard Evaluation ond Control***

Basic concepts of radiation protection standards - philosophy behind radiation protection - External radiation protection and internal radiation protection - ICRT recommendations - Radiation dose limits - system of radiological protection - radiation exposure - equivalents dose - effective dose -committed dose - Evaluation of external and internal radiation hazard and control - ALI- DAC - MPBB - Planning and shielding calculation of radiation therapy equipments installations - Transport of Radioactive materials - radioactive waste disposal - radiation emergencies , medical management and legislation.

UNIT - V ***Physics of Medical Imaging:***

Physics of diagnostic radiology - production and properties of X-rays- X-ray tube electrical circuits - tube rating - X-ray film, properties and processing - Intensifying screens - factors affecting radiographic imaging - fluoroscopy - computer tomography (CT) - Magnetic Resonance Imaging (MRI) - Gamma camera - Single photon emission computer tomography (CPECT) - positron emission tomography (PET) - quality assurance of diagnostic equipments - Technetium Generator - Radiopharmaceuticals - Propagation of ultrasound through body tissues - Acoustic impedance - ultrasound scanning modes - double Doppler shift - laser tissue interaction mechanism - optical properties of lasers - medical application of non ionizing radiation.

PSH7006 Chemistry

UNIT - I ***Organic Chemistry***

IUPAC nomenclature of organic compounds, Principles of stereochemistry, conformational analysis, isomerism and chirality, Reactive intermediates and organic reaction mechanisms, Concepts of aromaticity, Pericyclic reactions, Named reactions, Transformations and rearrangements, Principles and applications of organic photochemistry, Free radical reactions, Reactions involving nucleophotic carbon intermediates, Oxidation and reduction of functional groups, Common reagents (organic, inorganic and organometallic) in organic synthesis, Chemistry of natural products such as steroids, alkaloids, terpenes, peptides, carbohydrates, nucleic acids and lipids, Selective organic transformations – chemoselectivity, regioselectivity, stereoselectivity, enantioselectivity, Protecting groups, Chemistry of aromatic and aliphatic heterocyclic compounds.

UNIT - II ***Inorganic Chemistry***

Atomic structure, Chemical periodicity; Structure and bonding in homo- and heteronuclear molecules, including shapes of molecules; Concepts of acids and bases; Chemistry of the main group elements and their compounds - Allotropy, synthesis, bonding and structure; Chemistry of transition elements and coordination compounds – bonding theories, spectral and magnetic properties, reaction mechanisms; Inner transition elements – spectral and magnetic properties, analytical applications; Organometallic compounds - synthesis, bonding, structure and reactivity, Organometallics in homogenous catalysis, Cages and metal clusters; Bioinorganic chemistry – photosystems, porphyrines, metalloenzymes, enzyme catalysis, oxygen transport, electron- transfer reactions, nitrogen fixation. Solidstate chemistry - defects in solids, preparation of solids, properties - conductance, thermal, mechanical, thermoelectric, magnetic - Applications. Nuclear chemistry.

UNIT - III ***Physical Chemistry***

Basic principles and applications of quantum mechanics – hydrogen atom, angular momentum, Variational and perturbational methods, Basics of atomic structure, electronic configuration, shapes of orbitals, hydrogen atom spectra, Theoretical treatment of atomic structures and chemical bonding, Chemical applications of group theory, Chemical thermodynamics, Phase equilibria, Statistical thermodynamics, Chemical equilibria, Electrochemistry – Nernst equation, electrode kinetics, electrical double layer, Debye-Hückel theory, Chemical kinetics – empirical rate laws, Arrhenius equation, theories of reaction rates, determination of reaction mechanisms, experimental techniques for fast reactions, Solids - structural classification of binary and ternary compounds, diffraction techniques, bonding, thermal, electrical and magnetic properties Colloids and surface phenomena, Phase rule.

UNIT - IV ***Analytical Chemistry***

Sampling and error analysis, wet chemical methods of analysis electroanalytical techniques, thermal methods of analysis, separation techniques, basic principles and applications of spectroscopy – rotational, vibrational, electronic, Raman, ESR, NMR, mass spectrometry and mossbauer spectroscopy.

UNIT - V ***Applied Chemistry***

Polymer chemistry, Molecular weights and their determinations, Kinetics of chain polymerization, catalysis and its industrial application, corrosion and its control, coatings, fuel/solar cells, pollution and its control, nanochemistry and technology, environmental chemistry, green chemistry.

PSH7007 Applied Geology / Geology

UNIT - I *Geomorphology and Geological Remote Sensing*

Geomorphic cycle, process of weathering and indices of weathering. Landforms formed by river,wind, glacierand coastal processes. Aerial and space borne remote sensing platforms, Format and structure of multispectral digital image data. Spectral properties of natural and geologic features, image interpretation elements.Role of aerial photographs and satellite images in geomorphic, lithology and structural mapping. Components of GIS, standard GIS packages. Applications of Remote sensing and GIS for mineral and groundwater exploration

UNIT - II *Mineralogy and Petrology*

Physical, chemical and crystallographic characteristics of common rock forming minerals of igneous, metamorphic and sedimentary rocks. Optical properties of rock forming minerals. Formation of igneous rocks, classification, texture and structure, magmatic differentiation, two component systems, solid solution systems, Igneous rocks of ocean basins and lithosphere. Metamorphic rocks-texture, structure, grades of metamorphism, metamorphic facies. Types of sedimentary rocks, sedimentary texture and structures, diagenesis, provenance, heavy minerals and deposition systems. System tracts. Sedimentary basins of India.

UNIT - III *Stratigraphy, Palaeontology and Economic Geology*

Cratons of India, Proterozoic stratigraphy and mineral deposits, Phanerozoic stratigraphy of Spiti, Assam, Kutch, Narmada,Trichinopoly-Ariyalur, and Bengal Basins. Gondwana super group, Siwalik system, Himalayan orogeny, stratigraphy boundaries, and mass extinction in Indian stratigraphy records. Fossil records through Geological time scale, fossil preservation, morphology and significance of body and ichnofossils, molluscs, trilobites, graptolites, brachiopods. Organic mineral walled microfossils. Foraminifera, Ostracoda and dinoflagellates. Gondwana plant fossils. Ore genesis, ores and metamorphism, origin and distribution of metal, non-metal, refractory, abrasives, placer, phosphatic, minerals and coal, petroleum deposits,

nuclear minerals of Proterozoic to recent geological time, strategic, critical and essential minerals.

UNIT - IV *Structural Geology, Geophysics, Geochemistry*

Deformation structures and their characteristics, stress-strainand rheological properties of rocks, structural behaviour of igneous intrusions, petrofabric analysis, joint and shear fractures, Moh's circle and criteria for failure of rocks.Faults, dynamics, and types; folding mechanisms, types and structural analysis. Physical properties of the Earth,electrical, seismic, magnetic and gravity methods of prospecting. Geochemical cycles, Mineral stability, compositional changes in minerals, river and sea waters.Distribution of trace components in rocks and melts and its application in petrogenesis. Goldschmidt's classification of elements. Isotope dating methods.

UNIT - V *Hydrogeology and Engineering Geology*

Darcy's law, aquifer systems, groundwater parameters- confined and unconfined and semi confined aquifers, recharge systems, effect of aquifer boundaries, pumping test, groundwater resource evaluation-unsaturated flow, tracer technique, testing for yield, groundwater quality criteria, source of groundwater contamination, solute and particle transport. Engineering properties of rocks, geological investigations for building, Dam, reservoirs and Tunnel constructions. Landslides- types-causes and prevention.

PSH7008 English

UNIT - I

Chaucer to the Elizabethan Age: *1. Geoffrey Chaucer: Prologue to the Canterbury Tales, 2. Paradise Lost: John Milton Books 4 & 9, 3. Edmund Spenser: The Fairie Queen , 4. John Donne: All poems , 5.Andrew Marvel, 6.Robert Herrick, 7. George Herbert, 8 .Abraham Cowley, 9.Henry Vaughan The University Wits, John Webster, Ben Johnson, Shakespeare's sonnets and plays.*

The Augustan Age:

Pope, Dryden, Thomas Gray, Addison & Steele, Swift, Goldsmith, William Congreve, John Bunyan, Henry Fielding, Oscar Wilde, Samuel Johnson

UNIT - II *The Romantic Ageto the Twentieth Century*

William Blake, William Wordsworth, Samuel Taylor Coleridge, Percy Bysshe Shelley, John Keats, Lord Byron, Sir Walter Scott, Ann Radcliffe, Mary Shelley, Jane Austen, Edmund Burke, William Hazlitt, Charles Lamb, Robert Burns.Thomas Carlyle, the Bronte sisters, Robert Browning and Elizabeth Barrett Browning, Alfred Lord Tennyson, Lewis Carroll, Charles Dickens, George Eliot, Elizabeth Gaskell, Thomas Hardy, Christina Rossetti, Robert Louis Stevenson, Anthony Trollope, Oscar Wilde, Rudyard Kipling, George Bernard Shaw, John Galsworthy, E.M. Forester, G.K. Chesterton, John Masefield, Joseph Conrad, T.S. Eliot, Ezra Pound, D.H. Lawrence. James Joyce, W.B. Yeats, Wilfred Owen, Aldous Huxley, Virginia Woolf,Ted Hughes, Christopher Fry, John Osborne, Harold Pinter

UNIT - III *American Literature*

James Fenimore Cooper, Edgar Allan Poe, Ralph Waldo Emerson, Nathaniel Hawthorne, Herman Melville, Harriet Beecher Stowe, Henry David Thoreau, Henry Wadsworth Longfellow, Mark Twain, Henry James, Emily Dickinson, Walt Whitman, Robert Frost, William Faulkner, F. Scott Fitzgerald, Ernest Hemingway, Herman Melville, J.D. Salinger, John Steinbeck, Eugene O' Neill, Tennessee Williams, Lillian Hellman, E.E. Cummings, Theodore Dreiser, Toni Morrison, Langston Hughes, J.D. Salinger, John Updike, Stephen Crane, Thomas Wolfe, Truman Capote, James Baldwin, Joseph Heller, Vladimir Nabakov. Arthur Miller

UNIT - IV *World Literature*

William Golding, Muriel Spark, Toru Dutt, Rabindranath Tagore, George Orwell, Kingsley Amis, Salman Rushdie, V.S. Naipaul, Vikram Seth, Timothy Mo, Kazuo Ishiguro, Ben Okri, BuchiEmecheta, William Trevor, Margret Drabble, Nadine Gordimer, AmitavGhosh, RohintonMistry, SashiTharoor, Arundathi Roy, John Barth, Margret Atwood, Ian Mcewan, Chinua Achebe, Wole Soyinka, Dylan Thomas, Ted Hughes, Sylvia Plath, Samuel Beckett, NgugiwaThiong'o, Bessie Head, Patrick White, DavidMalouf, R.K. Narayan, Amrita Pritam, GirishKarnad, JhumpaLahiri, KiranDesia, NayantaraSehgal, MeenaKandasamy, Anita Nair, Kamala Das, IsmatChugthai, Mahasweta Devi, SashiDespande. Amiri Baraka, David Henry Hwang, Tony Kushner

UNIT - V *English Language Teaching and Linguistics*

Major approaches and methods in language teaching – Theories of learning:Behaviorism, Cognitivism, Constructivism –Current trends in ELT, Krashen's five hypotheses of second language acquisition: a) Acquisition-Learning Hypothesis, b) Monitor Hypothesis, c) Natural Order Hypothesis, d) Input Hypothesis, and e) Affective-Filter Hypothesis – Merrill Swain's output hypothesis – Richard Schmidt's noticing hypothesis – Applied Linguistics: Discourse analysis, Contrastive analysis, Error Analysis, Curriculum versus Syllabus – Principles of Syllabus Design –Types of Syllabus – Bangalore Project by N.S. Prabhu on procedural syllabus – Bridge course Syllabus – English for Specific Purposes (ESP) –Types of ESP: English for Academic Purposes, English for Occupational Purposes, English for Science and Technology, and Business English, Assessment versus evaluation – principles of testing – formative and summative assessments – norm-referenced and criterion-referenced tests – types of tests – wash back effect in testing - feedback in testing – current trends in language testing, Issues in neurolinguistics; social and psychological factors in second language learning; language pathology and disorders- aphasia, anomia, and dyslexia; stuttering; use of linguistics in diagnosis and prognosis of language disorders- therapeutic intervention.-Harry Whitaker-(Seminal work-Brain and Language)

PMS8001 Master of Business Administration with any specialization

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.