Association of Management of Coimbatore

Anna University Affiliated Colleges

M.E./M.Tech Common Entrance Test-2010

SYLLABUS

5.1 Syllabus for Entrance Test

PART – I

ENGINEERING MATHEMATICS (Common to all Candidates)

i)   Determinants and Matrices: Solving system of equations – Rank of the Matrix – Eigen values and eigenvectors – Reduction of quadratic form to canonical form.

ii)   Calculus and Differential Equations : Partial derivatives – Jacobians – Taylor's expansion – Maxima and Minima. Linear ordinary differential equations with constant coefficients – Simultaneous first order linear equations with constant coefficients. Formation of partial differential equation (PDE) – Solution of first order PDE – Solution of linear higher order PDE with constant coefficients.

iii)   Vector Calculus : Double and triple integrations and their applications – Gradient, Divergence, Curl and Laplacian – Green's, Gauss divergence and Stroke's theorem.

iv)   Functions of Complex Variables and Complex Integration : Analytic functions – Conformal Mapping – Bilinear transformation – Cauchy's integral theorem and integral formula – Taylor and Laurent Series – Singularities – Residues – Residue theorem and its applications.

v)   Transforms : Laplace Transform – Inverse transforms – Application to solution of linear ordinary differential equations with constant coefficients. Fourier integral theorem – Fourier transform pair – Sine and Cosine transforms. -transform – Inverse Z–transform – Solution of difference equations using Z– transform.

vi)   Numerical Methods : Solution of linear system by direct and iterative methods – Interpolation and approximation – Numerical Differentiation and Integration – Solving Ordinary Differential Equations.

vii)   Applied Probability : Probability and Random variables – Standard Discrete and Continuous distribution – Moments – Moment generating function and their properties. Two-Dimensional Random Variables – Covariance – Correlation and Regression.

PART – II

BASIC ENGINEERING & SCIENCES (Common to all Candidates)

i)   Applied Mechanics : Law of Mechanics – Lame's theorem – Forces, Moments and Couples

– Displacement, velocity and Acceleration – Friction – Moment of Inertia.

ii)   Mechanical Engineering : Laws of thermodynamics – Open and closed systems – Equation of state – Heat and Work.

iii)   Physics : Sound – Latices – Ultrasonic flaw detector – X-ray radiography – Interference Fringes – Planck's quantum theory – Laser and Fibre Optics.

iv)   Material Science : Fracture – Magnetic and Dielectric materials – Conductor and Semi conductor materials – Ceramic and Super conductor materials.

v)   Civil Engineering : Fluid Statics and Dynamics – Boundary Layer – Pumps and Turbines – Environmental Pollution.

vi)   Electrical Engineering : Ohm's law – Kirchoff's law – A.C. circuits – D.C. machines – Transformers – Synchronous machines – Instrumentation.

vii)   Computers : Computer organization – Architecture – Arrays – Pointers – User defined function – C program.

iii)   Chemistry : Adsorption – Chromatography – Chemical kinetics – Electrochemistry – Spectroscopy – Fuels and Combustion.

PART - III

1. CIVIL ENGINEERING & GEO INFORMATICS

i)   **Structural Engineering Division :** Mechanics: Stress-Strain Relationships – Principal stresses and Principal strain in two dimension and three dimension. Composite Bars – Composite Beams – Elastic Constants. Beams and Bending – Shear Force and Bending Moment Diagrams – Flexural and Shear Stresses. Slope and Deflection of Beams. Thin and Thick Cylinders. Torsion. Theories of Failure – Unsymmetrical Bending – Curved Beams – Theories of Columns. Combined Direct and Bending Stresses. Structural Analysis: Static and Kinematic Indeterminancy – Energy Principles – Deflection of pin jointed plane frames – rigid frames. Classical Method of Analysis of indeterminate structures (Slope deflection and Moment Distribution) – Matrix Method. Arches and Suspension Bridges – Influence Line for Determinate and Indeterminate Structures. Plastic Analysis of Structures. Building Materials: Cement - Concrete – properties of ingredients- Mix Design- Quality Control- Special Concrete – Concreting Methods- Brick – Brick Masonry – Stone – Timber – Steel. Concrete Structures: Design Methods – Limit State Design for beams, slabs, columns and footings – retaining walls – Water Tanks. Prestressed Concrete – Principles – Methods – Losses – Deflection – Design. Steel Structures: Steel Sections – Connections – Design of Tension and Compression Members – Beams, Column Bases – Plate Girders and Trusses.

ii)   **Soil Mechanics And Foundation Engineering :** Soil Mechanics: Nature of soil – phase relationships – Soil classification; Soil water – static pressure – effective stress principle; permeability – seepage; Stress distribution in soil – Consolidation (Terzaghi's one dimension consolidation theory); Compaction shear strength of soil – Mohr – Coulomb theory – determination

of shear strength by different methods; Slope stability analysis – protection measures. Foundation Engineering: Site investigation – scope and objectives – drilling techniques – depth and spacing of boreholes – sampling Techniques – penetration tests (SPT and SCPT) – plate load test – selection of foundation; Foundation types – shallow foundation – bearing capacity (Terzaghis Theory and BIS formula) – allowable bearing pressure – bearing capacity from field tests – settlement of foundation – allowable settlement – Codal provisions; Design of foundations – Isolated, combined and raft foundation; Pile foundations – static and dynamic pile driving formulae (Engineering News and Hiley method) – Pile groups – capacity and settlement – Codal provisions – pile load test – negative friction on piles; Earth pressure theories – Earth pressure on retaining walls – stability analysis of retaining wall.

iii) **Transportation Engineering :** Highway Planning: Road Classification, Geometric Design of Highways, Construction of Earth, WBM, Bituminous and concrete roads, Design of flexible and rigid pavements. Drainage of roads, maintenance of roads. Railways, Airways, Docks and Harbour Planning: Railway alignment, components of permanent way, geometric design Airport planning, components of airport, site selection, planning for terminal building, runways. Harbour planning, components of harbour, inland water transport. Traffic Engineering: Traffic characteristics, Traffic surveys, Traffic Signals, Road markings and signs.

iv) **Water Resources Engineering :** Fluid Mechanics and Hydraulics: Properties of fluids. Fluid statics and relative equilibrium. Basic concepts of fluid flow - kinematics and dynamics. Concept of system and control volume application to continuity, momentum and energy equations. Dimensional analysis and model studies. Laminar and turbulent flow through pipes. Boundary layers. Steady uniform and gradually varied flow in open channels. Rapidly varied flows. Turbines and pumps and positive displacement pumps. Hydrology and Ground Water: Hydrometeorology. Hydrologic cycle. Precipitation and its measurements. Abstractions. Runoff estimation. Hydrograph analysis. Unit Hydrograph. Hydrologic extremes floods and droughts. Rainwater harvesting. Properties of aquifer. Groundwater development. GEC norms. Well hydraulics. Steady and unsteady flows. Ground water quality. Irrigation Engineering: Irrigation system. National water policy. Components of irrigation network. Design of lined and unlined channels. Waterways, head works, gravity dams and spillways. Design of weirs on permeable foundation. Soil water relations. Crop water requirements. Irrigation scheduling and methods. Duty, delta and base period. Irrigation water quality. Irrigation water management. Participatory approach.

v) **Environmental Engineering :** Water and Waste water Engineering: Water requirements; water demand, quality standards; Development of water supply source, conveyance system; basic unit processes and operations for water treatment; water distribution; sewage characteristics; sewage treatment, primary and secondary treatment of sewage, sludge disposal, sewage disposal. Air Pollution and Control: Types of pollutants, their sources and impacts, air pollution meteorology, air pollution control, air quality standards and limits. Noise Pollution and Control: Impacts of noise, permissible limits of noise pollution, measurement of noise and control of noise pollution. vi) Surveying And Remote Sensing : Surveying: Chain survey-traversing-plotting: compassesbearings - plane table-leveling-bench marks-temporary and permanent adjustments-reduction: contouring and volumes-theodolites - Gale's table-lay out - setting out works-curve ranging-mine

surveyingtecheometric survey-triangulation-base line-corrections-trigonometric leveling - errors and sourcesclassification of errors-equation-level nets-astronomical survey-practical astronomy-photogrammetry- EDM-hydrographic survey-river. Electronic survey- infrared EDM-microwave system-modern positioning systems - trilateration. Remote Sensing: Satellite system- EMR interaction with each feature, spectral signature – image characters -interpretation keys- Image enhancement, filters, classification.-accuracy assessment-thematicmaps. GIS and Cartography: Cartography-map projection-map design-map compilation-generalization-map production- software and hardware GIS-data types-data base types-raster and vector-topology-data input-data analysis-DEM and TIN-data output-applications.

2. EARTH SCIENCES

i) **Physical Geology and Geomorphology :** Weathering process, kinds, products. Internal structure of the earth, fundamentals of plate tectonics. Landforms produced by River, winds, glacier and sea. Drainage pattern, Drainage Index , geomorphic features.

ii) **Mineralogy, Petrology, Stratigraphy, Paleontology and Structural Geology :** Physical properties of Industrial minerals classification, origin and description of Igneous, sedimentary and Metamorphic rocks. Origin of Himalayas major earth geological events through time scale. Origin of life, types of fossils evolution of mammals & Man. Joints, Folds, Faults and structures.

iii) **Economic Geology, Ore Geology, Geochemistry :** Origin, occurrence and distribution of Economic mineral deposits-Iron, manganese, gold, zinc, graphite, lead, coal and petroleum deposits. Ore-dressing, ore-reserves, estimation. Major elements, application in environmental studies REE-its implication in genesis/ provenance of rocks.

iv) **Remote Sensing, Geophysics and Hydrogeology :** Sensors & Platforms- Indian Remote Sensing – Spectral system characterizes of rocks & minerals – Photo geology – Photogrametry - Hydrogeology – Groundwater – occurrence, movement, Aquifer, field parameters & Lab methods of estimations.

v) **Engineering Geology, Environment Geology and Marine Geology** : Engineering properties of Rock. Geological investigation required for Dam, Tunnel, highways and building constructions. Renewable and non-renewable resources, pollution. Continental and marine environmental studies. Ocean features, physical, chemical & biological resources of the ocean.

3. MECHANICAL, AUTOMOBILE & AERONAUTICAL ENGINEERING

i) **Mechanics :** Statics of Particles, Equilibrium of Rigid Bodies, Properties of Surfaces and Solids, Dynamics of Particles, Friction and Elements of Rigid Body Dynamics – Basics of Mechanisms, Kinematics of Linkage Mechanisms, Kinematics of Cam Mechanisms, Gears and Gear Trains, Friction, Force Analysis, Balancing and Vibration.

ii) **Strength of Materials and Design :** Stress, Strain and Deformation of Solids, Transverse Loading on Beams and Stresses in Beams, Deflection of Beams, Energy Principles, Thin cylinders

and spherical resells Torsion - Fundamentals of Design for Strength and Stiffness of Machine Members, Design of Shafts and Couplings, Design of Fasteners and Welded Joints, Design of Springs and Engine Parts, Design of Engine parts, Bearings and Flywheels, Design of Transmission Systems for Flexible Elements, Spur Gears and Parallel Axis Helical Gears, Bevel, Worm Gears and Crossed Helical Gears, Design of Gear Boxes, Design of Cam, Clutches and Brakes.

iii) **Material Science and Metallurgy** : Constitution of Alloys and Phase Diagrams, Heat Treatment, Ferrous and Non ferrous Metals, Non-Metallic Materials, Mechanical Properties and Testing, Crystal Defects and Strengthening of Materials Conducting and Semiconducting Materials, Magnetic and Dielectric Materials, Nuclear Physics, Superconducting and New Engineering Materials.

iv) **Thermodynamics :** Basic Concepts and First Law, Second Law, Entropy and Availability, Properties of Steam, Psychrometry, Ideal and Real Gases and Thermodynamic Relations, Fuels and Combustion, - Gas Power Cycles, Stream Turbines, Internal Combustion Engines, Internal Combustion Engines Testing and Performance, Gas Turbines, - Steam Nozzle, Air Compressor, Refrigeration and Air-Conditioning, Boilers, Cogeneration and Waste Heat Recovery.

v) **Heat Transfer** : Conduction, Phase Change Heat Transfer and Heat Exchangers, Radiation, Mass Transfer- Refrigeration Cycle, Refrigerants, System Components and Balancing, Psychrometry, Air Conditioning Systems, Unconventional Refrigeration Cycles.

vi) **Production Technology :** Foundry Technology, Hot & Cold Working, Forging, Advances in Forming Process, Principles and Applications of Joining Processes, Theory of Metal Cutting, Centre Lathe and special Purpose Lathes, Reciprocating Machines, Milling Machines and Gear Cutting, Abrasive Process, Broaching, CNC Machine Tools and Part Programming.

vii) **Automotive Engines :** Engine Construction and Operation, SI Engine Fuel System, Cooling and Lubrication System, Combustion and Combustion Chambers, Two Stroke Engines, Diesel Engine Basic Theory, Fuel Injection System, Air Motion, Combustion and Combustion Chambers, Supercharging and Turbo charging, Diesel Engine Testing and Performance.

viii) **Automotive Transmission and Pollution :** Clutch and Gear Box, Hydrodynamic Drive, Planetary Gear Boxes, Automatic Transmission Applications, Hydrostatic and Electric Drive - S.I. Engine Combustion and Emissions, CI Engine Combustion and Emissions, Control Techniques for Reduction of SI and CI Engine Emission, Test Procedure & Instrumentation for Emission Measurement and Emission Standards.

ix) **Aerodynamics :** Basic Fluid Mechanics, Two Dimensional Inviscid Incompressible Flow, Airfoil Theory, Subsonic Wing Theory, Laminar and Turbulent Flow, Fundamental Aspects of Compressible Flow, Shock and Expansion Waves, Two Dimensional compressible Flow, High Speed Flow Over Airfoils, Wings and Airplane Configuration.

x) **Aerospace Propulsion :** Fundamentals of Gas Turbine Engines, Subsonic and Supersonic Inlets for Jet Engines, Centrifugal and Axial Flow Compressors, Combustion Chambers for Jet Engines, Turbines for Jet Engines, Nozzles for Jet Engines, Ramjet Propulsion, Hypersonic

Airbreathing Propulsion, Chemical Rocket Propulsion, Advanced Propulsion Techniques.

4. ELECTRICAL&ELECTRONICS ENGINEERING AND INSTRUMENTATION ENGINEERING

i) Electrical Circuits and Fields : KCL, KVL, Nodal & Mesh analysis, transient response of D.C and A.C networks; sinusoidal steady-state analysis; resonance in electrical circuits; concepts of ideal voltage and current sources, network theorems, driving point admittance and transfer functions of two port network, three phase circuits; Fourier series and its application; Gauss theorem, electric field intensity and potential due to point, line, plane and spherical charge distribution, dielectric, capacitance calculations for simple configurations; Ampere's and Biot-Savart's law, inductance calculations for simple configurations.

ii) Electrical machines : Single phase transformer-equivalent circuit, phasor diagram, tests, regulation and efficiency; three phase transformer-connections; auto transformer; principles of energy conversion, windings of rotating machines: D.C generators and motors-characteristics, starting and speed control, armature reaction and commutation; three phase induction motors-performance characteristics, starting and speed control; single-phase induction motors; synchronous generators- performance, regulation; synchronous motors-starting characteristics, applications, synchronous condensers; fractional horse power motors; permanent magnet and stepper motors.

iii) Power Systems : Electric power generation – thermal, hydro, nuclear; transmission line parameters; steady-state performance of overhead transmission lines and cables and surge propagation; distribution system, insulators, bundle conductors, corona and radio interferences effects; per-unit quantities; bus admittance and impedance matrices; load flow; voltage control and power factor correction; economic operation; symmetrical components, analysis of symmetrical and unsymmetrical faults; principle of over current, differential and distance protections; concepts and solid state relays and digital protection; circuit breakers; principles of system stability-swing curves and equal area criterion.

iv) Control systems : Principles of feedback; transfer function; block diagram; steady-state errors; stability-Routh and Nyquist criteria; Bode plots; compensation; root loci; elementary state variable formulation; state transition matrix and response for Linear time Invariant systems.

v) Power Electronics and Drives : Semiconductor power devices-diodes, transistors, thyristors,triacs, GTO, MOSFETs and IGBTs-static characteristic and principles of operation; triggering circuits; phase control rectifiers; bridge converters-fully controlled and half controlled; principles of choppers and inverters, basic concepts of adjustable speed dc and ac drives.

vi) Digital Electronics : Digital Logic Theory: Number systems-Combinational logic circuits-Minimization of Boolean functions-IC families-Arithmetic circuits, Multiplexer & decoders-

Sequential circuits-Flip flops, counters, shift registers, Schmitt trigger, timers and multivibrators. Microprocessor : General 8 bit microprocessor Architcture-8085, 8086 processor – Architecture, Memory, I/O interfacing, Instruction set, Addressing modes, Timing diagram & delays, Machine cycles, Interrupts, counters, Assembly language programming. Microcontrollers: 8 bit microcontroller – 8051 architecture, bus configuration, Instruction sets, programming & applications.

vii)   Digital Signal Processing : Analog signals-sampling & Aliasing-Discrete time signals & systems- LTI systems- Convolution sum-Difference equation representation-Z Transform & its Inverse-Discrete Fourier series & Fourier transform-Radix 2 FFT – Decimation in me and frequency- Inverse DFT using FFT-Analog Butterworth & Chebyshev filter design-IIR & FIR filter design and Realization.

viii)   Computer Control of Processes, Networks : State models and state equations-controllability & observability-pole assignment-discrete data system – state space representation-stability-data hold, Z & modified Z transform – Pulse transfer function-programmable logic controllers. Data networks-switching OSI, Data link control, Media access protocol-BISYNC, SDLC, HDLC, CSMA/CD, TCP/IPBridges, routers, gateways, Ethernet and Arcnet configuration.

ix)   Communication Engineering : Modulation and demodulation systems – Types of transmission lines – losses – standing waves – Ground wave and space wave propagation – Digital communication concepts – Data Communication codes, serial and parallel interface – Network protocol – Types of satellites – Advantages of optical fibre communication.

x)   Measurements, Instrumentation and Transducers : Measurement of R, L and C-Bridges, potentiometers & galvanometers- Measurement of voltage, current, power, power factor and energy-Instrument transformers, Q meter, Waveform Analyzers – Digital voltmeter, multimeter-Time, phase and frequency measurements-Oscilloscope – display and recording devices – Noise and interference in Instrumentation.

xi)   Industrial Instrumentation : Measurement of displacement, stress, strain, force, torque, velocity, Acceleration, Shock, vibration, humidity, viscosity & density- Pressure, temperature, flow & level measurement.

xii)   Analytical Instrumentation : Spectro Photometers-Spectral methods of analysis-source detectors and applications – Ion conductivity-sampling systems, ion selective electrodes, conductivity and pH meters- Analyzers – Chromatography – NMR & X ray spectroscopy – GM and proportional counters- Mass spectrometer.

Units and standards-Calibration methods-Errors-Transducer classification, static characteristics, mathematical mode, zero, I and II order transducers – Response to different inputs-variable Resistance, Inductance and capacitance transducers-Piezo electric, Magnetostrictive, IC and smart sensors- Digital, Fibre optic, Hall effect and feedback transducers.

5. ELECTRONICS AND COMMUNICATION ENGINEERING

I.   Circuit Analysis: DC Circuit analysis, Thevenin's and Norton's equivalent circuits, Sinusoidal steady state analysis, Transient and resonance in RLC circuits. Electronic Devices: Diodes, Bipolar Junction Transistors, FET, MOSFET, UJT, Thyristor. Electronic Circuits: Small signal amplifiers using BJT and FET devices, Large signal amplifiers, Power supplies, Feed back amplifiers, Oscillators, Pulse shaping circuits. Digital Electronics: Logic gates, Combinational circuits, Sequential circuits. Linear Integrated Circuits: Operational amplifiers and its applications, PLL, Voltage regulators, A/D and D/A converters. Measurements and Instrumentation: Transducers, Digital Instruments, Display and Recording systems. Microprocessor and its applications: Microprocessors-8085 and 8086 architectures and interfaces, Micro-controller and applications.

II.   Electromagnetic Fields: Static Electric and Magnetic fields, Time varying Electric and Magnetic fields, Maxwell equations. Transmission Lines and Networks: Transmission line equations, impedance matching, Filters. EM waves and waveguides: Guided waves, Rectangular and cylindrical waveguides. Antennas and Propagation: Aperture antennas, arrays, Propagation of radio waves. Microwave Engineering: Microwave tubes, semiconductor devices, Passive components, Microwave measurements.

III.   Communication Theory and Systems: AM, FM and PM, Sampling and Quantization, PCM, DM, ADM, Multiplexing. Digital Communication: Base band signaling, Band pass signaling, Error control coding, Spread spectrum techniques. Computer Communication Networks: Definition of layers, data link protocols, Network interconnection. Message routing technologies, End-End protocols. Optical Communication: Optical Fibers, optical transmitters and receivers.

IV.   Signals and Systems: Continuous time signals and systems-Fourier Transform, Laplace transform, Discrete time signals and systems-DTFT, DFT, Z-Transform. Digital Signal Processing: IIR and FIR filters, Realization and implementation, Quantization effects. Control Systems: Transfer function, Time and frequency response analysis, Stability analysis, state variable analysis

6. PRODUCTION AND INDUSTRIAL ENGINEERING

i)   Basic Mechanisms and Elements of Design : Mechanisms, Friction, Gearing and Cams, Balancing, Vibration, Fundamentals of Design, Design of Basic Machine Elements, Design of Mechanical drives, Design of Automotive components, Recent Advances.

ii)   Casting, metal forming and metal joining processes : Casting Processes, Welding Processes, Special Casting Processes, Testing of Castings & Weldments - Fundamentals of Metal Forming, Forging and Rolling, Extrusion and Drawing Processes, Sheet Metal Forming Processes, Recent Advances, Mechanisms, Friction, Gearing and Cams, Balancing, Vibration, Fundamentals of Design, Design of Basic Machine Elements, Design of Mechanical drives, Design of Automotive components, Recent Advances.

iii)   Tool Engineering, Machine tool operation, Metrology and Inspection : Mechanics of Metal Cutting, Tool Material, Tool Wear and Tool Life, Gear Manufacture, Concept & Programming of CNC machines, Advanced CNC programming & Tooling - General Concepts of measurements, Linear and Angular measurements, Measurement of Surface Finish Measuring

Machines, Metrology of Screw Thread & Gears, Computer Aided Inspection and Laser Metrology - Strength and rigidity of machine tool structures, Slideways, Spindles and spindle supports, Machine Tool Dynamics.

iv) **Engineering Materials, and Computer Aided Manufacturing :** Introduction and Constitution of Alloys and Phase Diagrams, Heat Treatment, Ferrous and Non Ferrous Metals, Mechanical Properties and Testing, Welding and Foundry Metallurgy, Manufacturing Processes for Plastic, Mechanical, Chemical and Electro-chemical energy based processes, Electrical Energy based Waste Processes, Thermal Energy Process, Rapid Prototyping and Rapid Tooling – polymer Matrix Composites, Metal Matrix Composites, Ceramics Matrix Composites, Advances in Polymers & Composites.

v) **Product and Process Design, Design of Jigs and Fixtures and Press Tools :** Computer Aided Design, Computer Graphics Geometric Modelling, Product Design Concepts, Recent Advances, Process Planning, Estimating, Costing and Elements of Cost, Analysis of Overhead Expenses, Estimation of Costs for Forging, Casting and Welding, Estimation of Machining Time, Purpose Types and Functions Of Jigs and Fixtures, Jigs, Fixtures, Press working Terminologies and Elements of dies and Strip Layout, Design and Development of Dies.

vi) **Operations Research :** Linear Programming, LP Extensions, Networks, Inventory Models, Dynamic Programming, Decision Analysis, Game Theory, Waiting Line Models, Markov Processes.

vii) **Operations Management :** Forecasting, Aggregate Planning, Capacity Management, Production Activity Control, Estimation and Costing, Product Cost Estimation, Software Cost Estimation, Costing Methods, Cost Analysis for Planning and Control.

viii) **Quality Control Reliability and Maintenance :** Quality Concepts, Statistical Process Control, Process Capability Analysis, Advanced Control Charts, Acceptance Sampling, Reliability Concepts, Failure Data Modeling, Reliability Prediction and Modeling, Reliability Management, Risk Assessment, Maintenance Concept, Maintenance Models, Maintenance Logistics, Total Production Maintenance, Fault Diagnosis.

7. COMPUTER SCIENCE AND ENGINEERING AND INFORMATION TECHNOLOGY

i) **Applied Probability And Operations Research :** Random Processes, Probability Distributions, Queuing Models and Simulation, Testing of Hypothesis, Design of Experiments.

ii) Discrete Mathematical Structures : Formal Language and Automata - Graph Theory.

iii) **Compiler Design :** Optimization – Code Generation – Implementation – Principles of Programming Languages – Programming Paradigms.

iv) **Operating Systems And System Software :** Process Management, Storage Management, I/O Systems, Design and Implementation of LINUX OS, assemblers, Loaders, Linkers, Macro Processors.

v) **Distributed Systems :** Communication and Distributed Environment, Distributed Operating

Systems, Distributed Shared Memory, Protocols, Fault Tolerance and Distributed File Systems, Distributed Object Based Systems.

vi)   Programming And Data Structures : Problem Solving Techniques, Trees, Hashing and Priority Queues, Sorting, Graph, Heap Search.

vii)   Algorithm Analysis And Design Techniques : Dynamic Programming, Greedy Algorithms, Advanced Algorithms, NP Completeness and Approximation Algorithms.

viii)   Microprocessors And Microcontrollers - Computer Architecture And Organization : Digital Fundamentals, Combinational Circuits, Synchronous and Asynchronous Sequential Circuits, Instruction Set Architecture(RISC,CISC,ALU Design), Instruction Level Parallelism, Processing Unit and Pipelining, Memory Organization.

ix)   Digital Signal Processing : FFT, Filter Design.

x)   Computer Networks : Data Communication Systems, Applications.

xi)   Database Management Systems : Relational Model, Database Design, Implementation Techniques, Distributed Databases, Object Oriented Databases, Object Relational Databases, Data Mining and Data Warehousing.

xii)   Software Engineering Methodologies : Software Product and Processes – Software Requirements Management - Requirement Engineering, Elicitation, Analysis, Requirements Development and Validation, Requirements Testing - Object Oriented Analysis And Design – Modular Design, Architectural Design, User Interface Design, Real Time Software Design, System Design, Data acquisition System - Software Testing And Quality Assurance - SQA Fundamentals, Quality Standards, Quality Metrics, Software Testing Principles, Defects, Test Case Design Strategies, Software Quality and reusability, Software Project Management, Software Cost Estimation, Function Point Models, Software Configuration Management, Software Maintenance.

xiii)   Artificial Intelligence : Intelligent Agents, Search Strategies, Knowledge Representation, Learning, Applications.

xiv)   Mobile Computing : Wireless Communication Fundamentals, Telecommunication Systems,Wireless Networks.

xv)   Security In Computing : Program Security, Security in Operating Systems, Database and Network Security, Scientific Computing, Information Coding Techniques, Cryptography, Network Security.

8. CHEMICAL ENGINEERING, CERAMIC TECHNOLOGY AND BIOTECHNOLOGY

i)   Fluid Mechanics and Particle Technology : Classification of fluids, flow patterns, manometry, continuity equation, Navier-Stokes' equation, Bernoulli equation, Dimensional analysis, Flow through pipes, Boundary layer concepts, Flow through fixed and fluidized beds, pumps – classification affinity laws, performance curves. Characteristics of solids, size analysis, Screening, Storage, Conveyance, Size reduction, Classifier, Centrifuges, Cyclones. Filtration, Mixing and

agitation.

ii)   Chemical Technology and Process Calculations : Gas calculations, Material balance and Energy balance – Steady and unsteady state, Humidity and Saturation, Combustion, Thermo chemistry, Role of Chemical Engineers in process industry, Cement, glass and ceramic industries, paper industry- Oil, soap, detergent industries, petroleum refining and petrochemicals- Polymer industry, Fertilizers, Food industry and other important process industries.

iii)   Thermodynamics and Kinetics : Laws of thermodynamics, PVT behavior of fluids, Thermodynamic formulations, compression of fluids, Phase equilibria – Application of the correlation and prediction. Free energy change and reaction equilibria. Refrigeration – principles, performance. Reaction rate – laws, theories, analysis. Design of reactors, Factors affecting design, Thermal reactors and rates of heat exchanges. Non-ideal reactors, Hetrogenous reactors and solid catalysts, Gas- solid catalytic reactors, Gas- solid non-catalytic reactors, Gas-Liquid reactors.

iv)   Heat and Mass transfer : Modes of Heat transfer. Heat conduction- steady and unsteady state, Natural and forced convection, Heat transfer to fluids with phase change, heat transfer coefficients, evaporation, heat exchangers – design and construction. Diffusion, Mass transfer coefficients, humidification, drying, absorption, distillation, extraction, leaching, crystallization, adsorption and ion exchange, analogies.

v) Process Control and Computer Applications in Chemical Engineering : Open loop systems, closed loop systems, Frequency response, Advanced control systems, Instrumentation. Application of spread sheet packages in Chemical engineering, Process flow sheeting, Development of software for design of equipments. Dynamic programming in Chemical engineering.

vi) Organic and Surface Chemistry : Carbohydrates, Oils, Fats, and Waxes, Heterocyclic compounds, proteins, dyes and dyeing, pharmaceutical chemistry. Adsorption – types, adsorption of gases over solids, isotherms, applications, ion exchange, adsorption chromatography, Catalysis – types, Equations.

vii) Electro, Polymer and Corrosion Chemistry : Factors influencing Corrosion, types of corrosion, corrosion control. Laws of migration of ions, conductometric titrations, advantages, galvanic cells, reversible and irreversible cells, Standard electrodes, electrode potentials, electrochemical series, Nernst equation. Polymeric materials, Teflon, polyamide, Nylon66, Kevlar, polyesters, polyethylene teryphthalate, poly butylene tetra phthalate, polycarbonates, bakelite, reinforcement, composites. Introduction to spectroscopic analysis, Molecular spectroscopy, IR, NMR, Mass Spectrometry.

viii)   Environmental Pollution and Control : Various methods of reduction of pollution, types of pollution, Air pollution – sources and effects- control techniques, Water pollution - sources and effectscontrol techniques, Soil pollution - sources and effects- control techniques and Solid waste disposal.

ix)   Bioprocess Engineering : Analysis of STR, Analysis of other configurations, Bioreactor scale-up, Modeling and simulation of Bioprocesses, Bioreactor considerations in Enzyme systems.

x)   Cell and Molecular biology : Cells, Cell lines, Cell culture, Cell Organelles and its functions, types of Cell divisions, cell cycle and its regulation mechanism. Transport Mechanism (passive, Active, ATPase pumps and Na+ /K+ pumps), Receptors, Signal Transduction, Models of Signal Amplification Secondary messengers, Structure of Nucleic Acids, Replication, Transcription, Translation and DNA repair mechanism in Prokaryotes and Eukaryotes. Promoters, Enhancers and Transcription factors. Genetic Codes and Lac & trp operons.

xi)   Biochemistry and Microbiology : Structure, function and metabolism of Carbohydrates, lipids Nucleic Acids and proteins. Enzymes and its mechanism. Electron Transport Chain system, High energy compound and reducing equivalents. History of Microbiology, Classification of Microorganism, structural organization and multiplication of Microorganism. Physical and Chemical control of Microorganisms, Primary and Secondary metabolites and their applications.

xii)   Genetic Engineering : Genes, control of gene expression, Restriction enzymes, Vectors (prokaryotic and Eukaryotic) construction of cDNA and genomic Library. Screening of DNA libraries, PCR, RACE PCR, RAPD, RFLP, AFLP, Site directed mutagenesis, Methods of Nucleic acid sequencing. Cloning vectors in plants, Transgenic and Knockout animals.

xiii)   Immunology : Immune system, immunity, lymphoid organs, antigens, adjutants, types of immune response. Activation and different ion of T-cells and B-Cells, Antibodies, Genes and generation of diversity, monoclonal antibodies. MHC APC, regulation of T-cell and B-cell responses. Immunity to viruses, Bacteria fungi and parasites, cytokines, complements, immunosuppression, allergy and hypersensitivity. Vaccines, Transplantation, Tumor Immunology, Autoimmunity and Autoimmune disorders.

xiv)   Bioinformatics : Search engines and algorithms, data management, data technology, biological databases and their uses. Pair wise sequence alignment (local and global), multiple sequence alignment, dot matrix, dynamic programming and Bayesian methods. BLAST, FASTA, machine learning and Hidden Markov models. Phylogenetic tree analysis. Bimolecular and cellular computing, microarray analysis and system Biology.

xv)   White wares, ceramic processing and fine ceramics : Quarrying of ceramic materials, size reduction, mechanical separation, mixing and conveying, powder characterization, Classification of whiteware products, heavy clayware, tests and quality control.

xvi)   Glass, Cement, Refractory and Ceramic coatings : Formation and Structure of glass, preparation of glass batch, glass melting process, Special glasses, annealing, different types of refractories, different types of cement, concrete, properties of cement and concrete.

9. TEXTILE TECHNOLOGY

i)   Fibre Science and Technology : Cotton varieties and their properties; silk – pre and post cocoon operations; varieties of silk and their properties; varieties of wool and their properties; properties of other natural fibres. Production and properties of viscose rayon and other regenerated fibres. Requirements of fibre forming polymers; structural principles of polymeric fibres; fluid flow during spinning; technology of melt, wet, dry, dry jet wet, liquid crystal and gel spinning of

polymeric fibres. Production, properties and applications of PET polyester, nylon 6, nylon 66, polyacrylonitrile and polypropylene. Spin finishes; drawing; heat setting; crimping and texturisation; tow to top converters and tow to staple converters. Structural investigation of fibres; study of moisture absorption, tensile behaviour, torsional rigidity and flexural rigidity, and optical, frictional, electrical and thermal properties of fibres.

ii)   Yarn Engineering : Yarn numbering systems- direct, indirect and conversions. Description and working of short staple spinning machinery - blow-room machinery, card, comber preparatory machines, comber, draw-frame, speed-frame, ring-frame; calculation of process parameters and process efficiencies; production calculations. Methods of mixing and blending; two-folding of yarns; two for one twist principle; man-made fibre processing. Principle and details of yarn formation in condensed yarn spinning, rotor spinning, friction spinning, air-jet spinning and other new spinning systems; structure of yarns produced from different spinning systems. Control of waste, productivity and quality.

iii)   Fabric Engineering : Fundamental concepts in winding, modern automatic winders; yarn clearing; winding synthetic and blended yarns and sewing threads; weft winding; Creels used in warping machines; beam and sectional warping machines; Sizing materials and recipes: size preparation and application; control systems used in sizing machine; sizing filament yarns; combined dyeing and sizing; energy conservation in sizing; process control in weaving preparation; preparation of warp beam for weaving. Yarns quality requirements and preparations for high speed weaving machines. Principles and limitations of various shedding, picking mechanisms; power required for picking; timing different mechanisms; automation and modern developments in weaving machine; cloth formation; loom accessories; process control in weaving. Cloth geometry; cover factor; concepts in fundamental and advanced woven fabric designs. Quality and preparation of yarn required for knitting; basic weft knitted structures and their production; needle control in weft knitting machines; factors affecting the formation of loop; effect of loop length and shape on fabric properties; process control in knitting; warp knitting fundamentals. Web forming techniques for dry method of web preparation; production of bonded fabrics by mechanical, chemical and thermal methods; productions of spun bonded and melt blown fabrics; end uses of bonded fabrics.

iv)   Chemical Processing : Chemical structure and chemical properties of natural and man-made fibres; singeing; desizing; scouring; bio preparatory operations; Mercerization; bleaching; heat setting; processing machines. Adsorption isotherms; dye-fibre interaction; properties and application of direct, azoic, vat, sulphur, reactive, acid, mordant, metal-complex, disperse and basic dyes; dyeing of blends; garment dyeing; assessment of colour fastness. Fundamentals of colour measurement; whiteness and yellowness indices; colour matching; spectrophotometers. Methods and styles of printing; printing machines; printing paste; printing with direct, reactive, acid and disperse dyes and pigments. Calendering; crease proofing; anti-shrinking; softening; felting and non-felting of wool; bio-polishing; assessment of finishes; assessment of eco-friendliness of textiles; finishing of knits; garment washing.

v)   Quality Evaluation : Textile quality parameters; online and off line testing methods.

Measurement of length and length uniformity, fineness, strength, maturity, trash content, moisture content of fibres using conventional and modern testing methods; advanced fibre information systems, high volume testing; measurement of lap, sliver and roving irregularity. Assessment of count, twist, hairiness, strength and extension, evenness, imperfection, friction, crimp rigidity, work of rupture, fatigue, abrasion resistance of yarn; classification of yarn faults. Determination of fabric construction parameters; assessment of tensile, bursting and tear strengths, lowstress mechanical properties, permeability, insulation properties, durability, comfort and handle properties of fabrics; grading of fabrics based on defects. Sampling; statistical significance tests; control charts.

10. LEATHER TECHNOLOGY

i)   Pre Tanning Operations : Hides & Skins – Histological characteristics structure of hides & skins defects – curing & preservation methods – Animal by products – soaking, unhairing, liming, deliming, bating, pickling, depickling and degreasing– Their objectives & principles involved. Biochemistry of collagen and other substances – chemicals & auxiliaries used in pre-tanning operations – General pretanning processes for manufacture of different types of heavy and light leathers - Process control in pretanning – Ecofriendly pretanning operations – Physical and chemical testing - Standards and quality control measures in pretanning. By products of animal and tannery operations.

ii)   Tanning Operations : Tanning materials – Vegetable, mineral and organic - their classification – chemistry & Technology of tanning materials & methods – characterization manufacture & analysis of various tanning materials. Theory & mechanism of vegetable, chrome, Aluminium, Zirconium, Iron, Titarium, Aldehyde, Oil and other organic tanning. Various unit operations involved in tanning processes their objectives & principles – cleaner processing options – Analysis & characterization of various types of leathers - Physical and chemical testing - Standards and quality control measures in tanning operations.

iii)   Post Tanning and Finishing Operations : Retanning, dyeing – fatliquoring and finishing operations – Their objectives & principles – chemicals used for the above unit operations – Syntans, fatliquors, dyes, dye-auxiliaries, pigments, acrylic and protein binders, wax emulsion, fillers, topcoats, NC, CAB lacquers and lacquer emulsions, feel modifiers, their nature & properties in finishing – machinery & methods for post tanning and finishing operations – upgradation methods – chemical and physical properties required for various finished leathers – physical & chemical testing of finished leathers – Tannery Effluent treatment –Effluent treatment plant - Liquid and solid waste management.

iv)   Leathers & Leather Products : Various types of leathers – upper, sole, garment, leather goods, sports & specially leathers – their characteristics. Leather supplement and synthetics - Design & manufacture of footwear, leather goods & garments. Leather Economics and Industrial Management – Project feasibility reports – organization & management of leather sector – marketing & export of leather & products - Machines for leather products manufacture - mechanics & operation - IT applications for leather & product design. Professional Ethics and human values.

11. PHYSICS AND MATERIAL SCIENCE

i)   Mechanics, Heat and Sound : Vectors – equilibrium - moment of a force – Newton's laws of motion – gravitation – work – energy – power – Impulse and momentum – collitions – recoil. Thermometry of thermal expansion – calorimetry and specific heats – transfer for heat – thermal process of matter - Law and processes of thermodynamics - Applications. Travelling waves – oscillations – spring – simple pendulum – forced oscillations – resonance – sound waves –Acoustic Phenomena and its applications- Doppler effect.

ii)   Light and Properties of matter : The nature and propagation of light – reflection of refraction at plane surfaces – interference – diffraction – polarization. Elasticity – Stress-strain diagram -- hydrostatics – Pressure in a fluid – Pumps – Archimede's principle – Surface tension – Contact angle – Capillarity - hydrodynamics - Bernoulli's equation – Applications and viscosity – Poiseuille's law – Stokes law – Reynolds number.

iii)   Electricity and Magnetism : Coloumb's law – Gauss's law – Applications - electrostatic potential – capacitors – dielectrics - current – resistance – emf – Kirchoff's law – thermo electric effect – applications. Magnetism - magnetic effects of current – motion of charge particles in magnetic field – cyclotron – magnetic forces on current carrying conductor – Hall effect – electromagnetic induction –Faraday's law – Lenz's law – eddy current – Inductance – mutual and self inductance – magnetic properties of matters – diamagnetism – paramagnetism – ferromagnetism - domains– Hysteresis - alternating current – circuits containing resistance, inductance or capacitance – transformer.

iv)   Modern physics : Emission and absorption of light – thermionic emission – photoelectric effect – atomic spectra - atom models – molecular spectra – dual nature of matter and radiation – nuclear structure – properties – natural radioactivity – nuclear stability - nuclear reactions – fission – fusion – fundamental particles – high energy physics.

v)   Solid State Electronics : Structure and bonding in solids - properties of solids – semiconductors – intrinsic – extrinsic – PN junction – diode characteristics – Zenar diode – LED, laser diode – Photodiode – Transistor – action and characteristics – amplifier – oscillator – basic logic gates.

vi)   Electron theory of solids: Classical free electron theory – density of states- electron in a periodic potential – origin of energy band gap – electrical conductivity – thermal conductivity – Widemann-Franz law

vii)   Dielectric and magnetic materials: Different types of polarization – Internal field – Clausius- Mosotti equation- dielectric breakdown- applications of dielectric materials – Different types of magnetic materials – domain theory of ferromagnetism – hysteresis - hard and soft magnetic materials applications of magnetic materials.

viii)   Superconducting materials: General properties of superconducting materials – Meissner effect – types of superconductors – Hi Tc superconductors- applications

ix)   Nanomaterials: Preparation – properties – applications – Carbon nanotubes.

12. MATHEMATICS

(i) Algebra

Algebra: Group, subgroups, Normal subgroups, Quotient Groups, Homomorphisms, Cyclic Groups, permutation Groups, Cayley's Theorem, Rings, Ideals, Integral Domains, Fields, Polynomial Rings. Linear Algebra: Finite dimensional vector spaces, Linear transformations – Finite dimensional inner product spaces, self-adjoint and Normal linear operations, spectral theorem, Quadratic forms.

(ii) Analysis

Real Analysis: Sequences and series of functions, uniform convergence, power series, Fourier series, functions of several variables, maxima, minima, multiple integrals, line, surface and volume integrals, theorems of Green, Strokes and Gauss; metric spaces, completeness, Weierstrass approximation theorem, compactness. Complex Analysis: Analytic functions, conformal mappings, bilinear transformations, complex integration: Cauchy's integral theorem and formula, Taylor and Laurent's series, residue theorem and applications for evaluating real integrals.

(iii) Topology and Functional Analysis

Topology: Basic concepts of topology, product topology, connectedness, compactness, countability and separation axioms, Urysohn's Lemma, Tietze extension theorem, metrization theorems, Tychonoff theorem on compactness of product spaces. Functional Analysis: Banach spaces, Hahn-Banach theorems, open mapping and closed graph theorems, principle of uniform boundedness; Hilbert spaces, orthonormal sets, Riesz representation theorem, self-adjoint, unitary and normal linear operators on Hilbert Spaces.

(iv) Differential and integral Equations

Ordinary Differential Equations: First order ordinary differential equations, existence and uniqueness theorems, systems of linear first order ordinary differential equations, linear ordinary differential equations of higher order with constant coefficients; linear second order ordinary differential equations with variable coefficients, method of Laplace transforms for solving ordinary differential equations.

Partial Differential Equations: Linear and quasilinear first order partial differential equations, method of characteristics; second order linear equations in two variables and their classification; Cauchy, Dirichlet and Neumann problems, Green's functions; solutions of Laplace, wave and diffusion equations using Fourier series and transform methods.

Calculus of Variations and Integral Equations: Variational problems with fixed boundaries; sufficient conditions for extremum, Linear integral equations of Fredholm and Volterra type, their iterative solutions, Fredholm alternative.

(v) Statistics & Linear Programming Statistics:

Testing of hypotheses: standard parametric tests based on normal, chisquare, and Fdistributions. Linear Programming: Linear programming problem and its formulation, graphical method, basic

feasible solution, simplex method, big-M and two phase methods. Dual problem and duality theorems, dual simplex method. Balanced and unbalanced transportation problems, unimodular property and u-v method for solving transportation problems. Hungarian method for solving assignment problems.

14. SOCIAL SCIENCES

i) Geography : Settlement geography-rank-size relationship, urban environment- physical and social, regional delimitation, central place theory, urbanization in India and Tamilnadu, relationship, concept and types of region, regional development planning in India, globalization and economics reforms and competitiveness.

ii) Sociology : Social institution, society, community, social roles, norms, status, values, social structure in India, social change and its relevance to economic development, urbanization as a way of life, social problems of developed and developing countries, impact of urbanization on society and rural development, impact of IT industry on society and development.

iii) Economics : Agglomeration economics- internal, external and urbanization economics, economic base of cities- meaning, types of economic base and methods of identifying economic base, multiplier concept, and approaches of development, Indian national economy –five year plans, environmental economics, economic geography of India. Land economics and industrialization policy, SEZs, IT, ITES industries

iv) Social work: Role of social worker and NGO's in development – community, rural, social, and national level; public participation in developmental framework- city, regional, and national level, awareness programme on policies, counseling- rational emotive therapy, behavior modification therapy, family counseling, group work- treatment group, task group, community work- rural and urban community developments/micro credit/micro finance\SHGs.