COURSE CONTENTS - PG&R

DEPARTMENT OF APPLIED MECHANICS & HYDRAULICS

HW701 Applied Fluid Mechanics (3-1-0) 4

Continuity equation, flow nets, standard patterns of flow, Magnus effect, Navier stokes equation and applications, parallel flow and applications, lubrication mechanics, Reynolds number and its significance, mechanism of turbulence, universal velocity distribution, varied flow equation and methods of computation, methods for natural channels, flow over spillways, hydraulic jump, types of spatially varied flow, DeMarchi's equation for side weirs, importance of sediment transport, modes of sediment motion, bed load formulae, rating curves, stable channel design, reservoir sedimentation.

H.R. Vallentine, Applied Hydrodynamics
H.Rouse, Elementary mechanics of fluids
Ven Te Chow, Open channel hydraulics

HW702 Surface Water Hydrology (3-1-0) 4

Importance/Applications, Water Budget, Catchment hydrological cycle, hydrometeorology. Rainfall, interception, infiltration, soil moisture, evapotranspiration, runoff, groundwater (process description measurement spatio-temporal data analysis, estimation of each). Rainfall runoff modeling, Unit Hydrograph, Flow routing, Flood estimation, Time series modeling.

Chow et al, Applied Hydrology
VM Ponce, Engineering Hydrology

HW703 Analysis of Water Resources Systems (3-1-0) 4

Systems approach, economic and social development, objectives of water resources development. Engineering Economics and Discount factors, Discounting Techniques, Supply and Demand analysis, Discount rate. Optimization of a function of single and multiple variables with equality constraints, Lagrangian multipliers, Trade off-Benefit cost analysis, risk and uncertainity in benefits, Formulation of an optimization problems. Linear programming technique, simplex method. Dual LP and its use. Dynamic programming –solution of simple problems.

James & Lee, Economics of Water Resources planning
A.Mass, Design of Water Resources systems
S.S.Rao, Optimisation

HW704 Hydrology Laboratory (0-0-3) 2

HW705 Ground Water Engineering (3-1-0) 4

Introduction, groundwater developments in India, objectives and scope. Groundwater motion – governing equations for saturated and unsaturated zones, steady and transient well flows, well design, construction and maintenance, well losses. Numerical groundwater flow/pollution modeling. Artificial recharge-rain water harvesting techniques, conjunctive use, groundwater management.

J.Bear, Hydraulics of groundwater, Jhon Wiley & sons, 1979
J.Bear and A.Verreijit, Modelling groundwater flow and pollution, D.Reidel Pub. Co. 1987.
N.Kresic, Hydrogeology and groundwater modeling, Lewis publication, 1997.

HW706 Design of Water Resources Systems (3-1-0) 4

Legal and institutional aspects, surface, GW laws, Identification and preliminary evaluation of Projects, Network models: standard transportation model, Transshipment model, Assignment model, shortest route and maximum flow models. Spanning tree model. CPM and PERT. Multiobjective optimization – Methods of analysis surrogate with trade off. Method of non inferior solution. Decision making under risk and uncertainity economic analysis of multipurpose projects resource allocation. System design. Introduction to simulation. Reservoir operation. Rigid, semi and flexible rules. Use of simulation. Environmental impact assessment.

A.Mass, Design of Water Resources systems ;;; Y.Y.Haims, Hirarcheal analysis of Water Resources system.

HW707 Hydraulics Laboratory (0-0-3) 2

MS701 Wave Hydrodynamics & Wind waves (3-1-0) 4

General meteorology, wave generation theories, statistical and spectral analysis of waves, wave forecasting and windcasting, small and finite amplitude wave theories, wave transformations, wave-structure interaction.

Ippen A.T., Estuary and Coastline Wave Hydrodynamics

Bendat and Piersol, Random Data Analysis and Measurement Techniques.

MS702 General Oceanography & Coastal Engineering (3-1-0) 4

Properties of seawater, oceanographic instruments, types of ocean currents, tides and tide producing forces, hydrography regional oceanography with reference to Arabian Sea and Bay of Bengal, coastal process and sediment procurement, marine process and sediment measurement, marine geology of Indian coast, coastal features.

George L. Pickard - Descriptive physical Oceonography.

Komar P.D., Beach processes and sedimentation

MS703 Marine Geotechnical Engineering (3-1-0) 4

Subsurface and Sub-Marine Explorations for On-Shore and Offshore structures: General planning of soil investigation programme, Boring and sampling in marine deposits Morphology. Mineralogy, and Chemistry of Marine Sediments: Morphology and genesis of marine sediments. Origin of clay minerals and their identification by the use of DT A. X-ray diffraction. and Electron microscope methods Engineering properties of Marine Sediments :Flow through soil with steady state and transient flow conditions - uniaxial and traixial consolidation. General failure theories - Lateral earth pressure - Rankine and Coulomb theories, Baring capacity of deep and shallow foundations, Slope stability analysis. Stresses and Deformations in Soils:

Winter Korn and Fang - Foundation Engineering hand book

P .L. Tirant - Sea bed reconnaissance and offshore soil mechanics for installation of petroleum structures.

D.A.Ardus - Offshore site investigation

MS704 Marine Structures Laboratory (0-0-3) 2

MS705 Port Planning (3-1-0) 4

Economic importance, water way transport, port development, classification of ports, traffic and hinterland studies, site investigation, queing theory and its application, preparation of master plan for ports. Design and planning of break bulk, passenger, fishery, containers, dry and liquid bulk terminals, cargo handling facilities.

Ernst G. Frankel – Port Planning and Development

UNCTAD Manual, Port Development, A Hand Book for Planner in Developing Countries

MS706 Analysis & Design of Marine Structures (3-1-0) 4

Introduction - Design principles - Functional design - safety factors General code provisions Breakwaters, factors determining their selection. Rubble mound breakwaters - Design factors - Hydraulics of cover layer design. Design of structure cross section - stability of foundations. Vertical wall breakwaters - Types - Design factors . pile breakwaters and floating breakwaters. Wharves, Piers, Bulkheads, Dolphins and Moorings - Types and factors controlling selection of type, Design considerations - Design of piled jetties and dolphins - mooring forces- Dock fenders. Dry docks, types of dock walls and floors - design factors. Locks, Slipways, Light houses.

US Army Corps of Engineers - Shore Protection Manual

Quinn - Design of Ports and Harbour Structures

Per Bruun - Port Engineering Vol. I

MS707 Coastal Engg. & Marine Geotech.Lab (0-0-3) 2

AM800 Coastal Erosion and its Mitigation (3-0-0) 3

Origin of Coasts, Sediment Transport and Budgeting, Coastal Erosion and Mitigation: A Global Scenario and Indian Perspective, Coastal Processes, Planning and Design of Coastal Protection Works, Soft and Hard Options, Innovative Technologies, Remote Sensing, Geographical Information System and Artificial Neural Network in Coastal Engineering, Performance of Coastal Protection Works in India, Coastal Zone Regulation, Integrated Coastal Zone Management, Coastal Pollution and Environmental Impact Assessment.

Bruun, P., Port Engineering, Vol. I &II.

Shore Protection Manual, U.S.Army Corps of Engineers, Coastal Engineering Research Center, U.S.Govt. Printing office, Washington D.C., Vol. 1 & 2. 1984.
Ippen A.T., Estuary and Coast line Hydrodynamics McGraw Hill, 1966.

AM801 Finite Element Method (3-0-0) 3

Direct approach. Basic structural elements. Plane elasticity problems. Galerkin weighted residual approach. Element properties. Linear and quadratic elements. Lagrange and Hermite shape functions. Isoparametric elements. Numerical integration using Newton-Cotes quadratures and Gauss-Legender quadratures.

L.T. Segerlind, Applied Finite Element Analysis, John-Wiley and Sons
J.N.Reddy, An Introduction to the Finite Element Method, McGraw-Hill Book Company.

AM802 Engineering Optimization (3-0-0) 3

Linear programming. Simplex method. Dual problem. Primal-dual relationship. Sensitivity analysis. Dynamic programming. Bellman's principle. Forward and backward recursions. Nonlinear programming. Unconstrained and constrained optimization. Lagrange multipliers. Kuhn-Tucker conditions. Integer programming, Multiobjective programming. Fuzzy multiobjective optimization.

S.S.Rao, Engineering Optimisation, New Age International (P) Ltd. Publishers.
A.Ravindran, D.T. Philips and J.J,Solberg, Operation Research - Principles and Practice, John Wiley and Sons.

AM803 Theory of Elasticity (3-0-0) 3

Stress, transformation of stress, principal stresses, Hydrostatic and deviatoric stresses. Mohr's circle for two and three dimensional state of stress. Strain, transformation of strain, principal strain, strain compatibility. Material constitutive relations. Generalised Hooke's law. Stress-strain laws for anisotropic, orthotropic and isotropic materials. Stain rosettes. Plane stress and plane strain. Iry's stress function. Plane elasticity in polar coordinates. Axially symmetric problems. Theories of failure.

Timoshenko S. and Goodier J.N., Theory of Elasticity, McGraw-Hill Book Company
Sadhu Singh, Applied Stress Analysis, Khanna Publishers.
Dally J.W. and Riley W.F., Experimental Stress Analysis, McGraw-Hill Book Company

HW804 Planning & Operational Management of Water Resources Projects (3-0-0) 3

Project-definition, characteristics, life cycle phases, types. PER, TEFR and DPR. Project Economic and profitability analyses. Project Organisation, Work breakdown structure, Contracts, Disputes, Arbitration. Planning tools – Bar charts, Network Analysis – PERT & CPM. Resources allocation, materials management and inventory control, equipment management, Decision analysis, EIA of projects. Maintenance of WR projects – Engineering & Economics.

S Chawdary, Project Management
P.K. Joy, Total Project Management
P Chandra, Projects Planning Analysis.

HW805 Finite Element Application to Flow Problems (3-0-0) 3

Introduction to partial differential equations, numerical methods, initial and boundary value problems, weighted residual techniques. Galrekin finite element method, element families, formulation of element equations, global matrix, higher order elements, solution techniques application of Galerkin. FEM to various surface and subsurface flow problems.

P.S. Huyakern and G F Pinder, Computational methods in sub-surface flow, Academic Press, 1983
J.Donea, Finite Element methods for flow problems, Applied Publishers, 2003

HW806 Computational Methods in Subsurface Flow (3-0-0) 3

Partial differential equations in subsurface flow, initial and boundary value problems, solution methodology. Finite difference method –various schemes and their solution, simulation of single phase subsurface fluid flow. Finite Element method – Galerkin method, element families, solution of steady and transient groundwater flow problems. Boundary element method – Basic concepts, application to one and two dimensional sub-surface flow problems. Method of characteristics and its applications, Analytical elements, infinite elements and applications.

P.S. Huyakern and G F Pinder, Computational methods in sub-surface flow, Academic Press, 1983
J.Bear and A.Verruijit, Modelling groundwater flow and pollution, 1988

HW807 Integrated River Basin Development (3-0-0) 3

Necessary conditions for river basin development Heceristic approach, sequential approach, components of river basin development, conjunctive use of seawater and groundwater, planning design and development of regional groundwater system in a river basin. Inverse modeling in regional GW system. Role of industries, NGO and VO in river basin development, Socio-economic fators rehabitation, concept of sustainable development some typical case studies.

T.M.Chaturvedi, Water Resource Systems
W.G.Yeh, Groundwater Management

HW808 Planning and Design of Hydraulic Structures (3-0-0) 3

Preliminary investigations and preparation of reports. Design of Gravity dams and other components like gates , sluices, Design of Earthern dams , Weir design , Construction procedure of dams, Instrumentation in dams.

Creager W.P.Justin, D and Hinds.J. - Engineering for Dams. Vol.I, II,III
Sharaar, et.al.- Earth and Rockfill Dams
M.S.Harr. - Ground Water and seepage

HW818 Selected topics in Hydraulics and Water Resources Engineering (3-0-0) 3

MS809 Remote Sensing & GIS Applications in Coastal Engineering (3-0-0) 3

Introduction, Physics of Remote sensing, EM spectrum, Black body concept, atmospheric windows, ranges of sensing systems, spectral signatures, false colour concepts etc. Orbits, Platforms and Sensors, scanners, Indian Satellite Family, Launch vehicles, Data products. Interpretation and Analysis techniques, Multispectral, Multitemporal, Multisensoral, Multistage concepts, Photo-interpretation techniques for aerial photos and satellite imagery, interpretation elements. Photogrammetry - Basic principles and photo interpretation, Digital analysis - Preprocessing and processing, image restoration/enhancement procedures, pattern recognition concepts, classification algorithms, post processing procedures, smoothening etc. Application to Coastal Engg.

Thomas N Lillesand and R W Kiefer - Remote Sensing and Image interpretation.
A.P.Cracknen - Remote Sensing in Meteorology, Oceanography and Hydrology.
F.L.Sabins - Remote Sensing Principles and Interpretation.

MS810 Computer Oriented Numerical Methods (3-0-0) 3

Numerical solution of non-linear algrebaic equations and simultaneous linear algebraic equations, finite difference method, numerical solution of ordinary differential equations and partial differential equations.

Alkis Constantinides, Applied Numerical methods with personal computers, McGraw Hill Int Inc.
Schaum's Series, Numerical Analysis

MS811 Offshore Engineering (3-0-0) 3

The Ocean environment - Waves, Currents, Winds, Sea bed Geoglogy, Earthquakes, Floating ice. Common Structural Systems - Jacket or Tension leg structures, Tower, Caissons, Concrete gravity platforms, Steel, Gravity platforms, Hybrids, Compliant structures, Factors governing form selection. Wave loading on Off-shore structures – Linear wave theory, Morison equation. Hydrodynamic loading of large offshore structures - Diffraction theory - Regions of validity - Application – Linear dynamic analysis. Foundations of offshore structures - Pile foundations, Prediction of axial pile capacity, Bearings capacity of footings, settlement of foundations. Offshore construction - Drilling techniques, logging methods, location of drill sites, Completion of walls, Marine survey, Welding, Checks on welding and codes.

T.R.Dawson - Offshore Structural Engineering
Det norske veritas - Rules for the Design, Construction and Inspection of Fixed Offshore Structures.
Recommended practice for Planning, Designing, and Construction of Fixed Offshore Structures- American Petroleum Institute.

MS812 Computer Aided Design of Marine Structures (3-0-3) 3

Concept of GVI, IS Codes and provisions for marine structures, code development for – spectral, statistical analysis of random waves, wave forces on piles, design of rubble mound, vertical wall breakwater, seawalls (in the final examination computer program is to be developed for the given problem)

Koutitas C.G., Mathematical models in Coastal Engineering.
Horikawa K., Coastal Engineering

MS813 Foundation of Marine Structures (3-0-0) 3

Soil structure interaction: Critical study of conventional methods of foundation design, Nature and complexities, advance techniques of analysis, relaxation and iteration for the evaluation of soil structure interaction for different types of structures under various types of loads and subsoil characteristics. Design of combined footing using soil structure interaction. Analysis and design of pile foundations, bored piles, technique of offshore piling for various types of structures, pile behavior under cyclic lateral loads, development of p-y curves etc. Analysis and Design of Caissons & Well foundations

Bowles J.E. - Foundation analysis and design.
Polous & Davis - Pile foundation
Winter Korn and Fang - Foundation Engineering hand book

MS814 Dredging (3-0-0) 3

Introduction : Port structures, dredging overview, environmental aspects, Geotechnical Information : Classification of soils and rocks, Geotechnical investigation for field test, Principle & methodology of dredging : Dredging process pretreatment, type of dredgers selection of dredgers, Dredging in Indian context, Drilling & Blasting environmental impact. Design of dredging works, Dredging for (i) navigation improvement. (ii) fill material, (iii)channel design & maintenance. Performance of dredging plant : Description and method of operation, production cycle and ancillary equipment for some important types of dredging and estimating their output. Use and disposal of dredged material: Reclnation fill, beach nourishment, disposal at sea, onshore disposal. Dredging costs and prices : Mobilisation and demo blimetires, capital costs, running costs, building up a cost estimate.

Bray RN, Bates AD, Land J M – Dredging - A Hand book for Engineers – Published by ARNOLD London, 1997.
Journal of Indian Ports
Dredging – Journal

MS815 Coastal Zone Management (3-0-0) 3

Estuaries – Classification, circulation pattern and sedimentation, determination of sediment yield from streams. Salt water intrusion. Marine environment pollution : Pollution estuaries and seas and its implementations. Costal erosion : Introduction, magnitude, consequences. Soft and hard options: various hard and soft options of coastal erosion mitigation. Innovative methods. Performance of hard and soft options. Environmental impact assessment of various investigation measures, remedies. Coastal Zone Management : Principle, CRZ act, sustainable development, integrated CZM, issues, constraints. Implementation of ICZM : world scenario, Indian scenario – case studies.

Coastal Management, Putting policy into practice, edited by C.A. Fleming, Thomas Telford, London, 1996.
Coastal Zone Planning and Management, Edited by Mce Barett, Thomas Telford, London 1992.
Coastal Management, Thomas Telford, edited by M.G.Barret, London 1989.

MS816 Construction Planning and Operational Management of Ports (3-0-0) 3

Project-definition, characteristics, life cycle phases, types. PER, TEFR and DPR. Project Economic and profitability analyses. Project Organisation, Work breakdown structure, Contracts, Disputes, Arbitration. Planning tools – Bar charts, Network analysis – Pert & CPM. Resources allocation, materials management and inventory control, equipment management, Decision analysis, EIA of projects. Special Construction Methods, Maintenance of Marine Structures, Engineering & Economics.

S. Chawdary, Project Management
P. K. Joy, Total Project Management
P. Chandra, Projects Planning Analysis.

MS817 Selected Topics in Marine Structures (3-0-0) 3

AM901 Fuzzy Logic, ANN and GA 3

Fuzzy logic – Classical sets and fuzzy sets. Fuzzy set operations. Fuzzy relations. Extension principle. Membership functions. Lambda-cuts for fuzzy sets and relations. Defuzzification methods. Fuzzy rule-based systems. Fuzzy nonlinear simulation. Fuzzy regression. Artificial Neural Networks (ANN) – McCulloch–Pitts model of a neuron. Learning rules. Activation functions. Single layer perceptron networks. Multilayer feedforward networks. Back propagation algorithm. Hopfield networks. Genetic Algorithms (GA), fitness function. Genetic Algorithm operators – reproduction, crossover, mutation. Schemata and schema theorem. Application of GA to optimization problems.

Ross T.J., Fuzzy logic with Engineering Applications, McGraw-Hill Book Company.
Haykin S., Neural Networks – A comprehensive foundation, Prentice Hall, International Inc.
Goldberg D., Genetic Algorithms, Addison-Wesley.

AM902 Wetland and Management 3

Introduction, Scope, Importance, Wetland Classification system, Wetland Indicators for Identification and Delineation, Wetlands Processes (Functions) and Values, Types of wetlands and their roles in the watershed. Human Impacts: wetland loss and Degradation, Major Causes, The Main Activities that cause wetland impairment, Wetland Protection and Successful Mitigation – Issues, Measures of Success, Common Mitigation-pitfalls, Wetland Management- Natural wetland protection, The Challenge of Protection, Management Issues Buffers and Other Protective Measures for Wetlands Natural wetlands and Riparian areas as Buffers, Wetland restoration and creation, Constructed wetlands, Comparison of created and natural wetlands.

Environmental Laboratory. Crops of Engineers Wetlands Delineation Manual, U.S. Army Engr. Waterways Expt Station, Vicksburg, MS,.1987, (Rev. Version 1997)

Lawrence R. Liebesman , The Water Supplier's Guide to Wetlands Regulation and Management, American Water Works Association, Denver CO 80235, USA, 1995

AM903 Ground Water Engineering 4

Introduction, groundwater developments in India, objectives and scope. Groundwater motion – governing equations for saturated and unsaturated zones, steady and transient well flows, well design, construction and maintenance, well losses. Numerical groundwater flow/pollution modeling. Artificial recharge-rain water harvesting techniques, conjunctive use, groundwater management.

J.Bear, Hydraulics of groundwater, John Wiley & sons, 1979

J.Bear and A.Verreijit, Modelling groundwater flow and pollution, D.Reidel Pub. Co. 1987.

D.K.Todd, 1974, Groundwater

AM904 Finite Element Application to Flow Problems 3

Introduction to partial differential equations, numerical methods, initial and boundary value problems, weighted residual techniques. Galerkin finite element method, element families, formulation of element equations, global matrix, higher order elements, solution techniques application of Galerkin. FEM to various surface and subsurface flow problems.

P.S. Huyakern and G F Pinder, Computational methods in sub-surface flow, Academic Press, 1983

J.Donea, Finite Element methods for flow problems, Applied Publishers, 2003

AM905 Computational Methods in Subsurface Flow 3

Partial differential equations in subsurface flow, initial and boundary value problems, solution methodology. Finite difference method –various schemes and their solution, simulation of single phase subsurface fluid flow. Finite Element method – Galerkin method, element families, solution of steady and transient groundwater flow problems. Boundary element method – Basic concepts, application to one and two dimensional sub-surface flow problems. Method of characteristics and its applications, Analytical elements, infinite elements and applications.

P.S. Huyakern and G F Pinder, Computational methods in sub-surface flow, Academic Press, 1983

J.Bear and A.Verruijit, Modelling groundwater flow and pollution, 1988

AM906 Inverse Modelling in Regional Ground Water System 3

Introduction to regional Ground Water system, Introduction to inverse modelling, Sensitivity analysis, parameter identifiability, parameterization, parameter structure, parameter uniqueness and stability. Uncertainty analysis using covariance matrix, some case studies.

Taha, Operation Research

Katanth, Ground Water Engineering

AM907 Innovative Type Breakwaters 3

Different types of breakwaters, function, location, design wave, advantage and disadvantage, rubble mound breakwaters : design factors, hydraulics of cover layer, stability of breakwaters and factors effecting them, artificial armour units, construction method. Berm breakwaters : stability and reshaping of berm breakwaters, factors influencing them, material specification, construction method, Tandem breakwaters : design factors, stability coefficient and factors effecting them, performance of other type of breakwaters : reef breakwaters submerged breakwaters, pile breakwaters, floating breakwaters, design factors, modelling technique : rubble mound and other types of breakwaters.

US Army Corps of Engineers – Shore Protection Manual

Per Brunn – Port Engineering Vol. 1.

J.B. Herbich – Hand Book of Coastal and Ocean Engineering Vol. 1

AM908 Advanced GIS 3

Statistical analysis, measurement, proximity analysis (buffering), overlay analysis, classification, network analysis, multicriteria analysis, site suitability analysis, nearest neighbor analysis, Theissen polygons, Surface mapping, interpolation (including TIN), digital elevation model (DEM), terrain classification – slope aspect, angle of incidence etc.

Atikson P and Tate N.J., Modelling scale in Geographical Information Science, John Wiley & Sons, Chichester.
Shekhar S. and Chawla S., Spatial Databases : A Tour, Prentice Hall, Englewood Cliffs.

AM909 Digital Image Processing 3

Image enhancement, contrast enhancement, spatial filtering, Image transformation, spectral rationing, principal component analysis, analysis of hyper spectral data, image classification, supervised classification, unsupervised classification, fuzzy classification, post classification analysis, neural networks, context analysis, accuracy assessment

Lillesans, Thomas M. and Ralph W.Kiefer, Remote Sensing and Image Interpretation, John Wiley, 1994.
Campell, James B., Introduction to Remote Sensing, 2nd Edition, The Guilford Press NewYork 1995.
Richards, Introduction to Digital Image Processing

AM910 Soil Physics 4

General physical characteristics of soils, soil texture, structure, particle size distribution, classification of soils, soil water content, soil water potential, flow of water in unsaturated soils and saturated soils, solute transport. Water and energy balance in the field, soil hydraulic properties, spatial variability.

Daniel Hillel, Fundamentals of Soil Physics, Academic Press
Maidment, Handbook of Hydrology, McGrawHill

AM911 Advanced Remote Sensing and GIS Applications in Coastal Engineering 3

Fundamentals of RS & GIS, Data products and data formats, fundamentals of visual and digital image processing, ground truth and accuracy estimation, Overview of instruments image processing and GIS software.

Case Studies : Shoreline change detection, Coastal land use / land cover, suspended sediment concentration, marine ecology, coastal cadastral mapping, Bathymetry, marine resources monitoring and management, ICZMP, Harbour area information system (HIS), CZIS, Coastal wetland monitoring and management, Disaster warning system, Coastal vulnerability analysis, Ocean parameter estimation wing, Satellite data.

Thomas N Lillesand and R W Kiefer - Remote Sensing and Image interpretation.
A.P.Cracknen - Remote Sensing in Meteorology, Oceanography and Hydrology.
F.L.Sabins - Remote Sensing Principles and Interpretation.
Jenson - Digital Image Processing.

DEPARTMENT OF CIVIL ENGINEERING

EN701 Environmental Chemistry & Microbiology (3-1-0) 4

Environmental Chemistry - Basic concepts from general chemistry, Acid -Base Equilibria, Solubility Equilibria, removal of heavy metals from complex water and wastewater systems, Oxidation-reduction Equlilibria, Water Stabilization, Water softening and neutralization.

Microbiology - The characterization, classification and identification of microorganisms, Pure cultures and cultural characteristics, Enzymes and their regulations, Microbial metabolism, Control of microorganisms. Microbiology of domestic water and wastewater, industrial microbiology. Epidemiology of infectious diseases, microbial agents of diseases.

Sawyer, C.L, McCarthy, P.L and Parkin, G.F. Chemistry for Environmental Engineering. McGraw-Hill.
Pelczar, M.J., Chan E.C.S. and Krieg, N.R. Microbiology. Tata McGraw-Hill.
Julia Levy, Campbell, J.J.R and Henry Blackburn, T. Introductory Microbiology, John Wiley

EN702 Physico-Chemical Processes for Water and Wastewater Treatment (3-1-0) 4

Water Quality, Physical, chemical and biological parameters of water, Water Quality standards, Water quality indices. Water purification systems in natural systems, physical processes, chemical processes and biological processes. Primary, Secondary and tertiary treatment. Unit operations, unit processes. Aeration and gas transfer, Sedimentation, Filtration, Adsorption, Ion Exchange-processes, Membrane Processes, Reverse osmosis, Ultrafiltration, Electrodyalisis, Disinfection

Weber, W.J. Physicochemical Processes for Water Quality Control, John Wiley.
Peavy, H.s, Rowe, D.R, Tchobanoglous, G. Environmental Engineering, Mc-Graw – Hill .
MetCalf and Eddy. Wastewater Engineering, Treatment, Disposal and Reuse, Tata McGraw-Hill

EN703 Environmental Quality and Pollution Monitoring Techniques (2-0–3) 4

General principles of sample collection and data analysis. Gravimetric methods for solids analysis in water and wastewater, analysis of common cations and anions in water/wastewater, determination of nitrogen, phosphorus and chemical oxygen demand (COD). Titrimetric methods; Electrochemical methods; Spectrophotometric methods; Nephlometric methods; Atomic Absorption spectroscopy; Biological methods and microbiology; Biochemical oxygen demand (BOD), MPN test for microbial pollution, plate counts; confirmatory tests. Sampling techniques for air pollution measurements; analysis of particulates and common chemical air pollutants

Sawyer, C.L, McCarthy, P.L and Parkin, G.F. Chemistry for Environmental Engineering. McGraw-Hill.

EN704 Biological Processes Design for Wastewater Treatment (3-1-0) 4

Waste waters-Sources, nature and characteristics, Process Kinetics, Enzyme reactions, Reactor Analysis, Design of wastewater treatment systems, Activated Sludge and its process modifications, Biological Nitrification and denitrification, Fundamentals of gas transfer, Treatment Ponds and Lagoons, Attached Growth Biological Treatment Systems, Anaerobic processes, Sludge Disposal, Waste water reclamation and reuse, Effluent disposal.

Benefield, L.D and Randall C.W. Biological Processes Design for Wastewater, Prentice -Hall.
Quasim, S.R. Wastewater Treatment Plants Planning, Design and Operation, CBS Publ.
Van Haandel A.C & Lettinga G. Anaerobic Sewage Treatment, John Wiley

EN705 Air, Noise and Solid Waste Management (3 –1- 0) 4

Air pollutants, Sources, classification, emission, Effects on Health, vegetation, materials and atmosphere, Reactions of pollutants in the atmosphere and their effects. Particulate emission control, and other removal methods like absorption, adsorption, precipitation etc. Noise Pollution- sources, mitigation. Municipal Solid Waste : Generation, Rate Variation, characteristics (Physical, Biological and Chemical); Management Options for Solid Waste, Waste Reduction at the Source, Collection techniques.

Wark Kenneth and Warner C.F, Air Pollution its Origin and Control. Harper and Row, Publ.
Sincero A.P. and Sincero G.A. Environmental Engineering.Prentice Hall.
Manual of Solid Waste Management, Ministry of Urban Development, Govt. of India.

EN706 Environmental Microbiology and Engineering Laboratory (0-0-6) 4

Examination of Microorganisms. Reactor design and operation – demonstration, session: laboratory biochemical reactor, coagulation, chlorination of water, heavy metal removal, colour removal, Absorpion studies using activateld carbon. Estimation of suspended particulate matter / NO2/NO3/SO2/SO3 in air using high volume sampler.

American Public Health Association et al. 'Standard Methods for the Examinations of Water and Waste Water' APHA.
Aneja, K.R. 'Experiments in Microbiology, Plant Pathology and Tissue Culture', Wishwa Prakashan, New Delhi.

Manual of methods of General Bacteriology, ASM Publication.

EN801 Earth and Environment (3-0-0) 3

Understanding the Earth, atmosphere and processes governing environmental conditions; the geologic, tectonic, hydrological and biogeochemical cycles. Study and significance of natural resources; renewable biological resources, wildlife conservation/management, fisheries, forestry, energy resources, energy consumption, scarcity and conservation; mineral resources, mineral availability and recycling; air, water and soil resources. World food supply; ecological impacts of modern agriculture, organic farming. Major environmental concerns

Heijungs, R. Environmental Life Cycle Assessment of Products. Center of Environmental Science , Leiden.

EN802 Transport of Water and Wastewater (3-0-0) 3

Transport of Water: Water Storage and Transmission: pumps and pumping units, Materials for pipes: Specification for pipes, pipe appurtenances, control devices.

Distribution Systems : Principles of design, analysis of distribution networks, maintenance of distribution systems, Transport of Wastewater: Concept of model based design - hydraulic fundamentals of design models - Basic properties and model formulations for the design of wastewater of collection system - transitions in flow of sewage. Storm Drainage: rainfall data analysis – hydraulics. Equipment requirement for O & M; preventive maintenance - monitoring safety requirements.

Fair, G.M. Geyer, J.C., Okun, D.A. Water and Wastewater Engg. Vol.I and II, John Wiley, 1981

EN803 Air Quality Management (3-0-0) 3

Atmospheric diffusion of pollutants and their analysis, Transport, transformation and deposition of air contaminants on a global scale, Air sampling and pollution measurement methods, principles and instruments, Ambient air quality and emission standards, Air pollution indices, Air Act, legislation and regulations, control principles, Removal of gaseous pollutants by adsorption, absorption, reaction and other methods. Biological air pollution control technologies; bioscrubers, biofilters, Indoor air quality

Wark Kenneth and Warner C.F, Air Pollution its Origin and Control. Harper and Row, Publi.

EN804 Models for Water and Air Quality (3-0-0) 3

Introduction to Mathematical Models: Modelling approaches to water quality - classification of models - considerations in selecting models, Model requirements and limitations. D.O. Models for Streams, Models for Estuary and Lakes, Air quality models

Thomann, R.V., and Mueller, A.J. Principles of surface water quality modelling and control, Harper and Row, New York.

EN805 Solid and Hazardous Waste Management (3-0-0) 3

Municipal Solid Waste : Generation, Rate Variation, characteristics; Management Options for Solid Waste, Transport of Municipal Solid Waste, Routing and Scheduling, Treatment, Transformations and Disposal Techniques. Norms, Rules and Regulations. Economics of the on-site v/s off site waste management options. Integrated waste management. Introduction to Hazardous wastes, Definition of Hazardous waste, Risk assessment, Transportation of hazardous waste, Current Management Practices: Environmental audit, Containment, remedial alternatives.

C.N. Haas and R.J. Vamos. Hazardous and Industrial Waste Treatment. Prentice Hall, Englewood Cliffs, New Jersey.

Freeman, H.W. Standard Handbook of Hazardous Waste Treatment and Disposal, McGraw Hill, 1989

EN806 Environmental Systems Analysis (3-0-0) 3

Introduction to natural and man-made systems. Systems modeling as applied to environmental systems, the model building process, addressing to specific environmental problems. Strategies for analyzing and using environmental systems models. Application of optimization methods. Integrated management strategies

Weber W.J. Jr. Environmental Systems and Processes, Wiley Interscience.

EN807 Management of Water, Waste and Sanitation Utilities (3-0-0) 3

Introduction to management of Water and Sanitation, Development programmes, Feasibility planning. The role, objectives and techniques of project management to deliver effective and efficient infrastructure services, Project Appraisal, Contract management, Strategic Management, Change Management, Financial & Marketing management for non-financial water managers, Sustainable water and material flux management, Environmentally sound technologies for fresh water and wastewater management, Waster quality surveillance programmes. The Emergence of Public Services Transnational Corporations and their Strategies in the Water Sector. Concept of Water Markets and the role of national and federal governments.

Mays, Urban Water Supply Handbook, Mc Graw Hill.

EN808 Membrane Processes for Water and Waste Treatment (3-0-0) 3
Introduction to membrane separation processes, Membrane filtration, dead and filtration, Cake filtration, Reverse osmosis, Nanofiltration, Ultrafiltration, Microfiltration, Membranes and modules, MF/UF experimental set up, Laws of MF/UF, Limiting Phenomena, Economic study, Applications, Case studies.
American Water Works Association Research Foundation, Water Treatment- membrane processes, Mc. Graw Hill.

EN809 Selected Topics in Environmental Engineering (3-0-0) 3

GT700 Basic Geomechanics (3-1-0) 4
Concepts of failure and yield in soil, Failure theories, Effective stresses in soils, Microstructural considerations, Stress-path concepts and their applications. Shear Strength of soils and rocks, Mohr-Coulomb strength theory, Shear strength tests, Stress-deformation characteristics. Critical state concepts and their application, constitutive relationships. Deformation analysis, components of settlement, permissible settlements, consolidation settlements . Flow through soils.
Mitchell, J.K. "Principles of Soil Behavior", John Wiley
Lambe, T.W. and Whitman, R.V. "Soil Mechanics", Wiley Eastern.

GT701 Shallow foundations (3-1-0) 4
Assessments of foundation loads, Determination of bearing capacity by theoretical approaches, penetration tests and plate load tests, Proportioning of footings, Structural design of shallow foundations, Expansive soils-Problems and remedial measures. Footings on layered soils and sloping grounds.
Bowles, J.E., " Foundation analysis and design", McGraw Hill.
Swamisaran S., "Design of substructures",Oxford and IBH publishers
Winterkorn and Fang," Foundation Engineering handbook", Von Nostran Reenhold Co.

GT702 Geotechnical Engineering Lab (0-0-6) 4
Identification of soils, Index properties, Hydraulic properties, Shear strength properties, Settlement characteristics, parametric studies. Rock testing- Shear and Compression tests. Tests on Geosynthetic materials. Demonstration of SPT and Pressuremeter.
Lambe, T.W.,"Soil testing", Wiley International.
Relevant latest IS Codes.
Head,K.H.,"Manual of soil laboratory testing" Volumes 1-3.

GT703 Earth and Earth Retaining Structures (3-0-0) 3
Introduction, Rankine and Coulomb theories, Graphical method, Passive earth pressure by curved rupture surface, Stability analysis of gravity type, Cantilever type, Counterfort type and Soil reinforced retaining walls. Braced excavations, Analysis and design of sheet piles, Stability of slopes, Finite and infinite slopes, Swedish circle method, Taylor's modified Swedish circle method and Bishop's method of analysis.
Terzaghi K, and Peck,R.B., "Soil Mechanics in engineering practice", McGraw Hill.
Bowles, J.E., " Foundation analysis and design", McGraw Hill.

GT704 Pile Foundations (3-1-0) 4
Shallow vs. deep foundations, Classification of pile foundations, axial load carrying capacity of a single pile by different methods, negative skin friction, pile group efficiency, distribution of load to piles in groups, Design of piles and pile cap; settlement analysis of single pile and pile groups; Laterally loaded piles, batter piles, under-reamed piles; Construction of pile foundation, pile driving equipments and Pile load tests; durability and protection of piles, economics of pile foundations.
IS 2911; Tomlinson, M.J., "Pile Design and Construction Practice", E and FN Spon.
Poulos, H.G and Davis, E.H.," Pile Foundation Analysis and Design", John Wiley

GT705 Ground Improvement Techniques (3-0-0) 3
Introduction to engineering ground modification, need and objectives, Soil stabilization techniques; Mechanical modifications (shallow and deep compaction methods); Hydraulic modification, Dewatering systems, use of Geosynthetics and Prefabricated vertical drains, Preloading and Vertical drains; Chemical Modifications, Modification by admixtures, grouting, deep jet mixing methods, stabilization using industrial wastes; Modification by inclusion and Confinement; Soil reinforcement techniques, soil nailing.
Hausmann, M.R.,Engineering Principles of Ground Modification, McGraw-Hill.
Purushotham Raj, "Ground Improvement Techniques", Laxmi Publications, New Delhi.

GT706 Computer Lab (0-0-3) 2
Evaluation of allowable bearing pressure for different condition, slope stability analysis by different methods, analysis and design of single pile and pile groups. Analysis and design of retaining walls.

Bowles J.E, "Foundation analysis and design", McGraw Hill.
Iqbal H. Khan " A text book of Geotechnical Engineering" Prentice-Hall

GT800 Soil Reinforcing Techniques (3-0-0) 3

Historical background, RCC, Vidalean concept of reinforced earth, Mechanisms, Types of reinforcements, Backfill soil properties, soil-reinforcement interaction studies, Internal and external stability criteria, Design principles of steep reinforced soil slopes, reinforced earth walls, reinforced soil footings, pavements, embankments on soft soils, geosynthetic clay liners, construction details; geosynthetic materials, functions, property characterization, testing methods for geosynthetics. Recent research & developments.

Koerner, R.M. "Designing with geosynthetics", Prentice Hall Inc.
Jones, C.J.F.P., "Earth Reinforcement and Soil Structures", Butterworths, Lodon.

GT801 Rock Mechanics (3-0-0) 3

Engineering classification of rocks, Engineering properties of intact rocks, Determination of insitu properties – shear strength, deformation, insitu stress, strength of jointed rocks, stability of rock slopes, Bearing Capacity determination, Ground improvement techniques in rock masses, Rock blasting.

Jaegar and Cook, "Foundation of rock masses".
Goodman, " Introduction to rock mechanics", Wiley international

GT802 Soil Dynamics and Machine Foundations (3-0-0) 3

Dynamic loads, Types of machine foundations, Theory of free and forced vibrations, Dynamic soil properties, mass spring dash pot model, elastic half space model, damping in soils, Design of machine foundations, Foundations under reciprocating engines, Foundations for machines producing impact loads, Vibration Isolation.

Barkan, "Dynamics of Bases and Foundations", McGraw Hill.
Richart R.E., Hall Ward Woods, "Vibrations in soils and foundations", Prentice Hall.
Prakash S., "Soil Dynamics", McGraw Hill

GT803 Advanced Engineering Geology (3-0-0) 3

Introduction, interior of the earth, weathering, Earthquakes, soils, mineralogy, petrology, study of igneous, sedimentary, metamorphic rocks, Engineering properties of rocks and their assessment, structural geology, geological structures, Dip and strike, folds, faults, joints, unconformities and their importance, clay mineralogy, stratigraphy, Hydrogeology, geophysical exploration, applied geology, geological investigations in dam projects, tunnel projects and in landslides, control measures

Blyth, F.G.H & de Freitas, H.H. "Engineering Geology", ELBS
Krynine & Judd "Principles of Engineering Geology and Geotechnics" Mcgraw Hill
Robert F. Legget "Geology and Engineering" McGraw Hill

GT804 Finite Element Method for Geotechnical Engineers (3-0-0) 3

Introduction; Single element - various shapes, displacement models, isoparametric elements, stresses and strains, stiffness matrices; The overall problem – an assemblage of elements; Techniques for nonlinear analysis; Application of FEM to soil and rock mechanics

Desai, C.S. & Abel, J.F. " Introduction to Finite Element Method" CBS Publishers.
Gudehus, R.D. "Finite Element in Geomechanics" John Wiley.

GT805 Earth and Rockfill Dams (3-0-0) 3

Introduction, site selection and exploration; Factors influencing design and design details; Treatment of rock foundations and abutments; Foundation treatment of Earth dams on pervious soils, controlling underseepage and relief wells; stability analysis; special design problems and details; measurements of porewater pressure and movements; Embankment construction procedures, equipments, quality control.

Sherard, J.C., Woodward, R.J., Gizienski, S.F. and Clevenger, W.A. – "Earth and Earth Rock Dams" John Wiley.
Sowers, G.P. and Sally, H.L. "Earth and rockfill Dam Engineering" Asian Publ. House.

GT806 Geotechnical Instrumentation (3-0-0) 3

Requirements of a good instrumentation; Theory, Design, Methods of analysis of data; laboratory and field instrumentation; Planning an instrumentation program; transducers, hydrometers, strain measuring devices, load cells, LVDTs, pH meter etc, measuring rock and rock mass properties; settlement gauges, inclinometers, earth pressure cells, piezometers, instruments used in geophysical exploration methods, ground probing radar and instruments used in field tests such as SPT, SCPT, DCPT etc., nuclear moisture meter/densitometer, frequency analyzer, role of electronics in instrumentation; calibration, maintenance and installation of instruments, uncertainty analysis

Hanna, T.H., "Field Instrumentation in Geotechnical Engineering, Trans-Tech Publ..

Bowles, J.E., "Engineering Properties of Soils and their Measurements", McGraw-Hill.

GT807 Selected Topics in Geotechnical Engineering (3-0-0) 3

ST700 Theory of Elasticity & Plasticity (3-0-0) 3

Elasticity : Definition and notation of components of stress and strain, Generalized Hooke's Law. Plane stress and plane strains. Airy's stress function. Differential Equations of equilibrium, Solution of two dimensional problems using polynomials. Solution in rectangular and polar co-ordinates. Torsion of Prismatic, Circular and Rectangular bars. Prandtl's membrane analogy.

Plasticity : Introduction to plasticity, Criterion of yielding, Bending of prismatic beams, residual stresses, Plastic torsion.

S.P. Timoshenko and N.Godier, "Theory of Elasticity", McGraw Hill
J. Chakrabarthy, "Theory of Plasticity", McGraw Hill
Sadhu Singh, "Theory of Plasticity",Khanna Publishers

ST701 Matrix Methods of Structural Analysis (3-0-0) 3

Discrete and Continuum Structures, Equilibrium and Compatibility in structures, Static and kinematic indeterminacy, Stiffness and flexibility matrices, Transformation matrices.

Formulation and solution of problems using stiffness methods, Applications to beams, trusses, frames and grids. Solution of problems of plane trusses, beams and frames using flexibility approach. Application to problems involving temperature changes, pre-strains, support displacements, oblique supports and elastic supports. Substructure method.

C.K. Wang – Intermediate Structural Analysis
Robert E. Sennet – Matrix Analysis of Structures
John L. Meek – Matrix Structural Analysis

ST702 Theory of Plates and Structural Stability (3-0-0) 3

Thin and thick plates-deflection of laterally loaded plates-Navier and Levy's method-Energy and finite difference methods-Plate subjected to in-plane and lateral loads-Circular plate with symmetrical loading-Bending of prismatic bars under simultaneous action of axial and lateral loads-Buckling of solid and open web columns-Analysis of beam columns-lateral stability of beams-Introduction to buckling of plates.

S. P. Timoshenko and S. W. Krieger, Theory of Plates and Shells, McGraw-Hill
S. P. Timoshenko and J. M. Gere, Theory of Elastic Stability, McGraw-Hill

ST703 Structural Dynamics (3-0-0) 3

Types of dynamic problems. D'Alembert's principle, equation of motion, degrees of freedom. SDOF systems – free and forced vibrations, support motion, vibration isolation, transmissibility, Duhamel's integral and its numerical evaluation. MDOF systems – Free vibrations, natural modes, orthogonality conditions, shear frame, matrix iteration for eigenvalues and eigenvectors, forced vibrations, mode superposition method, damping in MDOF systems. Vibrations of beams and plates with different end conditions. Principles of earthquake resistant design, response spectrum and equivalent force concepts, Introduction to design code IS 1893.

Mario Paz, Structural Dynamics,CBS Publishers
Clough and Penzien, Dynamics of Structures, McGraw-Hill

ST704 Computer Lab (0-0-3) 2

Students should develop flow charts and programs for design and detailing of RC elements. Analysis of structures using available softwares.

ST705 Advanced Design of Concrete Structures (3-1-0) 4

Review of limit state design method. Design of floor systems, ribbed slab, hollow cored slab, grid floor, yield line analysis, strip method. Redistribution of moments, continuous beams and frames. Industrial buildings, purlins, crane gantry girders, precast roof systems, shell and folded plate elements, double pitched roof beams, trusses, columns, corbels, deep beams, R.C. walls. Storage structures, silos and bunkers, PSC pipes and water tanks. Raft and pile foundations.

Mark Fintel 'Hand book of concrete engineering' ReinHold, New York 1995
N. Krishna Raju, 'Advanced reinforced concrete design' CBS Publishers 1996.
P. Purushothaman 'Reinforced concrete structural elements' Tata McGraw-Hill 1994.

ST706 Advanced Design of Steel Structures (3-1-0) 4

Review of design of structural members and connections, Bolted and welded connections – Flexible, Semi-rigid and rigid connections. Design of Industrial buildings – Trussed bents, rigid frames, Vierendeel girders, open web structures and castellated beams, beams with openings. Multi storey framed structures, bracings, semi-rigid

joints. Design of steel and concrete composite beams, columns, floors. Design of light gauge cold formed steel sections. Plastic design – beams, rectangular and gable frames. Limit state design – tension members, compression members and beams. Design of silos and bunkers.
Johon E. Lothers – Advanced Structural design in steel
Lynn S. Beedle – Plastic design of steel frames
Handbook of open-web structures – CMERI – Durgapur

ST707 Shells and Folded Plates (3-0-0) 3 PREREQ ST702
SHELLS – Classification of shells, Membrane and bending theory of Circular Cylindrical shells, beam method for Cylindrical shells. Membrane theory of doubly curved shells – Pucher's stress function, Applications for spherical dome, Conical shell, Hyperboloid of revolution, Elliptic paraboloids, Conoids, hyperbolic Parabolids. Folded Plates – behaviour, Whitney's and simpson's Methods, beam method.
Ramaswamy G.S, Design and Construction of shell roofs, CBS Publishers.
K Chandrashekhara, Analysis of thin concrete shells, Tata McGraw-Hill.

ST708 Structures Lab (0-0-3) 2
Concrete Mix Design by different methods, Strain measurements using mechanical and electrical strain gauges. Study of Structural behaviour of beams and columns, Non-destructive testing of concrete.

ST800 Finite Element Method (3-0-0) 3
Types of elements-Discretization of structures-Interpolation functions-Generalised and natural coordinates-Direct method of element formulation-Limitations-Variational method-Numerical integration-Timoshenko beam element-Plate bending elements-Mindlin element-Shell elements-Techniques for material and geometric non-linear problems.
C. S. Krishnamoorthy, Finite Element Analysis: Theory and Programming, Tata McGraw-Hill.
O. C. Zienkiewicz and R. L. Taylor, The Finite Element Method (vol. 1 and vol. 2), McGraw-Hill

ST801 Earthquake Engineering (3-0-0) 3
Earthquake magnitude and intensity, earthquake waves, seismic zoning maps, seismic risk and hazard, ground response spectrum, site amplification, liquefaction, selection of design earthquakes, peak ground acceleration. Earthquake analysis of structures, idealization, equivalent force concepts, response spectrum analysis, concepts of earthquake resistant design: ductility, lateral stiffness, strong column-weak beam design. Seismic retrofitting and repair. Concepts of base isolation and structural response control. Introduction to IS codes –IS 1893, IS 4326, IS 13935, IS 13920.
Newmark and Rosenblueth, Fundamentals of Earthquake Engineering.
Dowrick, Earthquake resistant design

ST802 Structural Optimization (3-0-0) 3
Classical optimization techniques, Linear Programming – Simplex method, Nonlinear programming – Unconstrained optimization techniques – Steepest descent method, DFP Method, Constrained techniques – SLP and SUMT, Introduction to GA. Applications to structural design problems, computer implementation.
S.S. Rao, optimization – Theory and applications, Wiley Eastern Ltd.
Kalyanmoy Deb, optimization for engineering design, Pentice Hall of India Private Ltd.

ST803 Soil Structure Interaction (3-0-0) 3
Soil-Foundation Interaction. Soil response model, Elasto plastic behaviour, time dependent behaviour. Beams on Elastic Foundations, Analysis of beams of finite length. Plates on Elastic medium, Infinite plates, thin and thick plates. Elastic analysis of piles, Analysis of pile groups, Interaction analysis.
A.P.S. Selva durai, "Elastic Analysis of Soil-Foundation Interaction".
H.G.Poulos and E.H. Davis, "Pile-Foundation Analysis and Design".John Wiley & Sons
R.F.Scott, "Soil Mechanics and Engineering ",McGraw Hill .

ST804 Safety of Structures (3-0-0) 3
Basic statistics and probability theory – characteristics of random distributions, levels of significance and confidence, Statistical distributions. Reliability theory, structural reliability – level 1,2 and 3. Characteristics of load and resistance – FOSM and AFOSM methods of assessment. Interpretation of safety. Determination of partial safety factors.
Ranganathan, Reliability analysis and design of structures.

ST805 Offshore Structural Engineering (3-0-0) 3

Common offshore structures – jacket, gravity-type, hybrids, guyed towers, TLP, compliant structures. Environmental loadings – wind, waves, ice, buoyant, earthquakes, diffraction theory and Morison equation approach for wave force. Static analysis – steel structures, concrete platforms, design stress criteria, examination for dynamic effects. Foundation analysis – piles, pile axial capacity, bearing capacity of footings, settlement of foundations. Dynamic analysis – governing equations for wave loadings, stress analysis, response to earthquake loadings.

Dawson, Offshore structural engineering, Prentice Hall

ST806 Advanced Concrete Technology (3-0-0) 3

Structure of Concrete – Concrete as a three-phase material – Strength Properties of Concrete – Compressive, tensile, shear, bi and tri-axial stresses; Deformation Characteristics of Concrete – elastic deformations, shrinkage, creep and thermal properties; Durability of Concrete – Permeability related problems, Alkali-aggregate reactions. Chemical and Mineral Admixtures, Concrete Mix Design Procedures, Testing and Quality Control of concrete – Conventional and non-destructive tests.

Mehta P.K. & Monteiro P.J.M, Concrete-Microstructure, properties and materials
Neville A.M., Properties of Concrete
Sandor Popovics Concrete Materials – Properties, Specifications and testing

ST807 Wind Resistant Design of Structures (3-0-0) 3

Tall buildings – structural concepts, wind effects, Lateral systems for steel buildings, concrete buildings and composite constructions – Shear walls and bracings; Gravity systems for steel buildings, concrete buildings and composite constructions. Analysis and design of Steel Transmission line towers, R.C. chimneys, R.C. cooling towers.

Structural Analysis and Design of tall buildings – Bungale S. Taranath.
Reinforced Concrete Chimneys and Towers – G.M. Pinfold.
Transmission line Structures – S.S. Murthy and A.R. Santhakumar.

ST808 Mechanics of Composite Laminates (3-0-0) 3 PREREQ ST702

Types and classification-Lamina stress strain relationship-Classification of laminates-Failure theories-Classical lamination theory-Stress strain variation in a laminate-Stress analysis-Intra and interlaminar stresses in laminates-First and higher order deformation theories-Bending, vibration and buckling analyses using the above theories-Equilibrium equations using PMPE-Boundary conditions-Solution methods.

R. M. Jones, Mechanics of Composite Materials, McGraw-Hill.
J. R. Vinson and R. L. Seierakowski, The Behaviour of Structures Composed of Composite Materials, Martinus Nijhoff Publishers.

ST809 Advanced Bridge Engineering (3-0-0) 3

Review of IRC and IRS loadings. Effect of concentrated loads on deck slabs, load distribution methods for concrete bridges. Analysis and Design of superstructures -T beam and slab, bridge, box girder bridge, Prestressed bridge, balanced cantilever bridge, rigid frame, arch, bow, string girder. Steel plate girder and trussed bridges, composite bridges, cable-stayed bridges, Dynamics response of bridge decks.

Essentials of Bridge Engg. – D.J. Victor, Oxford & IBH
Design of Bridges – N. Krishna Raju, Oxford & IBH
Cable Stayed Bridges – M.S. Troitsky

ST810 Analysis and Design of Substructures (3-0-0) 3

Introduction, Bearing Capacity of shallow foundation, proportioning and designing isolated footing, combined footing, strap footing and raft foundation. Pile foundations – Types of piles, load Carrying Capacity of single pile and pile groups. Analysis design of pile group and pile cap. Analysis and desuign of various types of retaining walls.

Swamisaran S., 'Design of Substructures', Oxford & IBH
Bowles, J.E., "Foundation analysis design', McGraw Hills
Tomlinson M J 'Pile Design and Constructions Practice', E & FN spon.

ST811 Computer Aided Design in Structural Engineering (3-0-0) 3

Computer Aided Design Concepts. Program planning and sequencing, Stages in structural design. Computer Graphics, Artificial Intelligence, Knowledge-based expert Systems, Architecture and Applications of KBES, Principles of Neural Net works. Flow-charts and programs for design and detailing of RC Elements.

C.S.Krishnamoorthy and S.Rajeev, "Computer Aided Design".Narosa Publishers.
H.B.Harrison, "Computer Methods in Structural Analysis ",Prentice Hall.
Adeli.H. and Balasubramanyan.K.V."Expert systems for Structural Design",Prentice Hall.

ST812 Selected Topics in Structural Engineering (3-0-0) 3

TS701 Pavement Design (3-0-0) 3

Introduction to Pavement – types-factors affecting design and performance of pavements. Highway and Airport Pavements, Subgrade and climate, Stresses and deflections in Flexible Pavements, Flexible Pavement Design Methods for Highways and Airports, Stresses in Rigid Pavements, Rigid Pavement Design.

Yoder, E.J., " Principles of Pavement Design", John Wiley
Yoder & Witczak, "Principles of Pavement Design", 2nd Edition, John Wiley

TS702 Urban Transport Planning (3-1-0) 4

Transport Systems and Travel Demand: Overview of Major Transport Systems, Interactions with Industry, Transportation-System Components and Problems, Travel Demand, Demand Function, and forecasting. Transportation Planning Process: Trip Generation, Trip Distribution, Modal Split, and Trip Assignment. Land Use Transport Planning: Lowry Model, Garin-Lowry Model, Other Lowry Derivative Models, ISGLUTI Models, and Other Land Use models. Graph Theory, Entropy in Transportation, and Commodity Flows.

Hutchinson, B.G., Principles of Urban Transport Systems Planning, McGraw Hill, London.
Bruton, Michael J., Introduction to Transport Planning, Hutchinson, London.
Wilson, A..G., Entropy in Urban and Regional Modeling, Pion Ltd., London.

TS703 Transportation Engineering Lab I (0-0-6) 4

Testing on Subgrade Soil, Testing on Road Aggregates, Tests on Bituminous Materials, Tests on Bituminous Mixes.

Khanna, S.K. and Justo, C.E.G., " Highway Material Testing", Nem Chand & Bros, Roorkee
I.R.C Specifications
I.S. Specifications

TS704 Traffic Flow Theory (3-0-0) 3

Traffic Studies and Surveys (Traffic Speed, Delay, Volume, and O-D Studies and Surveys, Time Mean Speed, Space Mean Speed and Lane Occupancy), Statistical Distributions in Traffic Engineering, Traffic Steam Models (Speed-concentration relationships, Flow-concentration relationship, Lighthill and Witham's Theory), Car Following Theory and Models, Queuing Theory and Applications, Vehicle Arrivals, Headways, and Gaps, and Simulation of Traffic.

Whol, Martin Traffic Systems Analysis for Engineers and Planners, McGraw Hill, London.
Haight, Frank A. Mathematical Theories of Traffic Flow, Academic Press, London.
Kadiyali, L.R., Traffic Engineering and Transport Planning, Khanna Publishers, New Delhi.

TS705 Transportation Engineering Lab II (0-0-6) 4

Volume Studies, Speed and Headway Studies, Journey time and delay studies, Intersection delays, Parking Surveys, Driver characteristics, Interviews, Exercise on driver knowledge

TS800 Pavement Evaluation (3-0-0) 3

Structural and functional requirements of flexible and rigid pavements, pavement distress, different types of failures and causes, Pavement Surface Conditions- Pavement Slipperiness, Unevenness, ruts, Pot holes, cracks, Evaluation of Surface Conditions, Condition of Pavement Structures, Evaluation of Pavement Structural Condition, Model Pavements – Testing of model pavements under controlled conditions, test setup and instrumentation, Overlay design, Instrumentation in Pavement Testing

Babkov, "Road Condition and Traffic Safety", Mir Publications
David Croney, "The Design and Performance of Road Pavements", HMSO Publications

TS801 Advanced Modeling Techniques in Transportation Engineering (3-0-0) 3

Fundamentals of Artificial Neural Networks, and their applications, Basics of Genetic Algorithms and Simple Applications, Applications of Statistical Techniques, Expert Systems and their Applications.

Kadiyali, L.R., Traffic Engineering and Transport Planning, Khanna Publishers, New Delhi.
Salter, R.J., Traffic Engineering: Worked Examples and Problems,The Macmillan Press, London.

TS802 Transportation Systems Management (3-0-0) 3

Quick Response Travel Estimation Procedures, TSM Actions- Traffic management techniques for improving vehicular flows, preferential treatment for high occupancy modes, promoting non auto or high occupancy use, transit and intermediate public transport service improvements. Demand management techniques for reduced traffic demand, staggered hours, vehicle restrictions, Intersection management techniques, signal progression, optimization and computer controls, Transit Operations Management- Bus transit operations, planning, routing

and scheduling. Location of loading and unloading platforms and transit terminals etc. Management of Bicycles, Small area Management- Planning for pedestrians, parking planning, traffic effects of land use developments.
John Black, Urban Transport Planning, Croom Helm, London .
Transportation Systems Management: State of the Art", UMTA, US Dept. of Transport

TS803 Soil Mechanics for Highway Engineers (3-0-0) 3
Functions of subgrade soil, importance of subgrade soil properties in highway engineering such as Design and performance of pavements, embankment foundations and slopes, Soil survey, Soil water, Detrimental matter in soils, Frost action in soil, Soil Compaction, Stress- Strain Relationships on Soils, Stress in Soils, Highway Embankments, Foundations, Stability Analysis.
RRL, DSIR, " Soil Mechanics for Road Engineers", HMSO London
Leonards, " Foundation Engineering", McGraw Hill Book Co.

TS804 Highway and Airport Geometric Design (3-0-0) 3
Design Controls and Criteria: Factors Influencing Functional Design of Highways, Design Controls and Criteria, Topography and Physical Features, Traffic, Impact of Vehicular Characteristics on Road Geometrics, Speed, and Safety. Cross-sectional Elements and Highway Geometrics: Cross-sectional Elements, Sight Distance, Horizontal Alignment, Vertical Alignment, Intersection Design, Parking and Other Facilities, Rotaries and Grade Separators. Airport Design Standards, Airport Configuration and Planning
AASHO, A Policy on Geometric Design of Rural Highways and Urban Highways.
Khanna S.K., and Arora, M.G., Airport planning and Design, Nem Chand and Bros., Roorkee.
Kadiyali, L.R., Traffic Engineering and Transport Planning, Khanna Publishers, New Delhi.

TS805 Urban Mass Transport Systems (3-0-0) 3
Transit Classifications: Classes of Transit Modes, Modes, Technologies, Service Types, and routing. Basic Transit Management Activities: Service, Finance, Marketing, Maintenance, Demand Analysis, Transit Subsidies. Transit Terminals: Design, Functional Aspects, and Scheduling of Transit Units. Efficiency and Effectiveness Indicators for Transit Planning: System, Subsystem, and Route Level Analyses, Staff Utilization, Fleet Utilization and Productivity, Passengers Carried, Revenue, Operating Costs, and Break-Even Load, Capacity Utilization, Financial Performance indicators, Cost-Benefit Analysis.
Vukan, R. and Vuchic, A. Urban Public Transport Systems and Technology.
Morlok, E.K. Introduction to Transportation Engineering and Planning, McGraw Hill, London.

TS806 Traffic Engineering and Design (3-0-0) 3
Traffic Studies – Nature of Traffic, Role of Traffic Engineering, Characteristics of Driver, road user and vehicle, Traffic Surveys and Analysis, Traffic Flow – Density speed and their relationships, Intersection maneuvers and operation, Level of Service- Highway Capacity and Level of Service Concepts, Capacity under Heterogeneous Traffic Conditions, Accidents and Road Safety, Design of Traffic Signals, Pedestrian Facilities and Parking Design.
Kadiyali, L.R.., Traffic Engineering and Transport Planning, Khanna Publishers, New Delhi
Pignataro, L., Traffic Engineering: Theory and Practice, John Wiley

TS807 Air Transport Planning and Design (3-0-0) 3
Airport Planning- Aircraft characteristics related to airport planning and design, airport master plan, site selection, planning surveys etc. Classification and Standards, Capacity and Delay, Terminal Facilities and Standards, The Demand Analysis, Optimal Route Frequency planning- Measure of air travel capacity, Approach to Demand Analysis, Microanalysis of Air Travel Demand, Calibration of Macromodels, Microanalysis of Air Travel Demand, Disaggregate Models of Air Travel Demand, Air travel Choice Models, Simultaneous Models of Demand and Supply. Optimal Route Frequency Planning, Air Traffic Controls.
Horonjeff, R and Mckelvey., The Planning and Design of Airports, McGraw Hill Book Company.
Kanafani, A., Transport Demand Analysis, McGraw Hill Book Company

TS808 Highway Construction Planning and Economics (3-0-0) 3
Equipment in Highway Construction, various types of equipment for excavation, grading and compaction-their working principle and advantages and limitations. Special equipment for bituminous and cement concrete pavement, stabilized soil road construction, Subgrade, Flexible Pavements : special materials, construction method and field control checks for various types of flexible pavement materials in sub-base , base, binder and surface course layers and their choice, Cement Concrete Pavements: Specifications, interlocking block pavements , joints etc., Soil Stabilised Pavement Layers, Drainage, Maintenance of roads, Hill roads
Peurifoy, R.L. Construction, Planning, Equipment and Method, McGraw Hill Book Co.
DSIR, Soil Mechanics for Road Engineers, HMSO London

TS809 Pavement Management System (3-0-0) 3

Components of Pavement Management systems, pavement maintenance measures, planning investment, research management, Pavement Performance Prediction: HDM and other models, Comparison of different deterioration Models, Functional Condition deterioration models, Unevenness prediction models and other models, comparison. Ranking and Optimization Methodologies, Design Alternatives and selection: Road Asset Management, Pavement Preservation Programmes, Techniques and Tools, Expert Systems and Pavement Management

Ralp Haas and Ronald W Hudson, " Pavement Management System", McGraw Hill
Ralp Hass, Ronald Hudson and Zanieswki,"Model Pavement Management", Kreiger Publications

TS810 Rural Roads (3-0-0) 3

Planning of rural roads, Location Surveys and Geometric Design, Pavement Materials: Soil Investigation, Properties and specifications of materials, Utilisation of locally available materials and waste materials in village road projects like fly ash, iron and steel slag, recycled and other waste materials etc., stabilized roads, road aggregates, materials for bituminous construction, cement concrete, special pavements. Pavement Design, Road Drainage, Construction and specifications, Maintenance of rural roads

HMSO, Soil Mechanics for Road Engineers, HMSO Office, London
IRC, Manual for Rural Roads, Indian Roads Congress.

TS811 Road Construction Planning and Management (3-0-0) 3

Various types of highway development projects in progress in India and their scope. Planning of new highway projects, consideration of alternative alignments, Planning different machinery for road project, their type, capacity and number, Optimum location of crushers, mixing plants, Planning various construction activities and their sequence. Application of CPM & PERT. Planning of road improvement and up-gradation projects, planning and construction method of road projects involving widening strengthening of existing road pavements, construction of new carriage-way for six – lane and four lane divided highway.

Peurifoy R.L., Construction, Planning Equipment Method, McGraw Hill
IRC Codes and MoTH Specifications

TS812 Road Safety and Traffic Management (3-0-0) 3

Road accidents, causes, scientific investigations and data collection, Analysis of individual accidents to arrive at real causes, statistical methods of analysis of accident data, application of computer analysis of accident data, Safety in Road Design, Operating the road network for safety, highway operation and counter measures, road safety audit, principles-procedures and practice, code of good practice and checklists. Road safety issues and various measures for road safety. Traffic Management techniques

Babkov, V.F., Road Conditions and Traffic Safety, MIR Publications.
K.W. Ogden, Safer Roads: A Guide to Road Safety Engg, Averbury Technical, Ashgate Publishing Ltd., Aldershot, England.
Kadyali, L.R., Traffic Engineering and Transport Planning, Khanna Publications, New Delhi

TS813 Pavement Materials (3-0-0) 3

Aggregates : Origin, classification, requirements, properties and tests on road aggregates for flexible and rigid pavements, Importance of aggregate shape factor in mix design. Bitumen and Tar: Origin, Preparation, properties and tests, constitution of bituminous road binders, requirements, criterion for selection of different binders, Bituminous emulsions and Cutbacks: fillers, extenders, polymers, crum rubber and anti – stripping agents on pavement performance. Bituminous mixes, Cement Concrete for Pavement Construction

SRL, DSIR, Bituminous Materials in Road Construction, HMSO Publication
ISI and IRC Publications on relevant topics
Asphalt Institute, The Asphalt Hand Book

TS814 Selected Topics in Transportation Systems Engineering (3-0-0) 3

CV800 Environmental Geotechnology (3-0-0) 3

Perspectives of Environmental Geotechnology, Soil – Environment water Interaction, Mass transport, Energy Gradient & Conductivity, Sources of water, Contamination – under ground, ground water, Flow conditions, Contaminate migration, Disposal and Containment of Solid water, Remediation.

Donald P. Coduto Geotechnical Engineering Principles and Practices, Prentice-Hall
Daniel, D. E. "Geotechnical Practice for Waste Disposal", Chapman and Hall, London.
Reddi, L. N., and Inyang, H. F. "Geoenvironmental Engineering- Principles and Applications" Marcel Dekker, Inc.

CV801 Environmental Impact Assessment (3-0-0) 3

Planning and Management of Environmental Impact Studies. methodologies Prediction and assessment of impacts, evaluation of alternatives. Case Studies. Sustainable development; Environmental policy.

Canter L.W. Environmental Impact Analysis, Mc. Graw Hill.
Srivastava A.K. Environmental Impact Analysis, APH Pub., New Delhi.

CV900 Soil Chemistry 4

Introduction, Soil formation, Soil structure, Clay mineralogy, Chemical composition of soils, Soil-lime reactions, Flyash reactions, Soil-cement reactions, Reactions of various other chemicals with soil, Soil grouting, Colloid chemistry, Change in soil properties due to chemical reactions, Impact of environment on soil properties.

Engineering Principles of Ground Modifications, McGraw-Hill.
Renben H. Carol, Chemical Grouting and Soil Stabilization, M. Drekker Publishers, NY.

CV901 Advanced Soil Reinforcing Techniques 4

Historical background, Reinforced soil structures and RCC, Vidalean concept of reinforced earth, Triaxial studies on reinforced soil, Enhanced confining pressure concept and apparent anisotropic cohesion concept, Reinforcing man made slopes, and natural slopes, Reinforcement in body embankment stability of reinforced steep soil slopes, reinforced walls, type of reinforcements, properties of backfill soils, Soil-reinforcement interaction studies, pullout tests and direct shear tests, Reinforcement beneath foundations and embankments, Geosynthetics properties, tests and applications in civil engineering. Recent advances in Soil Reinforcing Techniques.

CJFP Jones, Earth Reinforcement and Soil Structures, Butterworths, London.
R M Koerner, Designing with Geosynthetics, Prentice-Hall.

CV902 Vibration of Plates 4

Strain energy of vibrating systems, free and forced vibration, continuum and discrete systems, differential equations of lateral motions, flexural vibration of plates, Hamilton's principle, Energy methods for determining natural frequencies, eigenvalue and eigenvector, solution methods.

AW Leissa, Vibration of Plates, NASA SP-160.

CV903 Hydrogeology 4

Hydrologicalcycle, Aquifers, classification and characteristics, Groundwater distribution, occurence, movements, Groundwater exploration, Geological, hydrological, geophysical and remote sensing methods, Groundwater budgeting, Groundwater recharge, Rainwater harvesting, Quality of groundwater, Groundwater management, Case histories of typical groundwater studies.

David Keith Todd, Ground Water Hydrology, John Wiley and Sons.
K. R. Karanth, Groundwater assessment, development, managemen, Tata McGraw-Hill.

CV904 Advanced Environmental Geotechnology 4

Perspective of environmental geotechnology, Soil, environment, water interaction, mass transport, Energy gradient and conductivity, Sources of water contamination, Under ground, groundwater flow conditions, Contaminate migration, Disposal and containment of solid, water remediation. Recent advances in Environmental Geotechnology.

Donald P. Coduto, Geotechnical Engineering, Principles and Practices, Prentice-Hall.
Daniel, D. E. "Geotechnical Practice for Waste Disposal", Chapman and Hall, London.
Reddi, L. N., and Inyang, H. F. "Geoenvironmental Engineering- Principles and Applications" Marcel Dekker, Inc.

CV905 Special Concretes 4

High performance concrete, definition, materials used, mix design methods, properties of fresh and hardened states, Recent advances in mix design procedure, Lightweight aggregate concrete, definition materials used, mix proportioning and properties, Self compacting concrete, definition, mix proportioning, testing at fresh state, No fines concrete, definition, mix design and properties.

PC Aitcin, High Performance Concrete, E&FN SPON, London.
AM Neville, Properties of Concrete, Longman Scientific and Technical Publishers.

CV906 Mechanics of Composite Laminates 4

Types and classification, Lamina stress strain relationship, Classification of laminates, Failure theories, Classical lamination theory, Stress strain variation in a laminate, Stress analysis, Intra and interlaminar stresses in laminates, First and higher order deformation theories, Bending, vibration and buckling analyses using the above theories, Equilibrium equations using PMPE, Boundary conditions, Solution methods.

RM Jones, Mechanics of Composite Materials, McGraw-Hill.
JR Vinson and RL Seierakowski, The Behaviour of Structures Composed of Composite Materials, Martinus Nijhoff Publishers.

CV907 Basic Operation Research and Shape Optimisation 4

Structures, Hall marks of good structures, Stability Strength, Safety, Serviceability, Durability and economy, Need and scope for Optimization. Optimization basics, Classical methods, Numerical techniques, Objective function, Constraints, Problem formulation and solution. Structural Configuration, Inherent relationships between load and shape – topology. Minimum weight, minimum cost, Maximum strength to weight ratio, Multi-objective techniques of topology

SS Rao, Optimization, Wiley Eastern
Gallagher, Optimum Structural Design, Wiley, New York.

CV908 Structural Systems for Tall Buildings 4

Configuration, Structural Concepts, Building frames, Hard and soft connections, Lateral loads, Stability, lateral load resisting systems, Shear walls, Shear cores, Tube-in-tube concept, Soft tube structures, Core-frame interaction, Outriggers. Transmission line towers, Chimneys, Cooling towers, analysis and design, detailing.

Taranath, Analysis and Design of Tall Buildings, McGraw Hill, New York
Pinfold, RC Chimneys and Towers, Viewpoint Publ., London

CV909 Innovative Applications of Shells in Foundations 4

Foundations, Criteria for design, General and local shear failures, Settlements, Bearing Capacity and Allowable Pressures, Conventional Foundation Types. Shells and folded plates as foundations, Shell geometry, Classifications, Stability of shells and plates as footings, Strategic considerations for selection of type. Analysis, design and detailing of singly and doubly curved shell foundations, Applications of V and trough folded plates in footings and retaining structures.

G. S. Ramaswamy, Design and Construction of shell roofs, CBS Publishers.
N. P. Kurian, Design of Foundation Systems: Principles and Practices, Wesley Publishing Co.

CV910 Numerical Analysis 4

Solution of algebraic transcendental and polynomial equations. Newton-Raphson method, Muller method, Graeffe's and Bairstow's methods. Lagrange's, Hermite and Cubic Spline interpolation, Numerical differentiation and integration, Numerical solution to ordinary and partial differential equations, Finite element method, formulations using Galerkin and Ritz method. Gaussian integration, Frontal solution technique.

MK. Jain, SRK. Iyengar and RK Jain, Numerical Methods for Scientific and Engineering Computations, Wiley Eastern.
AR. Mitchell and R. Wait, Finite Element Method in Partial Differential Equations, John Wiley and Sons.

CV911 Advanced Geotechnical Instrumentation 4

Requirements of a good instrumentation; Theory, Design, Methods of analysis of data; laboratory and field instrumentation; Planning an instrumentation program; transducers, hydrometers, strain measuring devices, load cells, LVDTs, pH meter etc, measuring rock and rock mass properties; settlement gauges, inclinometers, earth pressure cells, piezometers, instruments used in geophysical exploration methods, ground probing radar and instruments used in field tests such as SPT, SCPT, DCPT etc., nuclear moisture meter/densitometer, frequency analyzer, role of electronics in instrumentation; calibration, maintenance and installation of instruments, uncertainty analysis. Recent advances in Geotechnical Instrumentation.

Hanna, T.H., "Field Instrumentation in Geotechnical Engineering, Trans-Tech Publications.
Bowles, J.E., "Engineering Properties of Soils and their Measurements", McGraw-Hill Book Co.

CV912 Earthquake Resistant Design of Structures 4

Introduction to earthquake resistant design, seismicity and earthquake ground motions, dynamic characteristics of structures, dynamic response of structures, initial design considerations, calculation of earthquake induced forces, IS1893, purpose of seismic strengthening, common deficiencies, seismic vulnerability assessment, procedures for repair, restoration and retrofitting of RC and masonry structures, examples seismic retrofitting

CV913 Design of Structures with Seismic Isolation 3

Principles of base isolation, general considerations, basic elements of seismic isolation systems, energy dissipation, force deflection characteristics, seismic-isolation design principles, feasibility of seismic isolation, design methods, design examples

CV914 Performance Based Seismic Engineering 3

Seismic performance, damage control, life safety, collapse prevention, immediate occupancy, performance based design, seismic demand and capacity, ADRS spectrum, target displacement, performance objectives, push-over analysis, capacity spectrum, static analysis, nonlinear analysis

CV915 Geotechnical Earthquake Engineering 4

Introduction, seismology and earthquakes, strong ground motion, seismic hazard analysis, seismic wave propagation, dynamic soil properties, ground response analysis, local site effects and design ground motions, liquefaction, seismic slope stability, seismic design of retaining walls, soil improvement against seismic hazards

S L Cramer, Geotechnical Earthquake Engineering, Pearson Education 2003

CV916 Seismic Design of RC & Steel Structures 3

Concrete structures: Design for inertial effects, estimates of demand and capacity, ductility in earthquake resistant design, behaviour of concrete members under earthquake-type loading, codal provisions, nonlinear response, design examples

Steel Structures: Introduction, codal provisions, design of moment resisting frames, design of concentrically braced frames, hysteretic energy dissipation capacity, design of eccentrically braced frames, design examples

CV917 Design of Structures Against Blast Loading 3

Introduction, partial safety factors in blast design, basic guidelines for enhancing building resilience, blast loading, structural response to blast loading, design of various structural elements for blast loading

CV918 Advanced Offshore & Coastal Structural Engineering 3

Introduction, deep water offshore structures, TLPs and compliant structures, dynamic analysis of offshore structures, breakwaters, jetties and other coastal structures, design parameters, codal provisions

CV919 Structural Safety and Reliabiliy 3

Reliability theory, Structural reliability – levels 1,2, & 3. FOSM and AFOSM methods of structural assessment, Interpretation of safety, determination of partial safety factors, reliability-based design examples

DEPARTMENT OF MINING ENGINEERING

SM700 Geomechanics (3-1-0) 4
Geological structures in rockmass, rockmass characterisation, strength and deformability of rock and rock mass, Measurement of rock loads and displacements, Failure criteria, Influence of anisotropy and discontinuity on rock behaviour, Pre-mining state of stress. Propagation of elastic waves ,dynamic behaviour of rocks, Stress distributions around single and multiple openings in rocks, mechanics of rock cutting, drilling and blasting.
Rock Mechanics and design of structures in rock by Obert L. and Duvell W. I.
Rock Mechanics by Bray and Brown.

SM701 Computer Applications in Strata Mechanics (3-1-0) 4
Mathematical programming, mine structure analysis, pit configuration, blast design, slope stability, stability of pillars and subsidence analysis, Application of computer algorithms and systems for mine design problems, Optimisation of mine parameters and mine systems, Management problems and data processing. MIS in rock excavation projects.
Brown E.T., analytical and Computational methods in engineering rock mechanics.
APCOM proceedings.

SM702 Rock Fragmentation Engineering (3-1-0) 4
Mechanisms of rock fragmentation due to blasting. Fragmentation prediction models. Fragmentation Assessment, initiation systems. Calculation of charge and powder factor, Blast design, Special techniques of blasting. Environmental effects and their control. Economic evaluation of blasting operations.
Sastry. V.R., Advances in drilling and blasting
Konya, C.G, Blast design.

SM703 Geomechanics Laboratory (0-0-3) 2
Different experiments related to geomechanics

SM704 Applied Rock Mechanics (3-1-0) 4
Rock mechanics programmes in mining and civil constructions, Design and stability analysis of underground openings. Caverns for underground storage of oil, gas and nuclear waste. Rock mechanics for improved mining methods in coal and non-coal mines, Rock support and reinforcement. Evaluation and testing of rock support systems. Selection of supports and roof cavability.
Obert L. and Duvell W. I., Rock Mechanics and design of structures in rock
Peng,, Coal Mine Ground Control

SM705 Geomechanics Instrumentation (3-1-0) 4
Introduction to rock mechanics instrumentation. Documentation, interpretation and evaluation techniques, Various types of deformation meters, strain gauges, LVDT's. Load cells. Photoelastic models, Ultrasonic monitors, geophones, seismographs, electro-magnetic velocity meters, accelerometers, high speed cameras, laser profilers. Field instrumentation for design of tunnels and underground structures. Convergence, subsidence, rock slope and blast monitoring instruments. Instrumentation for long-time measurements in underground openings.
Hunt, R.E., Geotechnical Engineering investigating manual.
Ervin, N.C., Insitu testing for geotechnical investigations.

SM706 Physical and Numerical Modeling Lab (0-0-3) 2
Different experiments related to physical and numerical modeling.

SM800 Rock Slope Engineering (3-0-0) 3
Role of slope stability in economics, design and operation of surface mines, waste dumps and embankments, Factor affecting slope stability, Geological data collection. Graphical presentation of geological data, Mechanics of slope failure, Slope stability analysis. Monitoring of slope movements.
Hoek, E. and Bray, J.W., Rock slope engineering
Giani , Rock slope stability analysis

SM801 Rock Excavation Technology (3-0-0) 3
Review of rock excavation techniques, Mechanical rock cutting methods and equipments, Ripping of rock, Determination of rippability and production rate, Water jet cutting, Flame jet cutting of rock, Laser cutting of rock, Hybrid cutting systems, Selection of excavating systems.
Chugh, C.P., Drilling technology hand book ;;;; Pozian at et al., Coal cutting by winning machines

SM802 Physical & Numerical Modeling (3-0-0) 3

Concept, methodology and principles of physical modeling. Dimensional analysis. Modelling as a technique for rock load determination and analysis. Physical modeling of rock mass rheological models, Various numerical techniques of mine simulation. Concepts and mathematical derivations of FEM, BEM, FDM method. Application in strata mechanics.

Kidybinski A & Kwasniewski M. (Eds); Modelling of mine structures, A.A. Balkema, Rotterdam. 1988.
Kidybinski A. & Dubinski J. (Eds); Strata control in mines, A.A. Balkema. 1990.

SM803 Design of Supports in Mines (3-0-0) 3

Local and regional supports, Temporary and permanent supports, Passive and active support systems. Pillars, fills and cable bolting as mass support systems, Design of support systems based on rock mass classification, Design of support systems, depillaring areas and stopes.

Biron, C. and Arioglu, E., Design of supports in mines.
MMF special issue on mine supports.

SM804 Subsidence Engineering (3-0-0) 3

Mining methods from the stand-point of subsidence, convergence and creep, Zones of movement in the overlying beds. Rock kinematics. Types of subsidence, Various methods of calculating convergence and subsidence. Prediction of subsurface subsidence and subsidence nomograms. Time dependent influence of subsidence. Impact of ground movement on structures. Special mining layouts to minimise subsidence.

Singh, B. Mine subsidence.
Peng, S.S., Coal mine ground control.

SM805 Environmental Management in Rock Excavation Projects (3-0-0) 3

Environmental problems associated with rock excavations, Environmental effects of blasting, Heat and humidity in underground excavations, Dust, Tunnel ventilation: estimation and design, Tunnel illumination, Environmental impact and assessment and environment management.

Dhar, B.B., Environmental management of mining operations
Chad- wick et al, Environmental impacts of coal mining and utilization

SM806 Tunneling & Underground Space Technology (3-0-0) 3

Tunnel Driving Techniques: Tunnel boring machines, Drilling and blasting, Rock damage due to blasting, Controlled blasting, Tunnel Supports: remote control and automation of supports. Tunnel lining. Rock anchoring and bolting, Tunnel environment, Underground opening, Underground excavation Failure Mechanisms, Design and construction of large Excavation, Stability analysis.

Vutukuri V.S. and Lama R.D., Physico – mechanical properties of rocks

SM807 Project Management in Rock Excavation Engineering (3-0-0) 3

Risk involved in mining projects. Analysis of risks, Mining costs. Incorporating risk in the NPV calculation. Sensitivity analysis, CPM & PERT charts and Work Scheduling. Time and cost over runs / net work crashing, Personal Management, Managing workers and executives, performance linked incentive schemes. Motivation, Work Study, Purchasing and Tendering, Project Monitoring, Industrial Disputes.

Prasanna chandra, Project management, Tata McGraw Hill, 2001

SM808 Selected Topics in Strata Mechanics in Mines (3-0-0) 3

MN901 Applied Rock Mechanics 4

Rock mechanics programmes in mining and civil constructions, Design and stability analysis of underground openings. Caverns for underground storage, Rock mechanics for improved mining methods in coal and non-coal mines. Design of pillars, Rock support and reinforcement –rock support inter action analysis. Evaluation and testing of rock support systems. Selection of supports and roof capability.

Rock Mechanics and design of structures in rock by Obert L. and Duvell W. I.
Fundamentals of rock mechanics by Jaeger and Cook.
Rock Mechanics by Bray and Brown.
Coal Mine Ground Control by Peng.

MN902 Rock Mechanics and Ground Control 4

Introduction to Rock Mechanics. Analysis of stress and strain. representation of stress- strain, Engineering properties of Rocks. Determination of various rock indices, Determination of physical and mechanical properties of Rocks. Elastic Constants, Engineering classification of rock mass. Instrumentation used for determination of in – situ stresses and laboratory investigations, Design of underground openings. Design of

pillars in underground coal mines, Rock reinforcement / Ground improvement techniques in rock masses, Subsidence:Prediction and measurement of subsidence. Subsidence damage and control.
Rock Mechanics and design of structures in rock by Obert L. and Duvell W. I.
Fundamentals of rock mechanics by Jaeger and Cook.
Rock Mechanics by Bray and Brown.

MN903 Geomechanics 4
Geological structures in rockmass, Objective and methods of rockmass characterisation. Methods of determination of strength and deformability of rock and rockmass, Failure criteria for rock and rockmass, Influence of anisotropy and discontinuity on rock behaviour, Pre-mining state of stress: sources, methods of determination and presentation, Propagation of elastic waves in rock medium and dynamic behaviour of rocks, Stress distributions around single and multiple openings in rocks: methods of estimation; factors influencing stress concentration; zone of influence of an excavation; effect of planes of weaknesses and shape of excavation; delineation of zone of failure. Introduction of mechanics of rock cutting, drilling and blasting.
Rock Mechanics and design of structures in rock by Obert L. and Duvell W. I.
Fundamentals of Rock Mechanics by Jaeger and Cook.
Rock Mechanics by Bray and Brown.

MN904 Drilling Engineering 4
Classification of rock drilling. Applicability and limitations, Factors influencing drilling. Drillability of rocks, Construction, operation and limitations of various drills, Drill bits. Coring and core barrels. Alignment and deviation in drilling. Fishing tools. Directional drilling, Surveying and logging of drill holes, Drilling practices. Drilling patterns for drivages.
Diamond drilling by Chugh, C.P.
Surface mining by Pfleider.
Oil well drilling engineering by Tabia.

MN905 Rock Fragmentation Engineering 4
Developments in explosives and accessories. Substitutes for explosives, Mechanisms of rock fragmentation due to blasting. Factors controlling fragmentation. Fragmentation prediction models. Fragmentation Assessment, Blast design. Choice of explosives, Theory of shaped charges. Recent advances in blasting techniques, Special techniques of blasting. Environmental effects and their control. Economic evaluation of blasting operations.
Mishra, G.B. , Opencast mining
Gregory , Explosives for North American Engineers
Sastry. V.R., Advances in drilling and blasting

MN906 Rock Slope Engineering 4
Role of slope stability in economics, design and operation of surface mines, waste dumps and embankments, Factors affecting slope stability, Geological data collection and graphical presentation, Mechanics of slope failure, Factor of safety of slopes, Slope stability analysis-techniques, Monitoring of slope deformations, field instrumentation, stabilistaion of slopes.
Hoek, E. and Bray, J.W., Rock slope engineering
Brawner , Stability in surface mining
Giani, Rock slope stability analysis

MN907 Physical and Numerical Modelling 4
Concept, methodology and principles of physical modeling. Dimensional analysis. Different materials used for physical modeling. Modeling as a technique for rock load determination and analysis. Physical modeling of rock mass. Elastic linear, elasto-plastic and time dependent rheological models, Various numerical techniques of mine simulation, FEM, FDM and BEM, Application in strata mechanics.
Kidybinski A & Kwasniewski M. (Eds); Modelling of mine structures, A.A. Balkema, Rotterdam. 1988.
Kidybinski A. & Dubinski J. (Eds); Strata control in mines, A.A. Balkema, Rotterdam. 1990.

MN908 Tunneling Technology 4
Design principles of underground openings, Rock conditions and initial state of stresses. Computer aided tunnel design, Tunnel driving techniques for hard and soft rocks. Blasting in tunnels, Tunnel supports, Remote control and automation of supports, Shield tunneling system with road headers, Support assessment, Tunneling in soft strata. Tunnel lining, Tunnel stability analysis, Monitoring. Back analysis, Case histories.
Obert L. and Duvell W. I., Rock Mechanics and design of structures in rock
Vutukuri V.S. and Lama R.D., Physico – mechanical properties of rocks
SME-AIME. Rapid excavation tunneling conference proceedings (1975-1998).

MN909 Design of Mine Supports 4

Insitu and induced stresses: Methods for determination insitu stresses and instrumentation:. Analysis of induced stresses, Rockmass classification systems, Design of support systems for bord and pillar method and longwall method of working, Rock reinforcement.

Biron, C. and Arioglu, E., Design of supports in mines.
Kaiser, P.K., Rock support in mining and underground construction
Chugh, Y.P., Ground control in Room & Pillar mining

MN910 Planning of Underground Coal Mines 4

Status of Underground Coal Mining in India, Stages of planning of underground coal mines: Feasibility and Detail Project Report, Bord and pillar mining systems. Design of Blasting gallary layout method, Design of Longwall Mining. Design considerations for exploitation of thick seams, Exploitation of contiguous seams and seams liable to bumps; hydraulic mining and underground gassification of coal.

R.D. Singh, Principles and practices of modern coal mining, New Age Int.(P) Ltd Publishers.
T.N. Singh, Underground mining of coal Oxford and PBA Publishing Co. Pvt. Ltd.
S.S. Peng, Longwall mining.

MN911 Planning of Underground Metal Mines 4

General engineering design; design methods in mining, Classification of exploitation methods; choice of mining systems, Design of stoping layouts, Mining in rockburst prone areas, Novel and innovative mining methods, Mine closure, sealing and abandonment.

Hartman H.L., Introductory Mining Engineering, John Wiley and Sons, Toronto, 1987.
Hustrulid W.A., (Editor) SME Handbook on Metalliferous Mining, USA, 1984.
Agoshkov M., et. Al., Mining of Ores and Non-Metallic Minerals, Mir Publishers, Moscow, 1983.

MN912 Planning of Surface Mines 4

Mine planning and its components; planning phases and planning costs; economic concepts, Steps in mine planning; reserve estimation; determination of mine size, Geometrical considerations; mine layouts; pit slope geometry; stripping ratios, Choice of mining system; determination of ultimate pit, Production planning and calendar plans for mining programme, Selection of equipment system, Design of high wall slopes and waste dumps, Design of haul roads.

Hartman H.L., Introductory Mining Engineering, John Wiley and Sons, Toronto, 1987.
Hustrulid W.A., (Editor) Openpit planning and design.
G.B. Misra, Surface mining

MN913 Underground Excavation Equipment 4

Various types of drilling equipment, Shaft drills and mucking system; shaft boring machines, loading and transportation techniques, Maintenance of excavation equipment, automation in excavation equipment.

C.P. Chug , Drilling technology hand book
Statham, Coal mining practice
Stack, Mining & Tunneling machinery

MN914 Surface Excavation Technology and Equipment 4

Classification of surface excavating equipment systems vis-à-vis unit operations. Equipment selection criteria. Continuous and conventional systems.

G.B. Misra ,Surface mining
Pfleider, Surface mining
S.K. Das, Surface mining technology

MN915 Environmental Impact Assessment and Management in Mines 4

Nature and Causes of environmental problems due to mining. Monitoring and control. Acid mine drainage and its control, Pollution due to noise and vibrations: Causes, monitoring and control techniques, Environmental Impact Assessment. Impact Assessment methods and preparation of EMP for mineral industries. Ranking of Impacts, Environmental Management plan. Environmental audits. Changes of Social Environment due to mining, Socio-economic factors. Legislation and Pollution Control Acts.

B.B. Dhar (Editor) Environmental management of mining operations.
Chad-wicketal, Environmental impacts of coal mining and utilization, Pergamon Press.
Proceedings of training programme on mining project plan, IBM, Bangalore, July 29-30, 1987.

MN916 Planning of Underground Ventilation Systems 4

Introduction to fluid mechanics: Fluid pressure, fluid in motion, Fundamentals of steady flow thermodynamics: Thermodynamic diagrams, Subsurface ventilation engineering, Incompressible flow relationships, Ventilation surveys, Ventilation network analysis, Simulation studies for heat flow in underground mines.

Vutukuri, V.S. and Lama, R.D., Environmental engineering in mines
McPherson, M.J., Subsurface Ventilation and Environmental Engineering

MN917 Risk and Safety Management in Mines 4

Accidents at work, accident prevention. Safety concepts management and direction of safety. Statutory provisions for safety in mining operations, Conceptional health problems in rock excavation; prevention and suppression of dust, Risk analysis, safety management, Hazard identification methodologies, risk assessment methods, Mine Safety, Safety audits and control, Accident investigation; reporting, analysis

Singh, C.P., Occupational safety and health in industries and mines
Rakesh & Prasad , Legislation in Indian mines a critical appraisal
Singh, V.N., Industrial and mine management

MN918 Research Methodology 4

Defining research problem and formulation of hypothesis, Experimental designs, Methods and techniques of data collection, Processing and analysis of data, Testing of hypothesis, Analysis of variance and covariance. Principles of multi-variable analysis, Interpretation and report writing.

Kothari C.R., Research Methodology : Methods and Techniques.Wiley Eastern Ltd., New Delhi 1995.
Jobson. J.D., Apllied Multivariate Data Analysis, Vol I: Regression and Experimental Design. Springer Verlag 1991.
Joseph F. Hair, J.R. , Rolph E. Anderson et al., Multivariable Data Analysis, IV Ed, Prentice Hall 1995.

MN919 Optimization of Mining Operations 4

Mathematical programming problem. Mathematical Models, Methods for special linear programs, Lagrange's method; sensitivity analysis, Non-Linear programming methods, Geometric programming; Goal Programming; stochastic linear programming, Dynamic programming; Game Theory.

Kalyanmoy Deb, Optimization for Engineering design: Algorithons and Examples, Prentice Hall of India 2000.
Kambo N.S. Mathematical Programming Techniques., Affliated East-West Press 1991.
Mital K.V. and Mohan C. , Optimization Methods in operations research and systems analysis, New Age International Publi. 1996.

DEPARTMENT OF COMPUTER ENGINEERING

CS700 Advanced Computer Architecture (3-1-0) 4
Solving Problems in Parallel, Temporal, Data, Combined parallelism, dynamic assignment/scheduling; Instruction Level Parallel Processing and Structure of Parallel Computers, Parallel Programming and Algorithms, PVM, MPI, Operating Systems for Parallel Computers & Performance Evaluation.
V.Rajaraman and C Siva Ram Murthy, Parallel Computers and Architectures and Programming, PHI, 2002.
David A Patterson and John L Hennessy, Computer Architecture: A Quantitative Approach, PHI.

CS701 Advanced Data Structures & Algorithms (3-1-0) 4
Data structures and its operations, trees, Heaps, Advanced Graph Algorithms and applications, Internet Algorithms, Compressions, search engines, spiders and crawlers, Integer and polynomial Arithmetic, modular Arithmetic, NP-Completeness, Approximation algorithms.
Thomos Cormen, Charles E Leiserson and Ronald D River, Introduction to Algorithms, PHI, 2001.
Algorithms, Data Structures and Problem Solving with C++ Mark Allen Weiss, AddisonWesley, 2002.

CS702 Advanced Concepts in Database Management Systems (3-1-0) 4
Distributed Databases: principles, Architecture, Design, Query, Optimization, Transaction, Concurrency, Client/server, Parallel, and Object Oriented Databases: model, recovery, versioning, indexing, Database Connectivity's: 3GL, 4GL, triggers, administration, XML and Internet DB.
Raghu Ramakrishnan, Database Management Systems, McGraw-Hill, 2000
Ceri S and Pelagatti G, Distributed Databases Principles and Systems, 2nd Edition, Mc-Graw Hill, 1999.

CS703 Advanced Computer Networks (3-0-0) 3
TCP/IP Protocol Suite and Protocol in different Layers, Remote Access and Wireless Networking, Network Management, Formal Methods in Networks, Network Security, Cryptography, Firewalls, Security in different layers and current Trends
James F Kurose and Keith W Rose, Computer Networking, Pearson Education, 2003
D.L.Stevens, TCP/IP Vol. 1, 2 and 3, PHI, 2001

CS704 Software Engineering & Quality Assurance (3-1-0) 4
Evaluation, Role, maturity in development, life cycle, models, maintenance issues, specification, object oriented design, management, testing, mechanisms, verification and validation, cost estimation, tools, debugging, simulators, ISO 9000 standards, Quality Assurance.
Pankaj Jalote, An Integrated Approach to Software Engineering, Narosh Publication, 1995.
John J Marciniack, Editor in chief Encyclopedia of Software Engineering, John Wiley 1994.

CS705 Compiler Optimization (3-0-0) 3
Introduction, Intermediate Languages, Basic Block, CFG, Code Generation, DAG, Graph Coloring, Code Optimization, Redundancy Elimination, Data Flow Analysis, SSA, code elimination, code compression, JIT compilation, memory hierarchy, case studies.
Steven S Muchnik, Advanced Compiler Design and Implementaton, Morgan Kaufmann, 1997.
A V Aho, R Sethi and J D Ullman, Compilers: Principles, Techniques and Tools, Addison-Wesley, 1986.

CS706 Lab and Mini Project (0-0-3) 2
A mini project will be carried out in the lab consisting of the concepts learned in the subjects of the curriculum.

CS800 Knowledge Based Computer Systems (3-0-0) 3
Architecture of AI & KBCS Systems, Design Issues of KBCS, Introduction to Expert System, Introduction to fuzzy logic systems, Natural Language processing, Heuristic Search techniques, knowledge based systems.
G.F.Luger, and W.A.Stubblefield. Artificial Intelligence – structure and strategies
Nilson, Artificial Intelligence: A new Synthesis

CS801 Advanced Computer Graphics (3-0-0) 3
Overview of basic raster graphics algorithms for 2D images, Curves & Surfaces –representation, algorithms and approaches, GUI-issues, methods, approaches, Graphics Standards
J.D.Foley, A.V.Dam et. Al., Computer Graphics – principles and practice.
D.Hearn, and M.P.Baker, Computer Graphics

CS802 Real Time Systems (3-0-0) 3
Introduction to rear time systems and characterization and task performance measures assignment and scheduling. Design of real time systems and development strategies, design analysis, fault tolerance, reliability evaluation.
C.M.Krishna and Kang G. Shin. Real time systems.
Stu art Bennett real time computer control

CS803 Soft Computing (3-0-0) 3
Artificial neural networks- concepts, single player, multi player, perception, feed forward neural networks, fuzzy systems- fuzzy set & operations, fuzzy logic and approximate reasoning, fuzzy relation, neuro fuzzy system, generic algorithm
S.Hay kin Networks: A Comprehensive foundation.
Jang J.S.R, sun c t and mizutain E., Neuro- Fuzzy and soft computing

CS804 Advanced Concepts in Theoretical Computer Science (3-0-0) 3
Finite automata and regular expressions – Finite state automata, push down automata, Turing machines, grammars, graph theory and application, analysis and design of sequential and parallel algorithms, computational complexity.
Papadimitirou C H, computational complexity
Moret B N , The Theory of computation.

CS805 Object Technology and Applications (3-0-0) 3
Introduction to object technology and applications-object oriented decomposition vs. structured decompositions, concepts of object technology, object oriented analysis, EJB, CORBA, COM, DCOM, COM+, XML, OOA.
Grady Booch, Object Oriented Analysis and design and applications
James Rumbaugh, O.O.Modeling

CS806 Computer Algorithms (3-0-0) 3
Sequential Algorithms: Algorithm Design Techniques; Parallel Algorithms: Designing parallel algorithms; Distributed Algorithms; External Memory Algorithms, Online Algorithms, Internet Algorithms and Security—Cryptography Algorithms.
Alfred V Aho, John E Hopcroft, Jeffery D Ullman—Data Structure and Algorithms, Addison Wesley Publi., 1993
Michael Jay Quinn—Designing Efficient Algorithms for Parallel Computers, McGraw Hill 1997

CS807 Computational Algorithms for VLSI (3-0-0) 3
VLSI Models and Computational Aspects, Algorithm Design Strategies for VLSI, Network Simplex Method, and Network flow Algorithms; Algorithms for VLSI Layout, Partitioning, Floor Planning, Placement and Routing; Algorithms for VLSI Design Tools; Systolic Algorithms
Jeffrey D Ullman—Computational Aspects of VLSI, Computer Science press, 1998
Lecture Notes of Computational Algorithms for VLSI CAD, CSE Dept, IIT Mumbai

CS808 Software Systems: Architecture and Testing (3-0-0) 3
Software Architecture; Software Architectures in Different Applications; Software Testing Concepts, Methods for developing the strategy, Life Cycle Testing, Installation Phase Testing and Various Phases of Testing; Tools and Techniques for Software Testing
Len Bass, Paul Clements and Rick Kazman—Software Architecture in Practice, Addison Wesley, 1998
William Perry—Effective Methods for Software Testing, John Wiley, 1995

CS809 Formal Methods in Computing (3-0-0) 3
Formal Methods in Computing Specification; Formal Description Techniques in Communication Software Systems; Formal Methods in Object Orientation and Software Engineering, Proof Methods and Techniques, Temporal and Model Logic
Jan Ven Lecuwen—Formal Model nad Semantics, Elsevier-MIT Press, 1992
Arindama Singh—Logic for Computer Science, PHI, IEEE, 2003

CS810 Internet Technology and E-Commerce (3-0-0) 3
Technology, Infrastructure and tools for E-Commerce, Current Trends in E-Commerce applications development, The Business of Internet Commerce, Enterprise level E-Commerce: SCM, CRM, EDI, EAT, B2Bi, ERP.
Henry Chan et al., E-Commerce- Fundamental and applications, John Wiley & Sons, 2002
G.Winfield Treese and Lawrence C.S, Designing Systems for Internet Commerce, Pearson Education, LPE, 2002

CS811 Mobile Computing (3-0-0) 3
Mobile Computing: Challenges, MAC Protocols, Mobile Ip, Pervasive Computing & Sensor Networks, Cellular Networks: GSM, GPRS, CDMA, Wireless LANs, Mobile satellite systems, Design of Digital Cellular Systems.
Cai and Goodman, "General Packet Radio Servide in GSM ", IEEE Communication, Magazine, Oct 1997, pp 122-131.
Betterstetter et al, IEEE Comsoc Survey, 1999. Most Pictures, Courtesy this article.

CS812 Hardware – Software Co Design (3-0-0) 3
Co Design overview, models and methodologies of embedded systems, UML based modeling of reactive system behavior, High-level synthesis and functional verification, system on Chip and IP cores, Hardware/Software co design for ASICs, co design tools and case studies.
G.Micheili, R.Emstand W.Wolf, editors, readings in hardware/Software- Codesign, Morgon Kaufman, 2002
J. Staunstrup and W.Wolf, editors, Hardware/Software Codesign Principles and Practices, Kluwer Academic 1997

CS813 Embedded Systems (3-0-0) 3
Embedded system design process: embedded Computing Platform, Program design and analysis for Embedded System, Operating System for Embedded Systems, Networks: Distributed Embedded Architecture
David E Silmon, An Embedded Software Printer Pearson Edition Asia, 2001
Wayne Wolf, Computer as Components – Harcort India Pvt. Ltd., 2001

CS814 Security in Computing System (3-0-0) 3
Basic concepts, Access control, Protection, Secure coding, Cryptography, Network security, Firewalls, Confining untrusted code, Security on the Internet and the World Wide Web, Attack Techniques, Case studies, extra topics
Hon C Graff, "Cryptography and E-Commerce - A Wiley Tech Brief", Wiley Computer Publisher, 2001.
Michael Cross, Norris L Johnson, Tony Piltzecker, "Security +", Shroff Publishers

CS815 Data Warehousing and Data Mining (3-0-0) 3
Data Warehousing: Data Warehousing components and building data warehouse. Data Mining – Objectives, examples, data mining process, Data mining techniques: Generalization, Data mining knowledge representation.
Data Warehouse Toolkit by Raph Kimball – John Wiley
Data Mining Techniques: Marketing, Sales, Customer support by Michael. J. Berry, Gordon Linoff : John Wiley.

CS816 Studies in Distributed Systems (3-0-0) 3
Distributed Systems: Goals, Hardware and Software system, Shared data and transaction, Concurrency, Fault tolerance, Security, Recovery & Issues and trends in distributed operating systems. Distributed Object based and document based systems.
George Couloris, Distributed Systems – concepts and design, Pearson Education,2002
A.S. Tanenbaum and M.V. Steen, Distributed Systems – Principles and Paradigms, Pearson Education 2003

CS817 ERP & SCM (3-0-0) 3
ERP: Needs, Models, Commercial ERP Packages, Client Server and Open Technology Solutions, Supply Chain Management – Issues, Drivers and Obstacles, Coordinating SCM and ERP in E-Business.
Vinod Kumar G & N.K. Venkitakrishna , ERP – Concepts and Practice , PHI, 1998
Sunil C & Peter- SCM – Strategy and Planning and Operation, Pearson Education, LPE, 2002

CS818 Optimization Techniques in Computing (3-0-0) 3
Basic OR techniques, requirements, networks, design, role and methods, databases, compilers, optimization and performance in web computing, internet application, performance measurement tools, case studies.
K kanth, Introduction to computer system performance evaluation, McGraw Hill, 1992
David K smith, Network Optimization in Practice, ellise, Horrwood publications, 1982

CS819 Digital Image Processing (3-0-0) 3
Digital Image Fundamentals, Image Enhancement, Image Restoration, Multiresolution Processing, Image Compression, Image Segmentation, Image Representation and Description
Digital Image Processing by R. C. Gonzalez and R. E. Woods, Addison Wesley 2002.
William K. Pratt, Digital Image Processing, 3rd Edition, John Wiley, 2001.

CS820 Selected topics in Computer Science and Engineeering (3-0-0) 3

CS901 Wireless Networks and Systems 4
Introduction to network resilience problems & solutions, Wireless beyond 3G, Performance modeling of (Wireless) networks & Formal Methods, Network design algorithms and Network design using Network Processors, Wireless Ad-hoc Networks, Security Issues in control, Management, routing and other areas of

networks, Distributed control in (Wireless) network and Middleware, Distributed Mobile Computing, Embedded Systems in Mobile/ Wireless/ Network Systems – Hardware & Software Design/ Development issues, Standardization in Wireless / Mobile Network Systems.

Wireless Communications – Principles & Practices by Theodore. S Rappaport, Pearson Education, 2nd Edition, 2002.
Cellular Radio Handbook, Boucher. N, Quantum Publishing, 1991.

CS902 Network Management 4

Network management Overview, Network Management, SNMP and Network Management, TMN, Network Management Applications, Management of Heterogeneous Network with Intelligent Agents, Network Security Management, Internet Management(IEEE Communication May, Oct /03), QoS in IP Network, Basic Methods & Theory for Survivable Network Design & Operation, Network Planning, Network Management Standards.

M. Subramanian, Network Management: Principles and Practice, Addson – Wesly, 2000
James F. Kurose and Keith W. Rose, Computer Networking , Pearson Education, LPE, 2003
J. Burke, Network Management Concepts and Practice , A Hands- On Approach, Pearson Education, 2000.

CS903 Evolutionary Computing 4

Introduction to Evolutionary Computation, Search Operators , Selection Schemes, Search Operators and Representations , Evolutionary Combinatorial Optimisation , Co-evolution, Niching and Speciation, Constraint Handling , Genetic Programming , Multi objective Evolutionary Optimisation , Learning Classifier Systems , Theoretical Analysis of Evolutionary Algorithms.

Handbook on Evolutionary Computation T. Baeck, D. B. Fogel, and Z. Michalewicz (eds.) IOP Press, 1997.
Genetic Algorithms + Data Structures = Evolution Programs (3rd edition) Z Michalewicz Springer-Verlag, 1996.
Genetic Algorithms in Search, Optimisation & Machine Learning D E Goldberg Addison-Wesley, 1989.

CS904 Software & IT Systems – Architecture , Measurement and Testing 4

Architecture, Measurement, Testing, Tools.

S/W Architecture in practice, len Bass, Paul elements & Rick Addison – Wesley
S/W Testing in the Real world, Edward kit, Pearson Education
Systematic S/W Testing, Rick D. Craig & Stefan P. Jaskiel, Artech House, Bosten, http://www.artechhouse.com. $69

CS905 Bioinformatics 4

Introduction to Bioinformatics, Biological Databanks, Sequence Analysis, Structure Prediction, Protein Folding, Proteomics, Emerging Areas in Bioinformatics.

KraneD.E.&Raymer M.L, Fundamental Concepts of Bioinformatics,Pearson,2003
Attwood & Parrysmith: Introduction to Bioinformatics, Pearson Ed, 2003
Gibas & Jambeck: Developing Bioinformatics Computer Skills, O'Rielly,2003

CS906 VLSI Systems- Design & Testing: Perspectives from Computer Engineering 4

State machine model design of VLSI system, Computational aspects of VLSI and algorithm, Genetic algorithms for VLSI Design partitioning cell routing.

VHDL for Designers, stefan sjoholm & Lennart lindth Prentice Hall
Computational aspects of VLSI, Jeffery D. Ullman, Computer Science Press
Genetic Algorithm for VLSI Design, Layout & Test Automation, Pinaki Mazumder, Elizabeth M. Rudrick PH PTR

CS907 Protocol Engineering 4

Protocol Design and Implementation, Protocol Verification and Validation, Protocol Testing, Formal Methods (FDTs) .

Web sites, IEEE, ISO and ITU-T sites

CS908 Software Reliability & Fault Tolerance 4

Introduction to fault tolerant computing, Software Safety, Software Fault Injection and fault analysis.

Books on Software Fault Tolerance, Reliability Engineering Journal and Internet/Web sites.

CS909 Simulation & Modeling 4

System models, System Simulation, Exponential growth models, exponential decay models, Discrete system simulation, Web based simulation and Distributed Simulation.

System simulation :- Geoffrey Gordon. Prentice Hall 1987
Maryanski. F., Digital Computer Simulation, CBS Distributors.
Banks and Carson, Discrete Event System simulation. Prentice Hall 1984

CS910 WEB Engineering 4

Requirements specification and analysis, Web-based systems development methodologies and techniques ,Migration of legacy systems to Web environments ,Web-based real-time applications development, Testing , verification and validation ,Quality assessment, control and assurance, Configuration and project management, "Web metrics" – generating metrics for estimation of development efforts, Performance specification and evaluation ,Update and maintenance, Development models, teams, staffing, Integration with legacy systems, Human and cultural aspects ,User-centric development, user modeling and user involvement and feedback, End-user application development.

DEPARTMENT OF ELECTRONICS AND COMMUNICATION ENGINEERING

EC700 VLSI Systems and Architecture (4-0-0) 4

Instruction set architectures of CISC, RISC and DSP processors. CISC Instruction set implementation and RT level optimisation through hardware flowcharting. Microprogramming approaches. Pipelined implementation of RISC instruction sets. Implementation of DSP instruction sets. Memory. I/O buses. Arithmetic: Fixed point, floating point and residue arithmetic, Multiply and Divide algorithms, Issues in arithmetic system design Issues in the applications (optimizing the hardware-software interface), ASIP, reconfigurable computing, Asynchronous architectures. Future microprocessor architectures.

D. A. Patterson and J. Hennessy, "Computer Architecture: A Quantitative Approach", 3rd edition, Harcourt Asia, 2002
D. A. Patterson and J. Hennessy, "Computer organisation and Design", Harcourt Asia, 1998
H.S. Stone, "High Performance computer architecture", Addison Wesley, 1993

EC701 Logic Synthesis and Techniques (4-0-0) 4

Introduction to computer aided synthesis and optimization. Hardware Modeling. Two level combinational logic optimization. Multiple level combinational optimization. Sequential logic optimization. Cell Library Binding. State of the art and future trends: State of the art in synthesis, synthesis systems (Production level synthesis system, research synthesis system, achievements and unresolved issues), growth of synthesis in the near and distant future (system level synthesis and hardware software co- design).

Giovanni De Micheli: "Synthesis and optimization of digital circuits", McGraw-Hill, 1994.
Srinivas Devadas,Abhijith Ghosh and Kurt Keutzer: "Logic synthesis", Kluwer Academic, 1998.
G.D. Hachtel and F. Somenzi, "Logic Synthesis and Verification algorithms", Kluwer Academic Publishers, 1996.

EC702 Advanced Digital Signal Processing (4-0-0) 4

Time frequency analysis, Time frequency distribution, Short time Fourier Transform.
Homomorphic Signal Processing , homomorphic system for convolution, properties of complex spectrum, Applications of homomorphic deconvolution.
Multirate Signal Processing: Decimation Interpolation, DFT filter banks, QMF filter banks, Multiresolution Signal analysis wavelets theory of sub band decompositions, Sub band coding and wavelet transforms, application of wavelet transforms.
Adaptive signal processing: Review of convolution & correlation. 2-D signals and System. Linear estimation of Signals & applications. Linear prediction and applications (deconvolution, least square filters). Adaptive filters and applications. Recursive estimation and Kalman filters.
Overview of DSP chips and Architecture. Elements of VLSI Signal Processing

P.P. Vaidyanathan, "Multirate systems and Filter banks", Prentice Hall, 1993.
A.V.Oppenheim and R.W.Schafer, "Discrete time Signal Processing ", PHI 1994
S.J. Orfanidis, "Optimum Signal Processing", McGraw Hill, 1989.

EC800 DSP Systems and Architectures (3-0-0) 3

Architecture and applications of general purpose digital signal processors. Harward architecture. Low power design strategies, Architecture and programming of TMS 320C55x. High performance design strategies, Case study of TMS320C6x. General purpose programmable DSP families from TI, AD, Motorola .Application case studies: Speech coding, image and video compression, Vitterbi decoding, wireless communication . VLSI Architectures for DSPc algorithms,

P. Lapsley (Ed.), "DSP Processor Fundamentals – Architetures and features", Chand 2000
S.M. Kuo, B.H.Lee, "Real-Time Digital Signal Processing : Implementations, Applications, and Experiments with the TMS320C55X", Wiley, 2001
K.K. Parhi, "VLSI Digital signal processing systems: Design and implementation", John Wiley, 1999.

EC801 Soft Computing (3-0-0) 3

Introduction to learning systems - Feed forward Neural Networks - Perception - Multilayer Perceptron propagation algorithm and its variants - Improving generalization by various methods.
Recurrent Neural Networks - Hopfield net - Boltzmann machine and Mean field learning - solving combinational optimization problems using recurrent Neural Networks.
Unsupervised Neural Networks. Competitive learning - Self organizing maps - Growing cell structures Principal component analysis. Basics of fuzzy sets. Genetic algorithms: Population based search techniques, evolutionary strategies, mathematical foundations of genetic algorithms, search operators, genetic algorithms in function and combinational optimization, hybrid algorithms, application to pattern recognition

S. Haykin, "Neural Networks : A comprehensive foundation", Pearson, 1999
J. M. Zurada, "Introduction to artificial neural networks", Jaico publishing, 1997.
B. Yajnanarayana, " Artificial Neural Networks", PHI, 1999

EC802 Optoelectronics (3-0-0) 3

Light Propagation in Material Media- Optical waveguides- Waveguide devices and fabrication-techniques. Optical sources & detectors -Opto-electronic devices-Principles of Acousto-optic effect. Basics of photonic switching :Priniples of optical bistablity; bistable optical switches; self-electro-optic-effect-devices (SEED); basics of optical interconnects.

B. E. A. Saleh, M. C. Teich, "Fundamentals of photonics", Wiley Inter science, 1991.
J. Singh, "Optoelectronics: An introduction to materials & devices", McGraw Hill, 1996.
J. Wilson & J. F. B. Hawkes, "Optoelectronics : An introduction", 2nd ed., Prentice Hall India, 1992.

DE700 Information Theory (4-0-0) 4

Introduction to Information Theory .ICoding Information Sources . Shannon's Theorems. Finding Binary Compact Codes, Huffman's code. r-ary compact Codes, Code Efficiency and Redundancy.

Channels and Mutual Information: Information Channels, Probability relations in a channel. Apriori and Aposteriori Entropies, Generalization of Shannon's first theorem, Mutual Information. Properties of Mutual Information Noiseless and Deterministic channels, Cascaded channels, Channel Capacity, Conditional Mutual Information. Reliable Messages through Unreliable channels: Error probability and Decision rules, the Fano bound, Hamming distance, Shannon's theorem for the Binary Symmetric channel, Random Coding. Ensemble performance analysis of block and convolution codes. Kolmogorov Complexity, Rate Distortion Theory, Network Information Theory.

S. G. Wilson,"Digital modulation and coding", Prentice Hall, Inc, 1996.
N. Abrahamson, "Information Theory and coding", McGraw Hill Book Co., 1963.
R.G. Gallagar, "Information theory and reliable communication", Wiley New York, 1968.

DE701 Signals Detection And Estimation (4-0-0) 4

Hypothesis Testing, Neyman Pearson Lemma, UMP test, Decision Theoretic framework, Multiple-Decision Problem. Parameter Estimation - Unbiasedness, Consistency, asymptotic normality, sufficient statistics, minimax estimation, decision theoretic framework, Rao-Blackwell theorem, Cramer – Rao ine uality. Estimation: Minimum mean square linear estimation, Wiener filter, Kalman filter, Levinson – Durbin and innovation algorithms.

Steven M. Kay, "Fundaments of Statistical Signal Processing" Vol. I:"Estimation Theory", Vol. II: "Detection Theory" , Prentice Hall International.
H. L. Van Trees Detection, "Estimation and Modulation Theory", Part I, John Wiley, 1968.

DE702 Digital Communication and Spread Spectrum Communications (4-0-0) 4

Digital signaling over a channel with inter-symbol interference and additive Gaussian noise: Characterisation of band limited channels. Signal design for band limited channels. Optimum demodulator for inter-symbol interference and additive Gaussian noise, coded modulation for bandwidth constraint channels-PSK, QAM & Trellis coded modulation, Linear equalization, decision feedback equalization, adaptive equalization, echo-cancellation. Multi-channel & multi-carrier systems: Multi-channel digital communication in AWGN channels, multi-carrier communications. Digital signaling over fading multi path channels. Introduction to spread spectrum systems .Application of spread spectrum system. Hybrid system. Code division Multiple Access (CDMA) & digital Cellular system Code tracking loops, Synchronization of the receiver spreading codes. Performance of spread spectrum system

J.G.Proakis, "Digital communication", 3rd edition, McGraw Hill,1995.
R.D.Gitlin and others, "Data communication principles", McGraw Hill.
R.L.Peterson and others, "Introduction to spread spectrum communication", Prentice Hall international edition 1995.

DE800 RF Circuit Design (3-0-0) 3

High frequency behaviour of passive components, Active RF components and modeling – diode, BJT, FET. RF filter design .RF transistor amplifier design. Amplifiers at GHz frequencies. Front-end circuits .Background for understanding oscillators: Brief review of classical control; Describing function analysis; Phase noise in oscillators .Oscillator circuit examples: Relaxation oscillators (Bose and ring); Tuned oscillators (Colpitts, Pierce, Clapp, cross-coupled).Synthesizers: Phase-locked loops (PLLs);Frequency synthesizers (integer-N, fractional-N).Power amplifiers; Transceiver design examples.

R. Ludwig and P. Bretchko, "RF circuit design", Pearson, 2001
T. Lee, "The Design of CMOS RF Integrated Circuits", Cambridge,2002
Clarke and Hess, "Communication Circuits: Analysis and Design", Krieger, 1994
H.L. Krauss, C.W. Bostian, F.H. Raab, "Solid State Radio Engineering", Wiley, 1980

DE801 Communication Networks (3-0-0) 3

Introduction to computer communication networks and layered architecture overview. Packet switching and Fast packet switching. Point to Point Protocols and links. Queuing models in communication networks. Multiaccess

Communication and multiple access protocols. Performance modeling and analysis. Local Area Networks. Internetworking issues: Bridges, Routers and Switched networks. Routing and Flow Control algorithms in data networks. Broadband Networks .Voice, Video & Fax over packet. Wireless networks.

R G Gallager and D Bertsekas, "Data Networks", PHI, 1994.
J F Hayes, "Modelling and Analysis of Computer Communication Networks", Plenum Publishing, New York, 1984.
W Stallings, "Data and Computer Communications", PHI, 1997.

DE802 Digital Signal Compression (3-0-0) 3

Data Compression .Speech & image waveform characterization .Predictive coding .Transform coding . Subband coding, VQ based compression, Fractal coding of images. High quality video & audio compression for digital broadcasting. Standards for digital signal compression-data, speech, audio, image & video.

M.Nelson, "The data compression book", 2ed., BPB Publications, 2002.
Jayant & Noll, " Digital coding of waveforms-Principles and applications to speech & video", PH, 1984.
K.R.Rao & Hwang.J.J, " Techniques & standards for image, video & audio coding", Prentice Hall, 1996.

DE803 Error Control Coding (3-0-0) 3

Coding for reliable digital transmissions and storage. Introduction to Algebra. Linear block codes. Cyclic codes .BCH codes. Reed Solomon Code .Convolutional codes . Application of Block and Convolutional codes.

Shu Lin and Danicl J. Costello Jr., "Error Control Coding: Fundamentals and Applications", Prentice Hall, 1983.
McWilliams & Sloane: "Error correcting codes", North Holland Publishing Co.
Peterson and Weldon:"Error Correcting Codes", John Wiley.

DE804 Fiber Optics Technology & Applications (3-0-0) 3

Introduction to Fiber Optics. Optical sources and transmitters. Optical components. Optical amplifiers and Integrated optics . Integrated Optical devices(Beam splitters, directional Couplers, Switches, Filters and Modulators.Principles of Optoelectronic Integration, devices and circuits for high speed telecommunication, Optical computation. Basics of Photonic Switching Applications: Telecommunication Trunking (Digital/Analog/Coherent/Non-coherent) ; Data communication links; Local Area Networks; Broadband Networks; WDM systems; Sensing systems

J.M Senior, "Optical Fiber Communications", Prentice Hall India, 1996.
B.E.A.Saleh, M.C.Teich, "Fundamentals of photonics", Wiley Inter science, 1991.
J.Singh, "Optoelectronics: An introduction to materials & devices", McGraw Hill, 1996.

DE805 Wireless Mobile Communication (3-0-0) 3

Radio Propagation Characteristics.Models for path loss. Jakes' channel model, Digital modulation for mobile radio analysis under fading channel; Diversity techniques and Rake Demodulation, Introduction to spread Spectrum Communication. Multiple access techniques used in mobile wireless Communications .The Cellular Concept : Theory of hexagonal cell layout; spectrum efficiency. FDM/ TDM Cellular systems; Channel Allocation Schemes. Hand over analysis, Cellular CDMA; Soft capacity. Erlang Capacity Comparison of FDM /TDM systems and cellular CDMA. Discussion of GSM standards; Signaling and call control; Mobility management, Location tracking. Wireless data networking.

J.G. Proakis, "Digital Communications", McGraw Hill, 1995
G.L. Sterber, "Principles of Mobile Communications", Kluwer Academic, 1996.
T.S. Rappaport, "Wireless Communications: Principles and Practice", Prentice Hall, 1996.

DE806 Advanced Digital Communications (3-0-0) 3

Optimum Receiver Principles. Fading channels, Scattering models, Single Transmission, Diversity Transmission, Optimum Diversity. Combined Modulation and Coding, Uncoded transmission, Concept of TCM and trellis representations, Decoding of TCM. Convolutional Codes and their Encoders, Fundamental Theorems from Basic Algebra, Systematic Encoders, Distance properties of Convolutional Codes. Turbo codes, Codeword structure, Iterative Decoding of Turbo Codes, Two way algorithm for APP decoding, Performance bounds, Distance Spectrum of Turbo Codes. Trellis coded modulation schemes for fading channels, Design criteria for TCM on fading channels. Introduction to Space Time Codes.

Wozencraft J.M and Jacobes I. M., "Principles of Communication Engineering", John Wiley, 1965.
R. Johannesson and K. S h. Zigangirov, "Fundamentals of Convolutional Coding", Universities Press (India) Ltd, 2001.
E. Biglieri, D. Divsalar, P.J. Mclane and M.K. Simon, "Introduction to Trellis Coded Modulation with Applications", McMillan Publishing Company 1991.

DE807 Algorithms in Coding Theory (3-0-0) 3

Groups, Rings, Vector spaces, Galois fields, Polynomial rings, Channel models, Block and Convolutional Codes, Algebraic and finite state descriptions, Linear and non linear codes, BCH, Reed Solomon and Goppa Codes. The Berlekamp – Massey and Euclid Decoding algorithms, Decoding Algorithms for Convolutional Codes, the Viterbi, Stack and Fano algorithms, Decoding beyond the minimum distance diameter.

Combinatorial descriptions of Block and Convolutional Codes, Algorithms for the construction of Mimimal and tail biting trellises, Soft Decision Decoding algorithms, Iterative Decoding algorithms, Turbo Decoding. The two way algorithm.

Blahut R.E., "Theory and Practice of Error Control Codes", Addison Wesley, 1984.
Lin S., Kasami T., Fujiwara T., Fossorier M., "Trellises and Trellis based decoding Algorithms for Linear Block Codes", Kluwer Academic Publishers, 1998.
Johannesson R. and Zigassgirov K.S., "Fundamentals of Convolutional Codes", IEEE Press, 1999.

DE808 Cryptography (3-0-0) 3

Elementary Number Theory, Finite series, Arithmetic and Algebraic Algorithms, Secrete key and Public key Cryptography, Pseudo Random bit generators, Block and Stream Ciphers, Hash functions and Message digests, Public key encryption, Authentication, Digital Signatures, Zero Knowledge Interactive Protocols, Elliptic curve cryptosystems, formal verification, Crypt analysis, Hard Problems.

Koblitz N., "A Course on Number Theory and Cryptography", Springer Verlag, 1986.
Menezes A. et. all, "Handbook of Applied Cryptography", CRC Press, 1996.

DE809 Selected Topics in Digital Electronics and advanced Communications (3-0-0) 3

MI700 VLSI Design (4-0-0) 4

Introduction to MOSFETs. MOSFET logic circuits. CAD tools for VLSI Design. MOSFET Logic gates. Interfacing CMOS & Bipolar logic families. Circuit characterization and performance estimation - Resistance, capacitance estimation - Switching characteristics - Delay models - Power dissipation - Packaging - Scaling of MOS transistor dimensions - Yield and Reliability. CMOS testing - Need for testing - Fault models - design strategies. CMOS subsystem design – Datapath operations - Addition, Multiplication, Counters, Shifters, Memory elements.

Jan M. Rabaey, " Digital Integrated Circuits", PHI, 1997
S.M.Kang & Y. Leblebici, "CMOS Digital Integrated Circuits", McGraw Hill, 1999.
N.Weste and K.Eshrangian, "Principles of CMOS VLSI Design: A systems perspective", 2nd edition, Addison Wesley, 1993.

MI701 Mixed Signal Design (4-0-0) 4

Building blocks for CMOS amplifiers. CMOS operational tranconductance amplifiers. Frequency compensation schemes – Miller compensation, Ahuja compensation and Nested – Miller compensation. Design of fully differential amplifiers, discussion of common mode feedback circuits. Switched capacitor circuits. Effect of op-amp finite gain, bandwidth and offset, circuit techniques for reducing effects of op-amp imperfections, switches and charge injection and clock feed-through effects. Design of sample and holds and comparators. Fundamentals of data converters; Nyquist rate A/D converters (Flash, interpolating, Oversampled A/D converters and D/A converters. Design of PLL's and DLL's and frequency synthesizers.

B. Razavi, "Design of Analog CMOS Integrated Circuits", McGraw Hill, 2001.
P. R. Gray & R. G. Meyer, "Analysis and Design of analog integrated Circuits", John Wiley, 1993.
R. Gregorian and Temes, " Analog MOS integrated circuits for signal Processing", Wiley, 1986.

MI702 VLSI Testing and Testability (4-0-0) 4

Defects and their modeling as faults at gate level and transistor level. Functional v/s structural approach to testing. Complexity of testing problem. Controllability and observability. Generating test for a single stuck-at-fault in combinational logic. Algebraic algorithms. Test optimization and fault coverage. Logic Level Simulation - Delay Models, Event driven simulation, General fault simulation (serial, parallel, deductive and concurrent). The problem of testing of sequential circuits. observability through the addition of DFT hardware, Adhoc and structured approaches to DFT - various kinds of scan designs. Fault models for PLAs, bridging and delay faults and their tests. Memory testing, Testing with random patterns. The LFSRs and their use in random test generation and response compression (including MISRs), Built-in self test. Analog testing - DSP based analog test and model based analog test. Test process and ATE, Test economics and product Quality.

M. Abramovici, M. A. Breuer, and A.D. Friedman, "Digital Systems Testing and Testable Design", Piscataway, New Jersey: IEEE Press, 1994. Revised printing.
M. L. Bushnell and V. D. Agrawal, "Essentials of testing for digital, memory and mixed-signal VLSI circuits", Boston: Kluwer Academic Publishers, 2000.
Learning module for the course "VLSI Testing and Testability", Dr. Ajai Jain, Dept. of Computer Science and Engineering, I.I.T. Kanpur, 2001.

MI800 Low Power VLSI Design (3-0-0) 3

Introduction to Low Power VLSI. Modeling and Sources of Power consumption. Power estimation at different design levels. Power optimization for combinational circuits and sequential circuits Voltage scaling Approaches .Low energy computing using energy recovery techniques. Low-Power SRAM architectures. Software design

for low power. Computer Aided Design Tools. Case studies - Recent trends in low-power design for mobile and embedded application.

Kaushik Roy, Sharat Prasad, "Low-Power CMOS VLSI design", John Wiley & Sons Inc, 2000.
Anantha P.Chandrakasan & Robert W. Brodersen, "Low Power Digital CMOS Design", Kluwer Academic Publi. 1995.
Gary K. Yeap, "Practical Low Power Digital VLSI Design", Kluwer Academic Publi. 1998

MI801 Modeling and Simulation (3-0-0) 3

Introduction to Modeling and simulation concepts. Levels of simulation for digital, analog & mixed mode circuits. IC CAD Overview. Device Simulation. Electrical simulation techniques. Relaxation based simulation techniques. Gate level simulation, Switch level timing simulation. Mixed mode interface, simulation and implementation, analog multi-level simulation. Discrete time models, Event driven simulation, Logic simulation, timing verification in ICs, setup and hold times for clocked devices.

R. Saleh, S. Jou & A.R.Newton, "Mixed mode simulation and anlog multilevel simulation", Kluwer Academic Publi. 1994.
V.Litovski & M. Zwolinski, "VLSI circuit simulation & Optimization", Chapman & Hall publications, 1997.
J Baker, Li & Boyce, "CMOS Circuit Design & Simulation", PHI, 2000.

MI802 Submicron Technology (3-0-0) 3

Review of basic device physics. MOS capacitor. Transistor theory. Scaling - Moore's law on technology scaling, MOS device scaling theory, Short channel effects, sub threshold leakage, Punch through, DIBL, High field mobility, Velocity saturation and overshoot. Reliability.

Various definitions of channel length, Performance metric of digital technology, Transistor design trade-offs, 0.18 micron technology case study (Intel, TI, Motorola, IBM), Silicon on Insulator (SOI) devices, Partially depleted and fully depleted SOI, Floating body effects, SOI for low power, Interconnects in sub micron technology, Foundry technology, International Technology Roadmap for Semiconductors (ITRS), End of the road map and beyond.

Yaun Taur, Tak H. Ning, Fundamentals of modern VLSI devices, Cambridge university press, 1998.
B. G. Streetman & S. Banerjee, Solid State Electronic Devices (5th Ed), Prentice hall, 1999.
ITRS Road map - http://public.itrs.net/

MI803 VLSI - CAD (3-0-0) 3

Introduction. Static Timing Analysis and Verification. Compaction and Routing. Partitioning, Floor planning, Placement. Case study: GORDIAN. Technology Mapping, Timing-Driven Logic Optimization. Power Optimization, CAD Algorithms. Finite State Machines, Re-timing. Verification .RTL Design and Synthesis: Expressing RTL models in hardware description languages. Current topics in computer-aided design. Based on the specific interests of the students in the class.

What's After RTL? Above RTL: Application Modeling, Above RTL: Architecture Modeling, Above RTL: Architectural Development, Above RTL: From Application Model to Architecture Model

S. Devadas, A. Ghosh, K. Keutzer, "Logic Synthesis", McGraw-Hill. 1994.
D. Hill et al "The IMAGES Language", appearing in Algorithms and Techniques for VLSI Synthesis" Kluwer Academic Publishers. 1989.
R. L. Rivest and C. M. Fiduccia, "A 'Greedy' Channel Router". Proc. 19th Design Automation Conf. June 1982. pp. 418-424.

MI804 VLSI Physical Design Automation (3-0-0) 3

Introduction to VLSI Physical Design Automation. Partitioning. Floorplanning and Pin Assignment. Placement .Layout styles. Discrete methods in global placement .Timing-driven placement .Global Routing .Performance issues in circuit layout, delay models, timing driven placement, timing driven routing, Via Minimization. Over-the-Cell Routing - Single layer and two-layer routing, Clock and Power Routing. Compaction, compaction algorithms, Physical Design Automation of FPGAs.

Majid Sarrafzadeh and C. K. Wong, "An Introduction to VLSI Physical Design", McGraw Hill, 1996.
Naveed Sherwani, "Algorithms for VLSI Physical Design Automation", 3rd ed., Kluwer Academic Pub., 1999
Sabih H. Gerez, "Algorithms for VLSI Design Automation", John Wiley, 1998

MI805 Hardware Software Co-design (3-0-0) 3

Codesign Overview, Models and Methodology of Embedded System codesign, UML based modeling of reactive system behaviors, Modeling behaviors via transition systems, Temporal Logics for specifying system properties, Explicit state model checking, Hardware Software partitioning and Scheduling, Cosimulation, High level Synthesis (HW) and functional verification, Architecture Mapping, Hardware/Software Interfaces, re-configurable logic and devices, System on Chip (SoC) and IP cores, Hardware/Software codesign for application specific processor, Codesign tools and case studies.

G. Micheli, R. Ernst, and W. Wolf, editors, "Readings in Hardware/Software Co-Design", Morgan Kaufman Publi. 2002
Balarin et al., "Hardware-Software Co-Design of Embedded Systems : The POLIS Approach", Kluwer Academic 1997
Wayne Wolf, "Computers as components: Principles of Embedded Computing System Design", Harcourt India, 2001.

MI806 Sensor Technologies and MEMS (3-0-0) 3

Sensor types and Classification – Mechanical, acoustic, magnetic, thermal, chemical, radiation and bio sensors; Micro-sensor; sensors based on surface acoustic wave devices; Micro-machining technology, bulk, surface and other micro-machining techniques' MEMS for automotive, communication, signal processing applications; Modeling and simulation of Micro-sensors and actuators; sensors and smart structures; micro-opto-electro-mechanical sensors.

Ristic L (ed), "Sensor Technology and Devices", Artech House, London, 1994.
Sze S.M. (ed), "Semiconductor Sensors", John Wiley, New York, 1994.
Wise K.D. (Guest editor), "Integrated Sensors, Microactuators and Microsystems (MEMS)", Special Issue of Proceedings of IEEE, Vol. 86, No. 8, August-1998.

MI807 Embedded Systems (3-0-0) 3

Introduction to embedded systems. Communication strategies for embedded systems. Software for Embedded Systems. Specification and modeling of embedded systems: functional, temporal and structural modeling methods. Programming Languages for Embedded Systems Programming Languages Issues. Real-time operating systems . Basic real-time operating systems concepts and services; interrupt processing; process and thread models; real-time software architectures and development environments.

H. Kopetz, "Real-time Systems", Kluwer, 1997
R. Gupta, "Co-synthesis of Hardware and Software for Embedded Systems", Kluwer 1995.
Gomaa, "Software Design Methods for Concurrent and Real-time Systems", Addison-Wesley, 1993.

MI808 Selected Topics in Microelectronics (3-0-0) 3

DEPARTMENT OF ELECTRICAL AND ELECTRONICS ENGINEERING

PS701 Optimisation Techniques (4-0-0) 4

Linear Programming : Simplex method and extensions. Network models: Shortest path, maximum flow and minimum cost problems. Dynamic programming: resource allocation, production scheduling and equipment replacement problem. Non-linear programming: selected unconstrained and constrained non-linear programming algorithms like quasinewton, reduced gradient and gradient projection methods. Penalty function methods, Quadratic programming.

RL Rox, Optimisation Methods for Engineering Design
Goerge L Nemhauser, Introduction to Dynamic Programming

PS702 Advanced Power Electronics (4-0-0) 4

Power Devices, Design of inductors, transformers, selection of core, design of capaciotors, selection of capacitors in different applications. AC to DC converters:. DC to AC converters, Multilevel level inverter, DC to DC converters: Hard switch converters : design and analysis, Isolated converters. Resonant converters

Ned Mohan, Undeland and others, Power Electronics
Rasheed, Power Electronics Circuits, Devices and Applications

PS703 Power System Dynamics (3-0-0) 3

Introduction. System modeling and dynamics of synchronous generator: Park's and Kron's transformations, excitation controllers, transmission lines and prime mover controllers, loads. Dynamics of synchronous machine connected to infinite bus. Stability of equilibrium points. Dynamic stability of power systems: Low frequency oscillations. Dynamic stability analysis using synchronizing & damping torque concepts. Subsynchronous Resonance: Transient stability of power systems.

KR Padiyar, Power System Dynamics, Stability and Control, Interline Publications, 1995
Prabha Kundur, Power System Stability and Control, McGraw-Hill, Inc., 1993

PS704 Advanced Control Systems (4-0-0) 4

Review of control system analysis using state variable methods. Digital control- concepts of signal processing. Discrete time signals. Z-domain description of sampled continuous time plans implementation of simple digital controllers. Z-plane specifications of control system design. Digital compensator design using root locus plots and frequency response plots. State variable analysis of digital control systems- state description, solution of state difference equations, controllability and observability.

W Brogan, Modern Control Systems, Prentice Hall, NY 1991
M Gopal, Digital Control and State variable Methods, Tata McGraw Hill, 1997

PS705 Power System Simulation laboratory (0-0-3) 2

PS706 Power and Energy Systems Planning (3-0-0) 3

Load forecasting: Classification and characteristics of loads. Classification of load forecasting techniques. Application of statistical techniques for forecasting. Generation capacity planning. Transmission system planning: contingency analysis, transmission system reliability analysis, composite generation and transmission system planning. Distribution system planning: need of distribution system planning, reliability analysis of simple radial, parallel and meshed networks.

RL Sullivan, Power System Planning
R Billinton and RN Allan, Reliability Evaluation of Power System

PS707 Computer Control of Energy Systems (4-0-0) 4

Characteristics of power generation units, economic dispatch of thermal units, unit commitment, hydrothermal coordination, load-frequency control including qualitative treatment of multi-area systems, energy interchange between interconnected systems, introduction to state estimation in power systems, reactive power control in electric systems.

Ellen J Wood and Bruce F Wollenberg, Power Generation, Operation and Control (2nd edition)
George L Kunc, Computer-Aided Power Systems analysis, PHI, New Delhi, 1986.

PS800 System Design using Microprocessors (3-0-0) 3

Microprocessor architecture and instrumentation set: 16 bit processors Microcomputer based system design: Peripherals for building minimum system based on 8086/TMS320CXX – Case studies. Real time programming: Concepts of real time programming – Applications in power systems. Parallel processing: Concepts of parallel processors – parallel processing applications in power system.

Yu-Cheng Lin& Glen A Gibson, Microcomputer systems 8086/8088 family, PHI

TMS 320 C50 Users Guide

PS801 Principles and Practices of Management (3-0-0) 3

Evolution of management thoughts and theories: Management techniques for managerial decisions: Operations management: Economic aspects of decision making, system planning and design, operations planning and control. Materials management:. Industrial psychology: Management information systems .

Herold Koontz, Management, TMH
Monks, Operations Management, TMH

PS802 Incremental Motion Control (3-0-0) 3

Introduction to incremental motion control systems and related definitions. Stepper motors. Drive circuit design. Open loop stepper motor control. Closed loop control- position sensing. Switching angle to maximize pull out torque- microprocessor based control. Electrohydraulic stepper motors.

PP Acarnley, Stepping Motors – A Guide to Modern Theory and Practice
BC Kuo and J Tal, Incremental Motion Control- Vol.I and II

PS803 Software Engineering (3-0-0) 3

Data Structure and algorithm:. Analysis of algorithm: Matrix manipulation, sorting, searching, etc. software engineering: principles, structural and object oriented software programming, development phases, software quality and reliability. Internet: introduction, programming in internet environment, security, portability.

Taune Baum, Data Structure and Algorithms
Pressman, Software Engineering, McGraw Hill, 1992

PS 804 High Voltage Engineering (3-0-0) 3

Review of breakdown in solid, liquid, gas and composite insulation mechanism of partial discharges and corona. PD measuring circuits, errors, calibration. PD signals and associated patterns. Introduction to application of artificial intelligence. Ageing of insulation. Pollution performance of insulators. Lightning and switching overvoltages, VFT overvoltages in GIS. Optical fibers and applications in HV measurements. Design of a HV laboratory, Industrial application of HV

FH Kreuger, Partial Discharge Detection in HV Equipments.
S Whitehead, Dielectric Breakdown of Solids

PS 805 Switched Mode Power Conversion (3-0-0) 3

DC-DC power converters operation and analysis. Dynamic model of switched mode power converters. Constant frequency current programmed control of converters. Subharmonic instability. Closed loop control of SMPC. Design of the controller. Protection schemes, soft starting. Resonant converters

RD Middlebrook and SM Cuk, Advances in Switched Mode Power Conversion, Vol.I, II, & III, Teslaco, Pasadena
Ned Mohan, et al, Power Electronics

PS 806 Advanced Electric Drives (3-0-0) 3

Electric drives: DC drives, modelling, analysis and simulation, Space pahsors, modeling of brushless dc motor, modelling of induction motor, Vector control of brushless DC motor. Induction motor drives: v/f control, vector control of induction motor, DT control of induction motor drives

W Leonard, Electric drives, Springer Verlag
BK Bose, Power Electronics and AC drives

PS807 Advanced Power System Stability (3-0-0) 3

Voltage Stability. Modeling of power system. Static voltage stability analysis using singularity of Jacobian. Singular value decomposition, sensitivity and continuation power flow methods. Dynamic voltage stability analysis. Use of eigen value analysis for local bifurcations. Voltage stability margin prediction. Calculation of worst loading condition. Methods to improve voltage stability margin. Voltage stability in HVDC systems and combined AC-DC systems. Direct methods for transient stability analysis. Energy functions. Characterization of stability boundary.

MA Pai, Power System Stability, NorthHolland Publishing Company, NewYork, 1981
MA pai, Energy function analysis for Power System Stability, Kluwer Academic Publishers, 1989

PS808 HVDC Transmission (3-0-0) 3

Control of HVDC converters and systems. Harmonics and their minimization. Faults and protection, Simulation of practical disturbances, AC system faults, DC line faults. Over current protection of valve group, DC line and filters. Transient overvoltages. Insulation co-ordination. Interaction between AC and DC. DC power modulation-dynamic stabilisation of AC systems, control damping of Dc interconnected systems, damping of SSR, active and reactive power co-ordination, transient stabilisation of AC systems

EW Kimbark, Direct Current Transmission

J Arrilaga, HVDC Transmission

PS809 Flexible AC Transmission Systems (3-0-0) 3
Review of transmission line compensation- series, shunt voltage-power characteristics, reactive power requirements. Static VAR systems-configurations, TCR, TSC, modelling and analysis of FC-TCR type SVC. Application in power system stability (dynamic and transient) analysis. Concept and development of FACTS controllers: STATCON-modelling, analysis and application for voltage control in transmission system. Thyristor controlled phase angle regulator. UPFC-general configuration, implementation and control.
TJE Miller, Reactive Power Control, John Wiley, NY, 1984
P Kundur, Power System Stability and Control, IEEE Press, 1995

PS810 Fuzzy Control (3-0-0) 3
Crisp sets and Fuzzy sets- operation on Fuzzy sets-Fuzzy relations and measures Fuzzy logic and control uncertainty and information. Development of fuzzy systems-applications of fuzzy control to power system analysis and FACTS controllers.
Klir and Folger, Fuzzy Sets, PHI, 1993
Kur George, Fuzzy Logic and Control, PHI, 1995

PS811 Computer Aided Protection (3-0-0) 3
Simulation methodologies of complex energy systems and transducers. Basic hardware scheme of a microprocessor based relay. Signal processing algorithms for energy system protection. Processor based protection schemes(algorithm, hardware schematic and relay logic) for transmission line, power transformers, synchronous generators and induction motors. Frequency relaying and load shedding. Computer control of substations-SCADA and ASTA. Automatic testing of protective relays.
Computer relaying, IEEE Tutorial course, 79EHO 148-7PWR, 1979
Microprocessor relays and protection systems, IEEE Tutorial course, 88 EHO 269-1 PWR, 1988

PS 812 Renewable Energy resources (3-0-0) 3
Energy scenario. Solar, thermal and photovoltaic systems. Biomass and biogas. Wind energy systems. Geothermal, tidal and wave energy resources. Micro and mini hydros. Integrated renewable energy systems. Energy storage techniques.
RH Taylor, Alternative Energy Sources, Adam Hilger Ltd.
Gary L Johnson, Wind Energy Systems, Prentice-Hall

PS813 Transients in Energy Systems (3-0-0) 3
Introduction to electrical transients, nature and characteristics of switching and lightning overvoltages. Effects of overvoltages on power components, methods of computation of transients. Frequency and time domain analysis techniques. Basics of EMTP and its application. Modeling of non-linearities, system insulation requirements, insulation co-ordination.
A Greenwood, Electrical transients in Power systems, Wiley, Inter-Science, 1971
Digital simulation of Electrical transient phenomenon, IEEE Tutorial Course, 1980

PS 814 Direct Energy Conversion (3-0-0) 3
Energy conversion and thermodynamic principles. Semiconductor basics. Solar cells and photovoltaic Systems. Electrochemical effects and fuel cells. Thermionic and thermoelectric systems. MHD generation.
SL Soo, Direct Energy Conversion, Prentice-Hall
SW Angrist, Direct Energy Conersion, Allyn and Bacon

PS 815 Electric Power Quality (3-0-0) 3
Electric power quality. Measures and standards of power quality, IEEE guides and recommended practices. Measurements. Loads which may cause power quality problems. Power quality improvement: harmonic filters, active filters, phase multiplication, power conditioners, UPS, CVP, SVC and SWC.
GT Heydt, Electric Power Quality, Stars in a Circle Publication, 1991

PS816 Energy Auditing (3-0-0) 3
What is energy auditing: purpose, methodology used, case studies of few selected industries, analysis of results and inference, different standards, instruments used in energy auditing.

PS817 MEMS (3-0-0) 3
Working principles of Microsystems, Microsystems fabrication process, Microsystems design and fabrication, Scaling laws in Miniaturization, Materials for MEMS, Overview of Micro manufacturing, Micro system packaging. Operating principles of various MEMS Transducers.
Tai-Ran Hsu, MEMS & Microsystems Design and Manufacturing, Tata McGraw Hill, New Delhi 2002

PS818 Design of Embedded Controllers (3-0-0) 3
Embedded controllers, real time controllers, design of systems using PLDs/FPGAs, Interfacing with the DSP/microprocessor controllers.

PS819 Electro Magnetic Compatibility (3-0-0) 3
Electromagnetic and electrostatic interference, Sources, Methods of measuring, Suppression techniques, Design considerations, EMI Standards, Measurement using modern instruments.

PS820 Selected topics in Power and Energy Systems (3-0-0) 3

EE900 Selected Topics in Power Electronics 4
Multilevel inverters, Topologies, Applications of multilevel inverters for high power applications. Active filters, FACTs controllers, High voltage power supplies: Topologies and design. Current topics in power electronics.

EE901 Selected Topics in Electric Drives 4
Switched reactance motors, Permanent magnet synchronous machines, CSI/VSI fed drives for high power applications, Special drives for electric vehicle, topics of current interest.

EE902 Selected Topics in Power System Protection 4
Topics of current interest in power system protection.

EE903 Selected Topics in Power Systems Dynamics and stability 4
Topics of current interest in power system control, stability, dynamics, Applications of FACTs controllers. Voltage stability analysis, Inter relation between voltage and angle stability.

EE904 Current topics in Electric Machines 4
Design of special machines, disc motors, switched reluctance motors, high power stepper motors, and other advanced topics.

EE905 Finite Element Methods and Applications 4
Field analysis of electric machines, finite element methods and its applications for the analysis of electric machines and other topics of interest.

DEPARTMENT OF INFORMATION TECHNOLOGY

IT900 Advanced Database Management Systems 4

Basic concepts and terminology, software architecture for data sharing, federated database management system, designing distributed databases, distributed transactions, client server architecture, multimedia databases, object oriented DBMS

Tamer Ozsu, Patrick Valduring: Principles of Distributed Database systems, PHI
Ceri S, Pelagatti S: Distributed Databases: Principles and Systems, McGraw Hill, New York

IT901 Distributed Computing Systems 4

Introduction Computer Networks and Multi-processor systems, Evolution of modern operating systems, Design Goals, transparencies and fundamental issues in Distributed systems, Temporal ordering of events, Global state detection, Physical clocks, Mutual Exclusion Algorithms, Interprocess Communication, Deadlocks in distributed systems, Load balancing techniques, Distributed databases

Shivarathi & Shingal, Advanced Operating Systems
Randy Chow, Distributed Operating Systems and Algorithms

IT902 Advanced Software Engineering 4

Managing software projects : Project management concepts, Project metrics, Project planning, Project scheduling and tracking; Quality, Configuration management, Technical metrics and formal methods; Object oriented software engineering; Reuse, Reengineering, Client/Server software engineering, CASE.

Roger S Pressman, Software Engineering – A Practitioner's Approach, McGraw-Hill
Ian Sommerville, Software Engineering, Addison Wesley.

IT903 Design and Analysis of Algorithms 4

Fundamentals of Algorithmic Problem Solving, Fundamental data Structures, Fundamentals of the Analysis of Algorithm Efficiency, Brute Force, Divide-and-Conquer, Decrease and Conquer, Transform and Conquer, Space and Time Tradeoffs, Dynamic Programming, Greedy Technique, Limitations of Algorithm Power. Coping with the Limitations of Algorithm Power.

Anany Levitin, Introduction To The Design And Analysis Of Algorithms, 2003, Pearson Education

IT904 Advanced Operating Systems 4

An overview of operating system functions, Distributed operating systems, Protection and security, Multiprocessor operating systems, Database operating systems, Concurrency control, Object oriented operating systems and its characteristics, Case studies of OS such as UNIX OS, Netware OS, Windows etc,

Mukesh Singhal Niranjan, Shivorothri G: Advanced concepts in Operating Systems
Andrew S Tenanbaum: Distributed Operating systems

IT905 Data Warehousing and Data Mining 4

Data Warehousing, Data Mining, Association Rules, Classification, Clustering, Decision Trees, Other Techniques for Data Mining, Web Mining, Searching Techniques

Jiawei Han, Micheline Kamber: Data Mining: Concepts and Techniques, 2001, Harcourt India Pvt.
Arun Poojary K., Data Mining Concepts, 2001, Hyderabad Press

IT906 Genetic Algorithms 4

Population based search techniques, Introduction to Genetic algorithms, Mathematical foundations, Computer implementation of genetic algorithms, Advanced operators and techniques in genetic algorithm search, Industrial application of genetic algorithms.

David Goldberg, Genetic Algorithms in Search, Optimization and Machine learning, Addison Wesley International
Charles L Karr and L Michael Freeman, Industrial Applications of Genetic Algorithms, CRC Press

DEPARTMENT OF CHEMICAL ENGINEERING

PC701 Industrial and Domestic Wastewater Treatment (3-1-0) 4

Introduction- Wastewater sources, components of wastewater flows, estimation of wastewater flows, analysis of wastewater flow rate data. Wastewater characteristics- physical, chemical and biological characteristics of wastewater. Wastewater treatment methods.

Wastewater Engineering-Treatment, disposal & reuse, Metcalf and Eddy,1991, Tata McGrawHill
Sewage and Sewage Treatment- H.E.Babbilt and R.Baumann, 1986.

PC702 Solid Waste Management (3-1-0) 4

Introduction. Evolution of solid waste management. Generation of solid waste, Onsite handling, Storage and processing, Transfer and transport, Processing techniques and equipment. Recovery of resources- Conversion, Chemical and Biological methods. Disposal of solid waste. Hazardous waste and their management. Case studies on major industrial solid waste generation units.

Solid Wastes, Martell, 1975, John Wiley, NY.
Solid Wastes, George Tchobanuglour, H.Theisen and R.Eliassen.

PC703 Air Pollution Control and Design of Equipments (3-1-0) 4

Introduction. Air pollution laws and standards. Meteorological aspects of air pollution dispersion. Air pollution sampling and measurements. Air pollution control methods and design of equipments. Particulate emission control. Control of gaseous emissions. Air pollution control in specific industries. Acid rain, green house effects, important air pollution episodes.

Pollution Control Theory, Martin Crawford, 1976, McGraw Hill, NY.
Air Pollution Part A&B, Joe Ledbetter,1972,Marcel Dekker, NY.

PC704 Environmental Impact Assessment and Management Plan (3-1-0) 4

Introduction and need for impact assessment. Methodologies. Application of Impact assessment methods in specific developmental projects. Ranking of impacts, environmental management plan. Legislation and pollution control acts and notifications. Environmental audits, waste audit, life cycle assessments, Industrial symbiosis. Clean Technology –options.

Environmental Impact Assessment-Theory and practice, Edited by Peter Wathern, Unwin Hyman Ltd, 1988.
Environmental Health and Safety Auditing Hand Book,1994, McGraw Hill Inc, NY.

PC705 Mathematical Modeling of Environmental Systems (3-1-0) 4

Introduction to modeling of Environmental systems, physical phenomena, chemical phenomena, biological phenomena. Air pollutants- Modeling of dispersion of pollutants in air. Water Quality modeling-basic theory, estuary models, river model, lake models; models of treatment processes-thickening process, anaerobic digestion, activated sludge process, trickling filter process. Modeling of transport of pollutants in subterranean media- modeling of ground water pollution

Air pollution control engineering, N.De Nevers, 1995, McGraw Hill.
Air pollution control engineering, W.Licht, 1988, Marcel-Dekker.

PC807 Environmental Law (3-0-0) 3

Historical Perspective. The regulation of environmental Protection. Town and Country Planning. Water Act. Air Act. Environmental Protection Act of 1986. Public Liability Insurance Act. Biomedical waste, Solid Waste management and Handling Rules.

Chemical Emergency Rules. Case Studies.

Environmental law, Simon Ball and Stuart Bell, Blackstone Press Ltd., London, 1991.
Environmental Law in Japan, Julian Gresser, The MIT Press, London, 1981.

PC808 Waste Management using EcoTechnology (3-0-0) 3

Sustainable development. Crop Irrigation. Vermiculture and Vermi Composting. Utilization of Solid waste from sewage treatment, fish farming in agriculture. Bio mass utilization. Sericulture. Root Zone Technology. Compost Techniques from crop residue. Case Studies about solid waste from industries.

Ecotechnology for Pollution Control and environmental Management, RK Trivedi, Arvind Kumar, Enviro Media, 1998

PC809 Environmental Biotechnology (3-0-0) 3

Concepts, Definitions, Criteria, Potable water quality, Biotreatment options for ground and water contamination, Bio accumulation of trace materials, Biodegradation of organic pollutants, biofertilizer, Immunocontraceptive biotechnology, agro technologies, phytoremediation and use of remote sensing technology.

Environmental biotechnology, Geeta bali et al., APH Publishing Corporation, New Delhi, 2002.

PC810 Industrial Pollution Prevention (3-0-0) 3
Concepts, Benefits, waste Reduction, Waste Audit, Environmental Audit, ISO 14000, ISO 18000 series standards, Total quality management, Life Cycle design/Assessment, Product labeling, Examples in Chemical Process Industries, Cost benefit Analysis, Role of Biotechnology.
Industrial Pollution Prevention Handbook, Harry M. Freeman, McGraw Hill Inc., 1995.

PC811 Industrial Microbiology (3-0-0) 3
Introduction, Industrial Fermentation Processes, Screening, Detection, Assay of Products, Stock Cultures, Innoculum Preparation, Media, Scale up Procedures, Typical Fermentation Process details, Antibiotics, Anaerobic, genetic Control, Hydrocarbon, Enzymes, Vitamins and Organic Acids.
Industrial Biotechnology, L.F. Casida Jr., New Age International Publishers, 1968.

PC812 Selected topics in Industrial Pollution Control (3-0-0) 3

PD701 Process Equipment Design I (3-1-0) 4
Detailed process design of Heat exchangers- Double pipe and Shell and Tube exchangers, Total condensers, partial condensers, vaporizers, reboiler, condenser-subcoolers, desuperheater-condensers, and Jacketed vessels. Detailed process design of Evaporators and Humidifiers
Process Heat Transfer, D.Q.Kern, 1950, McGraw Hill.
Chemical Engineering, Volume 6, Coulson and Richardson, 1996, Butterworth Heinemann.

PD702 Process Dynamics and Control (3-1-0) 4
Review of Stability analysis and controller design for linear time invariant systems. Advanced control techniques. Analysis of distributed parameter system dynamics. Multivariable process control. Sampled – data systems. Nonlinear control.
Process Systems Analysis and Control, D.R. Coughanowr, 1995, McGraw Hill.
Process Dynamics and Control, D.E. Seborg, T.F. Edgar and D.A. Mellichamp, 1989, Jonh Wiley

PD703 Process Equipment Design II (3-1-0) 4
Detailed process design of equipment for Absorption, Distillation, Multi-component absorption and distillation, Liquid-Liquid extraction, Leaching and adsorption.
Chemical Engineering, Volume 6, Coulson and Richardson, 1996, Butterworth Heinemann.
Mass Transfer Operations, R.E.Treybal, 1981, McGraw Hill.

PD704 Process Modeling and Simulation (3-1-0) 4
Introduction-Models and model building. Lumped parameter models (steady-state and unsteady-state). Distribution parameter models (steady-state and unsteady state) Stochastic models- discrete state/continuous state. Parameter estimation.
Computational Methods In Process Simulation, W.F.Ramirez. 1989, Butterworth.
Modeling and Simulation in Chemical Engineering, R.E.Franks, 1972, John Wiley.

PD705 Chemical Reactor Design (3-1-0) 4
Review of non-ideal reactor analysis. Non Isothermal reactor Design. Design of gas-liquid and liquid-liquid reactors. Design of plug flow type reactors-reactors for carrying out isothermal, adiabatic and non-isothermal operations involving homogeneous, heterogeneous, catalytic, non-catalytic reactions. Introduction to multiphase reactors-design concept for slurry reactors, trickle bed reactors, fluidized bed reactors.
Chemical Engineering Kinetics, J.M.Smith, 1970,McGraw Hill.
Chemical Reaction Engineering, Octave Levenspiel, 1974, Wiley Eastern Ltd.

PD807 Mechanical Design of Process Vessels (3-0-0) 3
General considerations in design of process vessels. Design of thin walled vessels under internal pressure. Compensation for openings and branches. Design of vessels subjected to external pressure. Design of vessels subjected to combined loadings. Design of vessels supports. Design of flanged joints and welded joints. Fatigue assessment of vessels and pressure tests.
Chemical engineering, Volume 6, Coulson and Richardson, 1996, Butterworth Heinemann.
Process equipment design –Vessel design, Brownwell and Young, 1951, Wiley Eastern Limited.

PD808 Integrated Process Design Flow Sheeting and Synthesis (3-0-0) 3
Flow sheet synthesis. - Structural optimization of process flow sheets. Process synthesis concepts. Design and scheduling of batch processes- single product batch plants, multiple product batch plants, sizing of vessels in

batch plants, inventories, synthesis of flowshop plants, optimal design and scheduling of multi product batch plants.

Systematic methods of chemical process design, L.T.Biegler. I.E.Grossmann and Westerberg, 1997, Prentice Hall Inc.
Chemical process design, Robin Smith, 1995, McGraw Hill Inc.

PD809 Advanced Process Control (3-0-0) 3

Linear multivariable control systems. Optimal control theory. Control of Distributed parameter systems. State estimation of Stochastic control. Optimal control of discrete data systems- linear quadratic Gaussian control, Kalman filter, Minimum variance control, Recursive least square identification and self tuning control.

Advanced Process Control, W.H.Ray, 1989, Butterworths.
Computer Controlled Systems, K.J.Astrom, Bjorn Wittenmark, 1990, Prentice Hall

PD810 Polymerization Reaction Engineering (3-0-0) 3

Classification of polymerization reactions. molecular weight distribution in batch and continuous reactors, average molecular weight and experimental determinations based on viscosity, osmotic pressure etc., semi-batch reactor operation, design of batch and continuous reactors. Heterogeneous poly-addition reactors. Polycondensation reactions.

Mechanism of Reactions, G.M.Burnett, 1954, Interscience.
Emulsion Polymerization, F.M.Bovey, A.J.Medalia, E.J.Meachan and I.M.Kolthoff, 1955, Interscience.

PD811 Selected Topics in Chemical Plant Design (3-0-0) 3

CH700 Transport Phenomena (3-1-0) 4

Introduction to general transport equations for momentum, energy and mass transfer in Cartesian, cylindrical and spherical coordinates, simplification of general equations with time and spatial coordinates for momentum, energy and mass transport, boundary layer concepts. Introduction to turbulent transport, formation of dimensionless groups by making use of general property balance equations. Interface transport in isothermal, non-isothermal and multicomponent systems. Macroscopic balances for isothermal, non-isothermal and multi component systems.

Transport Phenomena- A unified approach, R.S.Brodkey and H.C.Hershey, 1988, McGraw Hill.
Transport Phenomena- R.B.Bird, W.E.Stuart and E.W.Lightfoot, 1960, John Wiley.

CH800 Chemical Process Optimization (3-0-0) 3

Nature and organization of optimization problems, fitting models to data, formulation of objective functions. Optimization theory and methods. Non-traditional optimization methods. Applications of Optimization in process industries.

Optimization of Chemical Processes, T.F.Edger and D.M.Himmelblau, 1989, McGraw Hill.
Optimization of Engineering Design, Kalyanmoy Deb, 1995, Prentice Hall of India.

CH801 Biochemical Engineering and Bioreactor Design (3-0-0) 3

Microbiology. Characterization, Classification and enumeration of microorganisms, environmental and industrial microbiology, ecology, microbiology of soil and air, Laboratory techniques in microbial operations. Control of microorganisms by physical and chemical methods, biochemistry. Microbial metabolism. Mechanism and kinetics of enzyme catalyzed reactions. Enzyme technology. Bioreactor design.

Biochemical Engineering Fundamentals, J.E.Bailey and D.F. Ollis, 1977, McGraw Hill.
Biochemical Engineering, S. Aiba, 1965,Acadmic Press.

CH802 Selected Separation Processes (3-0-0) 3

Adsorption separation. Membrane separation processes. Surfactant based separations. External field induced separations. Supercritical fluid extraction- Physicochemical principles, thermodynamic modeling, process synthesis and energy analysis.

Large Scale Adsorption and Chromatography, P.C.Wankat, 1986, CRC Press.
Handbook of Separation Process Technology, R.W.Rousseau, 1987, John Wiley and Sons.

CH803 Computational Methods in Chemical Engineering (3-0-0) 3

Introduction to computational methods- matrix algebra. Finite difference methods. Partial differential equations- classification, solution of elliptic, hyperbolic and parabolic partial differential equations by finite difference equations, stability of different schemes. Variational methods.

Computational Physics, D. Potter, 1973, John Wiley
Computational Methods for Solution of Engineering Problems, C.A. Brebbia & A.J. Ferranta, 1978, Pented Press.

CH804 Advanced Chemical Engineering Thermodynamics (3-0-0) 3

Fundamental concepts of classical and statistical thermodynamics, thermodynamic properties of multi-component multiphase systems from equations of state, inter molecular forces and potential energy functions, molecular theory of corresponding states, fugacities in gaseous mixtures, fugacities in liquid mixtures, theories of solutions, solubility of gases in liquids, solubility of solids in liquids, high pressure equilibria, generation of multi component phase equilibria data by computer calculations.

Molecular Thermodynamics of Fluid Phase Equilibria, 2nd Ed., J.M. Prausnitz, R.N. Lichtenthaler and E. G. Azevedo, 1986, Prentice Hall.

The Properties of Gases and Liquids, 4th Ed., R.C. Reid, J.M. Prausnitz and B.E.Poling, 1987, McGraw Hill.

CH805 Risk and Safety Management in Process Industries (3-0-0) 3

Hazard identification methodologies, risk assessment methods-PHA, HAZOP, MCA, ETA, FTA, Consequence analysis, Probit Analysis. Hazards in work places. Workers' exposures to hazardous chemicals. Hazards peculiar in industries. Guidelines for safeguarding personnel. Safety education and training-Safety managements, fundamentals of safety tenets, measuring safety performance, motivating safety performance, legal aspects of industrial safety, safety audits

Loss prevention in process industries, 2/e, F.P.Lees, 1996, Butterworth-Heinemann.

Industrial Safety hand book, 2/e, W.Handley, 1977, McGraw- Hill

CH806 Process Energy Integration (3-0-0) 3

Introduction and role of Thermodynamics. Heat exchanger Networks. Heat and Power Integration. Economic Evaluation. Applications and Problems.

A User Guide on Process Integration for Efficient Use of Energy, B.Linnhoff, UMIST.

Chemical Process Design, Robin Smith, McGraw Hill.

CH901 Membrane Separation Processes 4

Introduction, Classification of Membrane Processes, Membrane Materials and their Selection, Membrane modules. Tran0sport in Membranes. Non-porous membranes. Flow patterns in membrane modules. Concentration Polarisation. Modelling and Design considerations of various membrane processes – Reverse Osmosis, Dialysis, Electrodialysis, Ultra filtration, Pervaporation, Gas permeation Membranes. Membrane Applications in Waste Water Treatment.

J.D. Seader, Emest J. Henley, Separation Process Principles, 1998, John Wiley & Sons.

S.Judd, B. Jafferman, Membranes for Industrial Waste Water Recovery and Re-use, 2003, Elsiever Publications.

CH902 Industrial Effluent Treatment 4

Introduction – Waste water sources and characteristics. Classification, Application and Selection of treatment methods - Principles and design. Chemical preparation, chlorination processes, activated sludge process, aerated lagoons, trickling filters, sludge digestion facilities, waste water reclamation and reuse. Treatment of effluents in specific industries.

Metcalf and Eddy, Waste water Engineering – Treatment, Disposal and Re-use, 1991, Tata-McGraw-Hill.

S.P. Mahajan, Pollution Control in Process Industries, 1985, Tata-McGraw-Hill.

J. Arundel, Sewage and Industrial Effluent Treatment, 1995, Blackwell Sewer Ltd.

CH903 Instrumental Techniques for Effluent Analysis 4

Fundamentals. Spectro Analytical Methods. Chromatographic Methods. Electro and Radio Analytical Methods. Thermal Analysis.

Willard H., Merritt, L. Dean D.A. and Settle F.A., "Instrumental Methods of Analysis", CSS Publisher, 1986.

C.W. Ewing, "Instrumental Methods of Chemical Analyser", 5th Edition, McGraw Hill 1995.

CH904 Computational Methods for Process Simulations 4

Introduction to Computational Methods. Modelling and Simulation of chemical Engineering systems. MATLAB – Simulation exercises using MATLAB.

W.F. Ramirez, Computational Methods in Process Simulation, 1989, Butterworth.

R.E.Franks, Modelling and Simulation in Chemical Engineering, 1972, John Wiley.

Rudra Pratap, MATLAB – A Quick Introduction for Scientists and Engineers, Oxford University Press, 2002.

CH905 Fundamentals of Biochemical Engineering 4

Microbiology. Environmental and Industrial microbiology, ecology, microbiology of soil and air. Laboratory techniques in microbial operation. Control of Microorganisms by physical and chemical methods Biochemistry/Chemistry of life Microbial metabolism, biosynthesis, molecular genetics and control systems Mechanism and kinetics of enzyme catalysed reactions. Mixed microbial populations in applications.

Biochemical Engineering Fundamentals, J.E.Bailey and D.F. Ollis, 1977, McGraw Hill

Biochemical Engineering, S.Aiba, 1965, Academic Press,
Microbiology, N.J.Pelczar Jr., 1988, McGraw Hill.

CH906 Design and Analysis of Bioreactors 4

Transport Phenomena in bioprocess systems. Design of bioreactors. Sterilization reactors, Immobilized biocatalysts, Multi-phase bioreactors ,Design and operation of typical fermentation process. Operating considerations for bioreactors. Selection, scale up, operation, Instrumentation and control of bioreactors. Product recovery operations.

Biochemical Reactors, B.Atkinson, 1974, Pion Ltd.
Bioprocess Engineering – Basic Concepts, Michael L. Shules, Fikret Kargi, Prentice Hall 1992.
Biochemical Engineering Fundamentals, J.E.Baily and D.F.Ollis,1977,McGraw-Hill..

CH907 Modeling and Simulation of Environmental Bioprocesses 4

Modeling Principles. Formulation of Dynamic balance equations. Chemical and Biological reaction systems. Modes of reactor operation. Modeling of bioreactor systems. Mass transfer theory. Optimization, parameter estimation and sensitivity analysis. Description, modeling and simulation of waste water treatment processes. Primary treatment processes. Secondary treatment processes.

Dynamics of Environmental Bioprocesses, J.B.Snape, I.J.Dunn, J.Ingham, J.E. Prenosil – V& H Publishers, 1995
Process Computations in Biotechnology, Jasun K. Ghosh, McGraw Hill 1994.

CH908 Applied Mathematics for Chemical Engineering 4

Introduction to computational methods – Matrix algebra by computers, elementary matrix operations, solutions of simultaneous linear equation, eigen values and eigen vector problems, matrix representation of extremum problems. Finite difference method. Solution of ordinary differential equations, partial differential equation.

Computational Methods in Chemical Engineering, O.T.Hanna and O.C. Sandall, 1995, Prentice Hall
Computational Methods for Solution of Engineering Problems, C.A. Brebba, and A.J.Ferranta, 1978, Pented Press.

DEPARTMENT OF MECHANICAL ENGINEERING

HP700 Advanced Thermodynamics (3-1-0) 4

Review of First law and Second law of thermodynamics and some of its consequences, Availability, Non-reactive gas mixtures, Reactive mixtures, Kinetic theory and statistical thermodynamics and it's applications. Introduction to irreversible thermodynamics. Compressible fluid flow, Introduction to transport processes in gases.

Michel M. Saad, Thermodynamics for Engineers, Prentice Hill
J.P. Holman, Thermodynamics, Mc Graw Hill
P.K. Nag, Basic and Applied Thermodynamics .

HP701 Advanced Heat Transfer (3-1-0) 4

Recapitulation of heat transfer. Modes of heat transfer and laws governing them. Extended surface heat transfer with variable cross section. Numerical methods in solving two and three dimensional heat conduction problems. Boundary layer analysis. Heat transfer with phase change. Two-phase flow heat transfer with pure and mixed fluids. Pressure drop in two phase flow. Boiling crises in two phase flow. Design of heat exchangers. Special heat transfer processes. Radiation heat transfer. Radiation properties and laws. Electrical analogy. Radiation configuration factor. Radiation through gases and absorbing media.

J.P. Holman, "Heat Transfer", McGraw Hill, New York.
Frank Kreith, "Heat Transfer", International Text Book Co.
Necati Ozisik M., "Heat Transfer: A Basic approach", McGraw Hill Book Company, New York.
Nijaguna B. T., Thermal Science/Engineering data Hand Book, KREC.

HP702 Advanced Refrigeration Technology (3-1-0) 4

Refrigeration and Environment - Refrigerants: Pure and Alternate Refrigerants. Thermodynamics of Refrigeration Systems.Analysis and Design of Refrigeration System Components.Recent Trends and Developments in the Refrigeration Engineering: Any Recent Innovative Development in the Subject to Be Taught.

Arora C. P., " Engineering Thermodynamics", Tata McGraw hill 1998.
Arora C. P., " Refrigeration and Air Conditioning", Tata McGraw hill.
Heat transfer/Refrigeration/Thermodynamics data handbook.

HP703 Combustion (3-1-0) 4

Introduction to the combustion of fuels, Fundamentals of chemical kinetics, Kinetics of chemical chain reaction, Thermodynamics of combustion, Laminar flame propagation, Determination of burning velocities, Turbulent flame propagation, flame stability, flame quenching, Diffusion flames, Detonation waves in gases, Minimum ignition energy, Limits of inflammability, Spray combustion, Combustion of liquid & solid fuels, Combustion applications, Rocket motor systems.

B.Lewis and G.Von Elbe, Combustion flames and explosion of gases.
S.P Sharma and Chandermohan, Fuels and Combustion.
R.A Strehlow, Fundamentals of Combustion.
M.J Zucrow, Jet propulsion and gas turbines.

HP704 Mechanical Lab (0-0-4) 2

HP705 Renewable Energy Sources (3-1-0) 4

Introduction to energy sources. Need for renewable energy sources. Wind energy, Biomass energy, Ocean energy, Geothermal energy, Mini Hydel power, sources, conversion systems, design of such a system for electric power conversion. Direct energy conversion. Hybrid system – their economic and technical feasibility.

J.W.Twidell and A.D. Weer, Renewable energy sources, ELBS.
P.D. Dunn, Renewable energies: Sources, Conversion and Application.
S.Rao and B.B. Parulekar, Energy Technology, Khanna Publisher.
Desire LE Gourieres, Wind power plant: Theory and Design, Pergamon press.

HP801 Industrial Pollution Control (3-0-0) 3

Introduction: Man and the environment, Consequences of pollution growth, Impact on environment by industrial growth. Air, water and soil pollution. Energy generation and environmental degradation, Ill effects of pollutants, Meteorology, Plume dispersion studies, particulates, smoke, gaseous pollutants, Formation of pollutants and control, Waste water treatment, Soil pollution, Noise and odour pollution. Legal aspects of pollution control.

C.S. Rao, Environmental Pollution Control Engineering, Wiley Eastern Ltd, 1994.

Henry C. Perkins, Air Pollution McGraw Hill
W.L. Faith, Air Pollution control, John Wiley
P. Mohanan, Report: Environmental Pollution Control and Repercussions.

HP802 Utilization of Solar Energy (3-0-0) 3

Introduction to energy and Solar energy option, Principles of solar radiation, solar concentrators, solar receiver, energy Storage principles and Techniques. Power cycles, working fluid and prime movers, Analysis of performance of storage system. Central receiver of solar thermal plants. Distributed solar thermal power plant. Direct energy conversion, Economics.

B.S. Magal, Solar power
Frank Freith and J.F. Kreider, Mc Graw Hill
Duffie and Bechman, Solar Energy thermal process, John Wiley.
S.P. Sukhatme, Solar Energy, Mc Graw Hill

HP803 Direct Energy Conversion (3-0-0) 3

Basic of energy conversion, Thermodynamic analysis. Thermoelectric, thermo-ionic. Magneto hydrodynamic, Photostatic, Electrochemical, Photovoltaic effect, Solar cell: construction and operating characteristics, typical layout. Current developments.

Sheldon S.L. Chang, Energy conversion-; Prentice Hall
George W. Sutton, Direct Energy conversion, McGraw Hill
Archie W. Culp, Principle of Energy conversion, McGraw Hill
G.D. Rai, Non –conventional energy sources, Khanna Publishers

HP804 Design of Thermal Systems (3-0-0) 3

Engineering Design - Designing a Workable system - Economics -Equation Fitting - Modeling Thermal Equipment - System Simulation -Optimization - search methods - Dynamic Programming – Linear Programming - Geometric programming - Mathematical modeling -Thermodynamic Properties.

Stoker W. F., Design of Thermal Systems, McGraw Hill

HP805 Rocket Technology (3-0-0) 3

Reaction Principles, Essential factors of propulsive devices. Momentum theory, Ramjet engine, Design of propulsion and turbo jet engines. Performance of rocket vehicles. Design parameters, Solid propellant rocket motors. liquid propellant rockets, combustion mechanism, Testing of rockets, Introduction to nuclear and electrical rocket system.

M.J. Zucrow, Principles of Jet Propulsion and Rocket Systems, John Wiley.
Mathur and Sharma, Gas Turbines and Jet Propulsion.
S.P. Sutton, Rocket Propulsion Elements.
M.J. Zucrow, Aircraft and Missile Propulsion, vol.- II, John Wiley.

HP806 Automobile Pollution and its Control (3-0-0) 3

Characterization of pollution control, Primary pollutants, Air pollution and health, Air pollution and the environment, Laws and regulation, Regulatory test procedures. Driving cycles and emission standards, Exhaust gas pollutants, Particulate pollutants. Methods of characterization and analysis, Analysis of pollutants: Carbon and nitrogen compounds, Analysis of pollutants and other products. Mechanisms of pollutant formation in engines, influence of fuel properties, effect of motor fuels, diesel fuels and alternative fuels, Post combustion treatments, Economic challenges.

Paul Degobert, Automobiles and pollution, Technip, Paris
M.N Rao and H.V.N Rao, Air Pollution, Tata McGraw Hill.
Crouse William, Automotive Emission Control, Gregg Division, McGraw Hill.
Obert E. F., Internal Combustion Engines and Air Pollution, Intext Educational Publ., 1980.

HP807 Applied Computational Methods in Heat Transfer & Fluid Mechanics (3-0-0) 3

Modeling, Computers, and Error Analysis: Mathematical modeling of simple problems, Algorithm Design and software development process, Approximations and errors. Roots of Equations: Bracketing and open methods as applied to thermal engineering problems. Solution of linear and non-linear algebraic equations, Statistical description of thermal data, Modeling of data, Boundary value and initial value problems of heat transfer (conduction, convection and radiation) and fluid mechanics, Numerical solution of partial differential equations of heat transfer and fluid mechanics. Eigen value problems.

William H Press, Saul A Teukolsky, William T Vellerling and Brain P Flannery, "Numerical Recipes in C", 2 ed., Cambridge university press.
E.V. Krishnamurthy and S. K. Sen, "Numerical Algorithms", 2 ed., Affiliated east-west press.

HP808 Bio-preservation (3-0-0) 3

Food Preservation – Refrigeration systems used in cold and frozen food storage. Factors affecting quality of food and estimation of thermal properties of food materials. Freezing and thawing of foods. Evaluation of heat transfer coefficients in freezers. Study of quick freezing systems. Dehydration of foods. Tunnel drying of food materials. Tray and component driers. Freeze drying. Calculation of freeze drying time. Household freezing and storage equipments. Packing materials for frozen foods and refrigerated transport of frozen foods.

Arora C. P., " Refrigeration and Air Conditioning", Tata McGraw Hill
Manohar Prasad, "Refrigeration and Air conditioning", Wiley Eastern Limited, New Delhi.
Refrigeration/Thermodynamics/Heat transfer/Air conditioning data hand book.

HP809 Nuclear Engineering (3-0-0) 3

Scope of Nuclear Power- Review of Nuclear Physics- Reactor Theory. Elements of Reaction Physics. Thermodynamics Aspects of Nuclear Power, Fusion Process System. Thermal Reaction Type: PWR, CANDU, HTGCR.

Fast Breeder: Fluid Fuelled, Organic Cooled Reactor, and Economics. Steady and Unsteady State-Calculation of Critical Size of Homogeneous And Heterogeneous Reactors. Elementary Idea of Reactor Instrumentation and Control. Reactor Materials, Shielding, Thermal Aspects of Nuclear Systems.

Richard Stephenson, Introduction to Nuclear Engineering, McGraw Hill.
Charles F. Bonilla, Nuclear Engineering, McGraw Hill.
K.S. Ram, Basic Nuclear Engineering, Wisely Eastern.

HP810 Measurement in Thermal Systems (3-0-0) 3

Error Analysis in Experimental Investigations-Curve Fitting of Experimental Data. Methods of Measuring Temperature-Thermocouple, Error Estimation. Convective and Radiation Affects. Measurement of Unsteady Temperature-Optical Methods Shadowgraph, Schilieren and Interferometer, Spectroscopic Temperature Determination. Measurement of Pressure, Vacuum, Level etc. Heat Flux Sponsors, Transient Experimental Techniques for Surface Flux Rates. Measurement- Thermal Radiation, Volume Flow Rate, Velocity- Hot Wire and Hot Film Anemometer, Acoustic Methods. Measurement of Turbulence, Pollutants-Gas Chromatography.

E.G.R. Eckert and R.G. Goldstein, Measurement Techniques in Heat Transfer.
E.O. Doebelin, Measurement Systems: Application and Design.
T.P. Holeman, Experimental Methods for Engineers.
H.D. Young, Statistical Treatment of Experimental Data.

HP811 Turbomachines (3-0-0) 3

Dimensional analysis and principle of similitude, Energy transfer between fluid and rotor, Potential flow through cascades of blades. 3- dimensional viscous and compressibility effects. Principles of design and performance of different types of turbomachines. Equilibrium running diagrams, Principles of Mechanical design of different components of turbomachines and its auxiliary equipment, Regulation of turbomachines.

D.G. Shephard, Principles of Turbomachinery, McMillan Co., New York.
S.M. Yahya, Turbomachines, IIT, New Delhi.
H. Cohen and Rogers, Gas Turbines Theory, Longman Green Co., Ltd

HP812 Steam and Gas Turbines (3-0-0) 3

Steam turbines: power plant cycles, Cycle analysis and design , losses in steam turbine, Design of a stage, Design of multistage axial flow turbines, Vortex flow and lower pressure stage design , Performance at varying loads governing , Calculation of design point efficiency using cascade data. Gas Turbines - Performances of practical gas turbine cycles, Design point performance of simple and series flow cycles, factors affecting performance.

W.J. Kearton, Steam Turbine Theory and Practice.
Lee, Theory and design of Steam and Gas Turbine, Mc Graw Hill.
Cohen and Roger, Gas Turbine Theory; Longmans London.
Jennings and Rogers, Gas turbine analysis and Practice, Mc Graw Hill.

HP813 Applications of Microprocessors and Computers in Thermal Engineering (3-0-0) 3

Recapitulation of fundamentals - Numbering system, Boolean algebra, Binary arithmetic, Character representation, Logic gates, Flip flops - Types, Registers. BCD to seven segment display, LED and LCD, D/A and A/D converter principles. 8085 Microprocessor Architecture and Instruction sets. Microprocessor 8085 Assembly language programming, Data acquisition using C language. Use of C language to experimental data analysis. Demonstration of interface of microprocessor with stepper motor. Demonstration of data accusation using the C language directly to store on hard disk and display on the computer.

A.P. Mathur, Introduction to Microprocessor, Tata McGraw Hill, 1989.
Malvino and Leech, Introduction to Digital Electronics, TMH, New Delhi.

Laventhal, Introduction to Microprocessor Software, Hardware and Programming, PHI

HP814 Design of Heat Transfer Equipments (3-0-0) 3

Review of fundamental of heat transfer: Conduction, Convection, Radiation and Extended surfaces. Design of double pipe exchangers, Shell and tube heat exchangers, Design of condensers, evaporators, boilers, cooling towers, selection of materials, Inspection and testing procedure.

Donald Q. Kern, Process Heat transfer, Mc Graw Hill.
Heat Exchanger handbook, Heat exchanger theory, Hemisphere Publishing Corporation.

HP815 Heat Transfer in Two-phase Flow (3-0-0) 3

Pool boiling and condensation - boiling curve. Introduction to two-phase flow -Definition, Methods of analysis, Flow patterns. Flow models – Homogeneous, separated, Drift flux models. Flow through bends and restrictions, chocking in two-phase flow.

Flow boiling and condensation: Introduction to convective boiling and condensation, flow pattern predictions, heat transfer and pressure drop in different flow patterns.

Empirical correlations in two phase flow, Critical heat flux and interfacial phenomenon. Multi – component boiling and condensation – pool boiling.

G.B. Wallis, One Dimensional Two-phase Flow.
J.C. Collier, Convective Boiling and Condensation.
L. Stong, Boiling Heat Transfer and Two-phase Flow.

HP816 Advanced Fluid Mechanics (3-0-0) 3

Recapitulation of fundamentals: Basic concepts. Navier Stokes equations, Potential flow theory and transformation flow around bodies, cylinders and aerofoils. Transformation of circle into aerofoil. Prediction of velocity and pressure distribution, boundary layer problems, laminar and turbulent boundary layers, separation criterion. Introduction to compressible flow, velocity of sound and mach number, Isentropic flow, flow with friction and heat transfer. Analysis of flows with normal and oblique shock waves. Supersonic flows. Unsteady flows.

Yuan, S. W., "Fundamentals of Fluid Mechanics", Printice Hall, India (S.I. Unit Edition).
S. M. Yahya, " Compressible Fluid Flow", IIT, New Delhi.
A. H. Shapiro, "The Dynamics and Thermodynamics of Compressible flow", Ronald Press.
Nijaguna, Thermal Science/Engineering data Hand Book", KREC.

HP817 Theory and Design of I.C. Engines (3-0-0) 3

Combustion phenomenon in SI engine, Combustion knock, Combustion chamber designs for the SI engine. Combustion phenomenon in the CI engine, Combustion chamber design for the CI engine. Delay period and diesel knock. Modern developments in stratified charge, bio-fuel, multifuel, multispark, electronic ignition engines. Petrol injection and rotary combustion engines. IC engine design principles, Design of engine components. Design of cooling system, lubricating oil system and radiator fans.

L.C.Litchy, Internal combustion engines.
P.M.Heldt, High speed Combustion engines.
E.F Obert, Internal combustion engines
Mathur and Sharma, A course in IC engines.

HP818 Cryogenics (3-0-0) 3

Liquefication of permanent gases, Methods of air liquefication, separation, storage and transport, applications. Thermo-electric refrigeration. Peltier refrigeration. Properties of solids and liquids at cryogenic temperatures. Cryogenic Insulation. Vacuum technology cryopumping. Cryogenic heat pipes. Applications of cryogenic engineering in various fields, Food preservation process. Cryogenic Instruments.

R.B. Scott, "Cryogenics Engineering", Van Nostrand.
R.F. Barron, "Cryogenic Systems, McGraw Hill, New York.
Arora C. P., " Refrigeration and Air Conditioning", Tata McGraw Hill
Refrigeration/Thermodynamics/Heat transfer/Air conditioning data hand book.

HP819 Advanced Air Conditioning Technology (3-0-0) 3

Psychrometry. Air-conditioning calculations. Comfort scales. Solar radiation. Estimation of solar radiation from the solar angles. Cooling load and heating load calculations. Solar space heating and cooling. Passive cooling systems. Dehumidification and humidification equipment. Design of cooling towers, spray washers, air washers, cooling and dehumidifying coils. Design of air duct system. Room air distribution. Various types of air conditioning systems. Various types of system controls. Mass transfer by molecular diffusion and convection. Calculation of mass transfer coefficients. Interface mass transfer. Application of air conditioning.

Arora C. P., " Refrigeration and Air Conditioning", Tata McGraw
Manohar Prasad, " Refrigeration and Air conditioning", Wiley Eastern Limited, New Delhi.
Heat transfer/Refrigeration/Thermodynamics/Air conditioning data hand book.

HP820 Selected Topics in Heat Power Engineering (3-0-0) 3

MF700 Advanced Metal Removal Processes (3-1-0) 4
Orthogonal and Oblique cutting, Machining parameters, Tool materials and Tool geometry, Mechanics, Tool wear and Tool life, Machinability, Economics of Machining, Surface Integrity, Measurement techniques, Modern Machining processes, USM, EDM, ECM, Mechanics and metal removal rates.
G Boothryod, Fundamentals of Metal cutting and Machining.
B L Juneja and Shekon G S, Fundamentals of Metal cutting and Machine Tools.
Venkateshan, Experimental Techniques.

MF701 Computer Integrated Manufacturing (CIM) (3-1-0) 4
Building blocks of automation, Mechanization of parts handling, Automation of assembly, Application development, Automated Manufacturing systems, Performance measures, Markov and Queuing models & Petrinet models. Various manufacturing systems – batch, mass, group, cellular and flexible manufacturing systems; Robotic welding and flexible welding system; Process planning and CAPP. Shop floor control and Automatic identification and assembly techniques, computer network for manufacturing, Integration of design and manufacturing. Design assignment and practice based on process planning and CAPP; Experiments on sensory integration and image processing. Experiments on scheduling manufacturing systems, process optimization, CIM implementation case studies.
Mkell P. Groover, " Automation, Production Systems, and Computer Integrated Manufacturing, Prentice-Hall..
Jerome H Fuchs, "The Illustrated handbook of Advanced Manufacturing methods", Prentice Hall.
P. Radhakrishna & S. subramanyan "CAD/CAM/CIM".

MF702 Product Design and Rapid Prototyping (3-1-0) 4
Generic process of Product Development, Concept generation, selection and Testing – CAD applications in Testing, CAD Hardware and software, Virtual Prototyping, Product Architecture, Industrial Design and Design for manufacturing, Design considerations, Economic and Human Factors in Engg. Design for production- Metal and Plastic components, Optimum Design, Rapid Prototyping Technologies – Processes and Comparison, Detail of Process constituents.
Karl T. Ulrich and Steven D. Eppinger, Product Design and Development, McGraw-Hill, 2000.
A. K. Chitale and R. C. Gupta, Product Design and Manufacturing, PHI Pvt. Ltd., 2002
Chris McMahon and Jimmie Browne, CAD/CAM, Pearson Education Asia Pvt. Ltd., 2002

MF703 Advanced Control Engineering (3-1-0) 4
Introduction, Transfer function, Time response, modes of control, Routh criteria, Nyquist stability analysis, Bode diagram, Root locus method, system compensation, analog and digital computers, modern control theory.
Harrison H L and Bollinger J G, "Automatic controls" International Text Book Co.
Murphy, "Basic Automatic control " Van Nostrand
Reven, "Automatic control systems" McGraw Hill.

MF704 Manufacturing Systems Lab (0-0-4) 2

MF705 Tool Design (3-1-0) 4
Sheet materials and properties. Presses – classification. Plastic moulds, Jigs and Fixtures Cutting tools.Die casting and forging dies – pressure die casting, die lubricants, die design, die casting allowances, steps in die design.Tool design for numerically controlled machine tools.
F.M. Wilson, Handbook of Fixtures Design.
F.M. Wilson, Die Design Handbook.
DonaldSon Leeain and Goold, Tool Design.

MF801 Advanced Metal Casting Technology (3-0-0) 3
Introduction, Carbon Dioxide and Shell Moulding, Die Casting, Squeeze casting, Design principles and methodologies, Gating and Risering, Modern Melting and Metal transfer practices, Computers and softwares in Foundries, Foundry Mechanization.
R W Hiene and P C Rosenthal, Principles of Metal Casting, TMH Publication
A J Clegg, Precession Casting Processes, Pergoman Press
P L Jain, Foundry Technology.

MF802 Composite Materials (3-0-0) 3

Definition and characteristics of composite materials, overview of advantages and limitations of composite materials, Significance and objectives, Types and classification of typical composite materials.

Processing of Polymer Matrix, Metal Matrix and Ceramic Matrix Composite Materials, Testing of Composite Materials, Cutting, Machining and Joining of Composite Materials, Design of Composite Materials, Applications and Developments, Quality Assurance, Tribology of Composite Materials.

M.M.Schwartz, Composite Materials Handbook, McGraw Hill Inc., New York, 1992.
F.L. Matthews and R.D. Rawlings. Composite Materials- Engineering and Science, CRC Woodhead Publi., 1994.
Krishan K. Chawla, Composite Materials- Science and Engineering, Springer, New York, 1998.

MF803 Metal Forming Technology (3-0-0) 3

Introduction and classification, primary and secondary forming processes, Hot and Cold working, Friction and Lubrication in Metal Forming.

Forming processes – selection and testing of stock materials, basic Forging operations. Technology of hammer forging, press forging and upsetting operations. Inspection and tolerance in forging. Extrusion – parameters in hot and cold extrusion, metal flow, affect of friction – selection of press for extrusion. Wire Drawing – Principles and parameters and operations. Sheet metal working – Shearing processes, techniques and tool design aspects for blanking, drawing etc. Die design principles. Near net shape manufacturing.

P. Pollukhin et.al., Rolling Mill Practice.
C. Peareson and R. Parkinson, Extrusion of metals.
J.A. Waller, Press Tools and Press Works.

MF804 Advanced Welding Technology (3-0-0) 3

Classification and characteristics of Welding. Equipment details and working of Gas Metal Arc Welding (TIG & MIG). Carbon Arc Welding. Ultrasonic welding. Plasma Welding. Under Water Welding. Physics and Metallurgy of Welding. Welding of Jigs and Fixtures, Inspection and testing of welds. Welding defects, residual stresses, welding distortion.

O P Khanna, Welding Technology, Dhanpat Rai.
Parmer, Welding processes and Technology.
LITTLE, Welding Technology.

MF805 Industrial Drives (3-0-0) 3

Industrial Prime movers, System comparison, Definition of Terms, Electrical, Hydraulic and Pneumatic Drives, Motors and Generators – control aspects including stepper and servo control, Hydraulic and Pneumatic Basics, Hydraulic pumps, valves and actuators – Symbols for components, laying symbolic circuit for control – practical control problems, Displacement-step diagrams for Multi sensor and actuator controls, Pneumatic components and their symbols – Exercise problems, Safety and Maintenance aspects in Industrial Drives.

Andrew Parr, Industrial Drives, Butterworth-Heineamann, 2000
S. R. Majumdar, Oil Hydraulic Systems: Principles and Maintenance, Butterworth-Heinemann 1998
Andrew Parr, Hydraulics and Pneumatics, Butterworth-Heineamann, 1998

MF 806 Microelectromechanical Systems (MEMS) (3-0-0) 3

MEMS – overview and working, Sensors, Transducers and Actuators Design and manufacturing of electromechanical systems, Application of MEMS in automotive and Medical Electronics, Basics of MEMs Engineering, Scaling Laws, Materials for MEMS, Microsystem manufacturing – Photolithography, Bulk, surface and LIGA processes, Comparison of Processes, Wet and Dry Etching, Stiction, Method to Reduce Stiction, Microsystem Design, CAD applications in MEMS Design

Tai Ran Hsu, MEMS and Microsystems – Design and Manufacture, Tata McGraw-Hill, 2002
Marc J. Madou, Fundamentals of Microfabrication, The science of miniaturization, IEEE press
Stephen D Centuria, Microsystem Design, Kluwer Academic Pub, 2003

MF807 Machine Tool Dynamics (3-0-0) 3

Mechanical vibration theory – a review, Single degree, free, damped and forced vibration, multi degree freedom systems – specific example related to machine tool, dynamic modeling of machine tools. Theory of vibration measuring instruments. Machine tool chatter- dynamics cutting process, cause of chatter, general theory of machine tool chatter. Effect of flexible mounting on chatter, vibration absorber to avoid chatter.

W T Thomson, "Theory of Vibration with application", Prentice Hall
S A Tobias, "Machine tool vibration", Blachie &Sons Ltd
J D Smith, "Machine Tool Dynamics: An Introduction", University Press.

MF808 Database Management Systems (3-0-0) 3

Introduction; E-R Models; Relational Models; Relational Algebra & Calculus; SQL Queries, programming and triggers; Data Storage; File Handling; Security; Parallel & distributed data; Internet database; Data Mining; Object Database systems; Real Time Database systems; Case studies in Mechanical Engineering.

R. Ramakrishnan & Johannes G, Database Management System, McGraw Hill Publishers.
J.O. Ullman, Principles of Database systems, Galgotia Publishers
Stamper & Price, Database Design and Management-An Applied Approach, McGraw Hill .

MF809 Artificial Intelligence in Manufacturing (3-0-0) 3

Computational Techniques for representing and solving problems; Perceptions; Representation, production system & search; Heuristics; Fuzzy Logic and control, Artificial Neural Networks techniques; Back propagation Algorithm, Adaptive Resonance Theory, Case studies in manufacturing.

George F. Luger, Artificial Intelligence, Pearson Pub.
VVS Sharma, B.Yajnanarayan and Deekshitalu, Artificial Intelligence & Expert System Technologies, Tata McGraw Hill.
Bart Kosko, Neural Networks and Fuzzy Systems.

MF810 Concurrent Engineering (3-0-0) 3

Definition & philosophy of concurrent engineering; Teamwork; Interfacing of manufacturing and design – Design for Manufacturability; Project Management; Life cycle based on concurrent engineering; Design for Assembly; Prototype tooling; Virtual Manufacturing; Activity based costing; Networking Technologies; Video Conferencing.

Syan, Channan S and Unny Menon, Concurrent Engineering: Concepts, Implementation & Practice, Chapman and Hall, New York.
Ulrich, Karl T and Steven D Epipinger, Product Design & Development, McGraw Hill.
Ettlie, John E and Henry W Stoll, Managing the Design-Manufacturing Process, McGraw Hill

MF811 Optimization Methods (3-0-0) 3

Preliminary concepts, Unconstrained Minimization, LPP, Constrained Minimization, Duality-based Methods, Direct Search and dynamic Programming, Pareto Optimality, Finite Element based Optimization, New approaches to optimization like ANN, GI and Simulated Annealing, Optimization in fuzzy control

A. D. Belegundu and T. R. Chandrupatla, Optimization concepts and Applications in Engg.
C. Onwubiko, Introduction to Engineering Design Optimization, Prentice Hall, 2000
G. V. Reklatis, A. Ravindran, and K. M. Ragsdell, Engineering optimization: Methods and applications, Interscience 1983.

MF812 Robotics (3-0-0) 3

Introduction, Classification, specifications, work volume, control resolution, end effectors, Drives and transmission, Robot sensors, Robot layout, Robot kinematics and dynamics, Material handling systems.

Groover M P and et.al., "Industrial Robotic Technology- Programming and Application", McGraw Hill
Koren Y, " Robotics for Engineers", McGraw Hill
Ranky P G and Ho C Y, "Robots modeling control and applications with software", Springer Verlag, Berlin.

MF 813 Mechanical and Non-destructive Testing of Engineering Materials (3-0-0) 3

Introduction. Need, Tensile test, Fatigue test, creep test, hardness test, impact test, Basic elements of NDT, Magnetic particle test, liquid Particle test, ultrasonic test, Radiography, Acoustic Emission Test, Eddy current test, Leak test, New methods, reliability, case studies.

Geerge Dicter, Mechanical Metallurgy
Warren J. McGomnagle, Non Destructive Testing
ASME Metals Hand Book.
TMEH Hand Book.

MF814 Selected Topics in Advanced Manufacturing Engineering (3-0-0) 3

ME 800 Finite Element Methods (3-0-0) 3

Variational formulation, Ritz method, one-dimensional FEM, Finite element modeling of Beams, trusses, and frames. Two Dimensional formulation, Plane Stress/ Strain for triangular and rectangular model. Solution techniques, Pascal triangle. Alternative formulation.

J. N. Reddy, "An Introduction to Finite Element Method", McGraw Hill, 1984
Zienkiewicz O. C., "Finite Element Method in Engineering Sciences", McGraw , 1977
Bathe K J and Wilson E L, "Numerical Methods in Finite Element Analysis", PHI Publ., 1977.

ME 900 Satellite Thermal Control 4

Introduction: Satellite Temperature and Thermal Energy Management. Relation Between Heating and Temperature: Method of Control. Thermal Interface Requirements. Heat Transfer: Conduction, Convection, Radiation. Radiation in Thermal Control, Heating Fluxes, Orbit Environment Heating Fluxes, Satellite Thermal Analysis, Thermal Energy Equation, Thermal Model, Approximate Analytical Solution, Thermal Control Hardware, Heat Pipes, Thermal Verification Tests

Robert D. Karam, Satellite Thermal Control for System Engineers.

ME 901 Estimation of Thermodynamic and Thermophysical Properties of Working Fluids 4

Development of thermodynamic and thermophysical properties of various working fluids used in power plants, refrigeration plants(pure and mixtures)

ME 902 Computer Simulation of IC Engines 4

Introduction S.I. Engines and C.I. engines, reactive processes, adiabatic flame temperature, isentropic changes of state, simulation: with air as working medium, with adiabatic combustion, with progressive combustion, with gas exchange processes.

V. Ganesan, computer simulation of S.I. Engines processes, Universities press
V. Ganesan, computer simulation of C.I. Engines processes, Universities press
Ramos J.I, internal combustion engine modelling, Hemisphere publishing Corp.

ME 903 Tribology in Machine Design 4

Introduction to Tribology, Basic Principles of Tribology, Elements of Contact Mechanics, Friction, Lubrication and Wear in Kinematics pairs, Sliding element and Rolling contact Bearings, Lubrication and efficiency of Involute Gears.

T.A. Stolarshi, Tribology in Machine Design, Industrial Press Inc. 1990.
Arnell R.D., Davies P.B., Halling J., Whomes T.L., Tribology – Principles and Design Applications, Springer Verlag.
Karl-Heinz Zum Gahr, Microstructure and Wear of Materials, Elsevier, 1987.

ME 904 Failure in Materials in Mechanical Design 4

Modes of Mechanical Failures, High cycle & low cycle fatigue, Use of statistics in fatigue analysis and testing. Concepts of cumulative damage, Life Prediction and Fracture Control, Tribological Failures – Frelting, Frelting Fatigue and Frelting Wear, Buckling and Instability, creep, stress rupture, corrosion.

J.A. Collins, Failure of Materials in Mechanical Design – Analysis, Prediction, Prevention, John Wiley 1981.

ME 905 Materials in Tribological Applications 4

Tribological properties of solid materials, metals, bearing, alloys, solid lubricants, polymers and composites, ceramics and cermets, super alloys. Materials for Nuclear Reactors. Friction Materials for Clutches and Brakes. Surface treatments to reduce wear.

William A. Glaeser, Materials for Tribology, Elsevier, 1992.

DEPARTMENT OF METALLURGICAL & MATERIALS ENGINEERING

ML700 Advanced Physical Metallurgy (3-1-0) 4
Thermodynamics, phase diagrams, classification of transformation, diffusion, high diffusivity path, applications; nucleation and growth kinetics, TTT diagram, precipitation hardening, spinodal decomposition, strengthening mechanisms, dispersion strengthening, eutectoidal transformation, order – disorder transformation, recovery and recrystallisation.
D. A. Porter and K. E. Esterling, Phase transformation in metal and alloys, Chapman Hall, 1992.
V. Raghavan, Solid state phase transformation, PHI Pvt. Ltd., New Delhi, 1987.

ML701 Materials Characterisation (3-1-0) 4
Quantitative metallography stereological aspects, electron microscopy and diffraction, basis of electron microscopy, TEM: Theories of contrast in crystal, electron diffraction, lattice defects, precipitates, second phases, specialized techniques, specimen preparations, SEM: Modes of working, x-ray, anger, induced conductivity, high resolution scanning transmission microscopy, field ion and field emission microscope; analyses of materials using x-ray diffracion techniques, x-ray diffraction profiles, texture studies, stress analysis.
P. G. Grundy and G. A. Jones, Electron Microscopy in Study of Materials, Edward Ernold, 1976.
B. D. Cullity, Elements of x-ray diffraction, Addison – Wesley Publications.
Gareth Thomas "Transmission Electron Microscopy of Metals"

ML702 Plastics Engineering (3-0-0) 3
General properties of plastics, polymeric materials, plastics available to the designer, selection of plastics, mechanical properties of plastics, testing of plastics, design of plastics, mathematical deformation behaviour of reinforcement plastics, fracture creep, fatigue, impact behaviour of plastics, processing of plastics: reinforced thermoplastics, reinforced thermosets, behaviour of polymer melts, elastic behaviour, residence and relaxation times, power used to extrude a polymer melt, experimental methods used to obtain flow, analysis of flow during processing.
R. J. Crawford, "Plastic Engineering", 2nd edn. Pergamon Press, 1987, Reprinted in 1989.
William J. Patton, "Plastic Technology", D. B. Taraporevala Sons and Co. 1981.
Peter C. Powell, "Engineering with Polymers", Chapman & Hall, 1983.

ML703 Mechanical Behaviour and Design of Materials (3-1-0) 4
Atomic and molecular bonds, Types of materials, properties, dislocation and plastic deformation, slip, twin, CRSS, slip systems, strain hardening, recrystallization, tensile behaviour and testing, temperature & strain rate effects, compression behaviour and testing, hardness testing, torsion testing, impact testing & transition temperature, failure under combined stresses (triaxial) – design against failure, fracture behaviour and testing: Behaviour of materials design against fatigue failures, creep behaviour and testing: design against creep failures, design aspects, failure analysis: a few case studies.
G. I. Dieter, Mechanical Metallurgy, Sl edition, McGraw Hill, 1988.
J. A. Collins, Failure of Materials in Mechanical Design, Wiley Interscience Publi. 1981.
Metals Handbook, Vol.11, 9th edition, ASM, 1986.

ML704 Materials Engineering Lab (0-0-4) 2
Experiments in quantitative metallography, X-ray diffraction, diffusion, phase transformations and properties of materials.

ML705 Ceramics Engineering (3-1-0) 4
Introduction, Bonding in ceramics, Pauling's rules, structure of glasses, zachariasen rules, silicate structures, microstructure of ceramics, Defects in ceramics: thermodynamics approach; structure, formation and properties of glasses, processing of ceramics: general route – traditional ceramics, advanced ceramics, sol-gel synthesis, slip casting, roll forming process, powder metallurgy technique, properties of ceramics: mechanical – thermal – magnetic – ferroelectric optical - ceramic fibres.
Michel W. Barsoum, "Fundamental of Ceramics", International Edition, 1997.
W. D. Kingery, "Introduction to Ceramics", 2nd Edition, 1991, John Wiley & Sons.
James S. Reed, Principles of Ceramic Processing, Wiley Inter Science, 1994.

ML800 Steels and Their Heat Treatment (3-0-0) 3
Iron and its solid solutions, iron – carbon equilibrium diagram, plain carbon steel, influence of alloying elements in Fe-C alloys, low alloy steels, heat treatment of steel, formation of martensite, bainite reaction,

concept of hardenability, tempering of martensite, thermomechanical treatment, surface hardening, stainless steels, tool steels, embrittlement and fracture of steels, cast irons, characteristics, applications.

R.W. K. Honeycombe, Steels – Microstructure and Properties, Edwards Arnold.
W. C. Leslie, The Physical Metallurgy of Steels, McGraw Hill Book Company, New York
F. B. Pickering, Physical Metallurgy and the Design of Steels, Applied Science Publishers (1978).

ML801 Composite Materials (3-0-0) 3

Introduction, their characteristic features, interfaces, wettability, bonding, important reinforcements fibers, whiskers, short fibers and particles production properties & applications polymer matrix composites. Metal matrix composites, ceramic matrix composites, carbon /carbon composites, intermetallic matrix composites, mechanics of tensile loading and compressive loading, fracture, laminate composites, short fiber composites, toughness of composites – thermal, fatigue and environmental effects, joining of composites, designing with composite materials.

K. K. Chawla, Composite materials, Springer – Verlag Press, 2001.
Mathews F. L. and Fawlings R. D., Composite Materials: Chapman Press, 1996.
Bryan Harris, Composite Materials, Institute of Materials, London 1996.

ML802 Electronic Properties of Materials (3-0-0) 3

Introduction: Brilluion Zone Theory: Fermi level, Band theory.
Thermal Properties: specific heat, thermal expansion & thermal conductivity.
Electrical Properties: conductors, insulators, intrinsic semiconductors, extrinsic semiconductors, single crystal growth, zone refining, production of PNP, NPN transistors, Intergrated circuits. dielectrics – materials and applications, electrostriction, magnetostriction, ultrasonic transducers – piezoelectric materials and applications, ferroelectric materials and applications
Magnetic Properties: soft magnetic materials, hard magnetic materials, ferrites, garnets, ESD magnets, magnetic tapes, films, ferromagnetic materials, antiferromagnetic materials, materials for computer memories. Neutron diffraction; superconductivity, Type I, Type II superconductors, hard and soft superconductors, Meissener effect, high temperature superconductors, Applications of superconductors, photoconducting applications, Optical Properties - Lasers, gas laser, He-Ne laser, N_2, CO_2, Ar, H_2-Cd lasers, liquid lasers, dye lasers solids laser, Ruby, Nd – YAG glass lasers, Semiconductor diode laser, applications of laser, Optical storage, optical computing, optical fibres.

R. E. Hummel, "Electronic Properties of Materials", Narosa 1995
J. Wulff, "Electronic Properties, Wiley 1964.
C. M. Srivastava & C. Srinivasan, "Science of Engineering Materials", 1999, NewAge International Pvt. Ltd., India.

ML803 No-destructive Testing (3-0-0) 3

Ultrasonic inspection: Ultrasonic waves, variables, attenuation, inspection methods, pulse echo, transmission methods, inspection standards, standard reference blocks. Practical applications; radiography inspection: priniciples, radiation sources, image quality, radiographic sensitivity, geometric unsharpness, modern image intensifiers, X-ray films, exposure, penetrameters, inspection standards, neutron radiography, industrial computed tomography; other techniques: visual inspection, insitu metallography, liquid penetrant inspection, magnetic particle inspection, eddy current method, acoustic emission method

Barry Hull & Vernon John, Non-destructive Testing, ELBS edn., Macmillan,1989.
R. Halmshaw, Non-destructive Testing, 2nd edn., Edward Arnold, London, 991.
McGonnagle W. J., Non-destructive testing, Gordon & Beach Science, New York, 1983.

ML804 High Temperature Materials (3-0-0) 3

Materials composites and structure, Fe based super alloys, Ni base super alloys, Co base super alloys, titanium and its alloys, refractory metals and alloys, high temperature ceramic materials cermets, cemeted carbides, creep resistance, fatigue resistance, corrosion resistnce, oxidation resistance, formability, weldability, fluidity; application of superalloys, titanium alloys, refractory metals and alloys, cermets, cemented carbides ceramics.

Donachiect, A technical guide on Super Alloys, A.S.M. Ohio, 2002.
C.T.Sims & N. C. Hagel, super Alloys, Johnwiley Publishers, 1972
Betteridge, The Nimonic Alloys – Edward Arnold Publishers Ltd., London.

ML805 Fracture Mechanics (3-0-0) 3

Failure analysis, conventional design concepts & its limitations, mechanics of fracture – fracture toughness, determination of fracture toughness – ASTM standards, Brittle and ductile fractures, cleavage fracture, cleavage cracks, crystallographic mechanism, designing and testing for fracture resistance, design, improved toughness in ceramics, composites, case studies in failure analysis.

D. Broek Elementary Engineering Fracture Mechanics,3rd Edition, Marines Nijhoff, Dordredet (1986).
J. F. Knott, Fundamentals of Fracture Mechanics, Butterworths (1973), London

S,. Teteleman and A. J. Mccvily, Facture of Structural Materials, John Wiley and Sons, (1967)

ML806 Surface Engineering (3-0-0) 3

Wear modes, diffusion processes: carburising, nitriding, carbonitriding, special diffusion processes, surface hardening by flame and induction, thin film coatings: thermal evaporation, ion planting and applications, high energy surface modification, electron beam hardening, laser hardening, ion implantation, special surfacing processes; hard facing process: welding processes, thermal spray processes, hard facing consumables, hard facing metallurgy, selecting a wear resistance surface: methodology, identifying a wear mode, diffusion treatments, selective hardening, thin film coatings, high energy surface modifications and hard facing, specification for plating, diffusion treatments and other processes of surface modifications.

K. G. Budinski, "Surface Engineering for wear resistance", Prentice Hall, 1988.
P. K. Datta and J. S. Grey, "Surface Engineering", Vol. I, II & III, Royal Society of Chemistry, 1993.

ML807 Selected topics in Materials Engineering (3-0-0) 3

PM700 Advances in Ferrous Extractive Metallurgy I (3-1-0) 4

Modern developments in the blast furnace, performance, Physico-chemical study of the reduction of iron ores and oxides, Study of blast furnace processes and of blast furnace slags, Heat exchange zones in blast furnace, Recent trends in the operation of blast furnaces, HyL, Midrex, fluidized bed, rotary kiln, election furnace and Corex process, production of ferroalloys.

A. K. Biswas, "Principle of Blast Furnace iron makings", 1981, Cootha, Australia.
Strasburger, Brown, Stephenson & Dancy, "B.F. Theory and Practice, Vol. I & II", 1969, Gordon & Beach, New York.
K.V. Sastry, Agglomeration, Vol. I & II, Proceedings of 2nd International Symposium on agglomeration, Atlanta, March, 6-10, 1977, A.I.M.M. and P.E., New York.
Robert L. Stephenson, "Direct reduce iron – Technology and Economics of production and use", 1980, Iron & Steel Society of AMIE.
C.K.Gupta and A.K.Suri, "Ferroalloys Technology in India", C.K.!982, Milind Pub.

PM701 Advanced Metallurgical Thermodynamics (3-1-0) 4

Review of heat capacity, enthalpy, entropy and free energy concept, fugacity, activity, activity coefficient and the equilibrium constant, solutions – Raoult's law and Henry law, properties of Raoultian ideal solution, non-ideal solution, binary Gibbs-Duhem equation and its application to activity and activity coefficient determination, study of thermodynamic properties of metallurgical systems with special emphasis on liquid metals and slags, quasichemical theory, excess thermodynamics functions, regular and sub regular models of metallic solutions, interaction parameter and interaction coefficient, ternary Gibbs-Duhem integration, theory of ideal mixing of silicates, tubular representation of thermodynamic data and the free energy function.

R. T. Dehoff, Thermodynamics in Materials Science, McGrawHill, 1993
D. R.. Gaskell, "Introduction to Thermodynamics of Materials", McGraw Hill
R. A. Swalin, "Thermodynamics of solids", John Wiley.

PM702 Metallurgical Design (3-1-0) 4

Design and its significance, modern trends, fluid flow and heat transfer principle to design, furnaces – classifications – Glinkovs theory and others, Heat balances, burners – liquid and gaseous fuel burners, design features, principles of chemistry design, fuel economy – recuperator and regenerators, design features of electric arc furnaces, induction furnaces, Reheating furnaces and soaking pits, refractories for furnaces, design of vacuum systems, similarity criteria and models.

Geiger and Poirier, "Transport Phenomenon in Metallurgy", Addison Wesley.
Krivandin and Markov, "Metallurgical Furnaces", 1980 Mir Publishers.
N. Themelis, "Transport and Chemical Rate Phenomenon", Gorden Breach.

PM703 Experimental Techniques (3-0-0) 3

Experimental determination of phase diagrams including TTT and CCT diagrams, Heat Treatment of steels, TMT, TRIP steels, HSLA Steels, mechanical properties testing, methods for tensile, creep & fatigue properties, fracture toughness testing, x-ray methods – qualitative and quantitative chemical analysis by diffraction absorption and fluorescence, stress analysis, texture.

V. Raghavan, Physical Metallurgy, Principles and Practice, Prentice – Hall 1985.
G. E. Dieter, Mechanical Metallurgy, 1986, McGraw Hill, New York.
B. D. Gullity, Elements of X-ray Diffraction, Addison – Wesley, New York.

PM704 Process Metallurgy Lab (0-0-4) 2

Experiments in quantitative metallography, X-ray diffraction, diffusion, phase transformations and properties of materials.

PM705 Theory of Metallurgical Processes (3-1-0) 4

Review of various rate theories, Gibbs and Langmuir isotherms, diffusion in solids, liquids and gases, mass transfer: concept of mass transfer coefficients, mass transfer correlations, mass transfer models, interfacial phenomenon, interfacial turbulence, electrocapillary effects, enhanced vaporization; process analysis, staged operations, impinging jets and submerged jets, continuous flow systems, analysis of single particle reactions, correlation with packed beds and fluidized beds.

F. D. Richardson, "Physical Chemistry of Melts in Metallurgy", Vols.1 & 2, 1974, Academic Press, London.
J. Szekely & N. Themelis, "Rate Phenomenon in Process Metallurgy" Wiley International.
L. Coudrier et al, "Fundamentals of Metallurgical Processes", 1978, Pergamon

PM800 Advances in Ferrous Extractive Metallurgy II (3-0-0) 3

Review steel making processes, Thermodynamics and kinetics of oxidation and removal of impurities in steel making, modern developments, foam and emulsion, their importance, bottom blow oxygen processes, combined blowing, continuous steel making processes, energy optimizing furnace process, basic electric furnace, recent developments in stainless steel making, Secondary steel making processes – Nonmetallic inclusion in steel, electroslag refining, vacuum arc re-melting, continuous casting of steel, recent developments.

Turbin and Oiks, "Steel Making – Open hearth and combined process", 1977, Mir, Moscow.
R. H. Tupkary, "Modern Steel Making", 1982, Khanna Pub. New Delhi.
V. Origoryan L., Bedyanchikov and A. Stomakhin, "Theoretical Principles of Steels Making", 1965, ELBS, London.

PM801 Mechanical Processing of Steel (3-0-0) 3

Review of stress and relationship for elastic behaviour, elements of the theory of plasticity, effects of various factors on the plastic deformation of polycrystalline aggregates, fundamentals of metal working, effects of various factors on forming processes, mechanics of metal forming, work of plastic deformation, formability tests and evaluation, friction informing operations experimental techniques of forming analysis, detailed analysis of the various hot and cold working processes with special reference to steels based on the following points: Classification of processes, equipment, deformation forces and geometrical relationship variables, defects, residual stresses, theories of the forming process, power requirements lubrication problems, recent developments, heating for mechanical working, soaking pit practice, control methods and computer simulation.

G.E. Dieter, Mechanical Metallurgy, S. I. Metric McGraw Hill, 1988.
T. Altan, S. Oh. H. Gegel, Metal Forming – Fundamentals and Applications, ASM, Ohio, 1983.
Making, Shaping & Treating of Steel, 10th Edition, USS, 1985.

PM802 Advanced Foundry Technology (3-0-0) 3

Liquid solid and solidification; shrinkage nucleation and growth, segregation, mechanism of solidification of ferrous alloys, flow of metals in gates, heat transfer during solidification, melting furnaces and processes for the production of cast irons and steel castings, special problems in heat treatment to ferrous castings, sand practice for iron and steel casting production, modern trends, engineering design of castings, sources of fluctuation in properties, influence of form and environment.

J. Campbell, "Castings", Butterworth, 1991, London
Loper, Heine and Rosenthal, "Principles of Metal Casting", 1955, McGraw Hill, NY.
W. C. Winegard, Solidification of Metals Institute of Metals 1964.

PM803 Advanced Welding Technology (3-0-0) 3

Basis of welding, conventional welding processes, gas cutting, brazing and soldering, arc physics and metal tranfer, coated electrodes, slag/metal reactions, gases in the weldments, inclusions in weldments, compositional control of weldments, MIG, CO2, submerged welding processes, special welding processes, TIG, ESW, Plasma ultrasonic, laser, electron beam welding, solidification of weldments, thermal history of weldment, structure of weldment, stresses in weldment, weldability of metals and alloys, weld defects, fracture and failure of weldments, weld design, weld tests, NDT, quality control, welding, equipments, safety in welding codes.

Richard L. Little, "Welding Technology", Tata McGraw Hill.
J. F. Lamcaster, "Metallurgy of Welding"
Gianchino, Weeks & Johnson, "Welding Technology", American Technical Soc., Chicago.

PM804 Corrosion Engineering (3-0-0) 3

Introduction: Corrosion damage, economics of corrosion electrochemical mechanism, electrode potentials, galvanic cells; electrode kinetics: exchange current density, activation and concentration polarization, polarization diagrams, mixed potential theory – Passivity forms of corrosion: characteristics, mechanisms and preventive measures, kinetics factors, uniform attack, Poubaix diagrams and their applications oxidation of metals: Wangner's theory, corrosion testing: corrosion prevention: Design factors metallic and nonmetallic coatings, inhibitors and passivators, cathodic and anodic protection.

Uhlig H. H., "Corrosion and Corrosion Control", John Wiley, 1971.

M. G. Fontana, "Corrosion Engineering", McGraw Hill, 1986.
Denny A. Jones, Principles & Prevention of Corrosion, Maxwell Macmillan 1992

PM805 Strengthening of Steel (3-0-0) 3

The role of crystal imperfection on the mechanical properties; anealsticity; internal friction, plastic yielding, strain hardening, alloy hardening; solid solution, precipitation, fibre reinforcement, application of steels, transformation, strengthening of steels for low and high temperature applications.

D. Mclean, "Mechanical Properties of Metals", John Wiley, 1962.
G. E. Dieter, "Mechanical Metallurgy", McGraw Hill, 1988 SI Metric Edition.
F. B. Pickering "Physical Metallurgy and Design of Steels", Applied Science Publ. 1978.

PM806 Selected Topics in Process Metallurgy (3-0-0) 3

MT900 Metallurgical Process Design 3

Design and its significance. Modern trends, fluid flow and heat transfer principles applicable to design. Furnaces, classifications, Glinkove theory. Burners. Principles of chimney design. Fuel economy. Design features of electric arc furnaces, induction furnaces, reheating furnaces and soaking pits. Refractories for furnaces.

A. Glinkove, 'A general Theory of Furnaces', Min Publishers Moscow, 1980
G. E. Dielw, 'Engineering Design', 2nd Edition, McGraw Hill, 1990

MT901 Mass Transfer and Chemical Kinetics 3

Review of various rate theories, Gibbs and Langmiuir isotherms, diffusion in solids, liquids and gases. Mass Transfer: interfacial phenomenon-significance, interfacial turbulence, electrocapillary effects, enhanced vaporization electro, chemical theory of smelting and refining. Process analysis, impinging jets and submerged jets. Continuous flow systems. Analysis of single particle reactions - correlation with packed beds and fluidised beds.

N. J. Thumelis, 'Transport and Chemical Rate Phenomena', Gordon Breach, New York, 1995

MT902 Thermodynamics of Solids 3

First law of thermodynamics, second law of thermodynamics, some relations between thermodynamics quantities, thermodynamics of phase transformation and chemical reactions. Partial molar and excess quantities. Thermodynamic properties of alloy system – equilibrium between phases of variable composition. Free energy of binary system. Thermodynamics of surfaces and interfaces. Classification of defects in the crystal, defects in the metals, defects in elemental semiconductors, defects in nearly stoichiometric compound, defects in non – stoichiometric compound.

R. A. Swalin, 'Thermodynamics of solids', John Wiley.

MT903 Solidification of Metals 3

Heat flow in solidification, plane front solidification of single phase alloy, cellular solidification, plane front solidification of polyfront alloy, solidification of castings and ingots, solidification of polyphase alloy. Fluid flow, thermodynamics of solidification, nucleation and interface kinetics growth. Processing and properties: homogenization, mechanical properties of equiaxed cast structure, properties of columnar structure, aligned composites, effect of working.

M.C. Flemings, 'Solidification Processing', McGraw Hill, 1974
W. Kurz, D. J. Fischer, 'Fundamentals of Solidification', Trans Tech, 1984.

MT904 Materials Science and Engineering 3

Introduction, atomic structure and bonding, crystal structure and crystal geometry, solidification, crystal imperfections and diffusion in solids, electrical properties of materials, mechanical properties of metals, polymeric materials, phase diagrams, engineering alloys, ceramic materials, silicate structure, processing of ceramics, electrical, mechanical, thermal properties of ceramics. Magnetic materials, corrosion, composite materials, optical properties, superconducting materials.

E. Reed Hill, 'Introduction to Physical Metallurgy' Van Nostrand, East west Press, New Delhi, 1973.

MT905 Plastics Deformation 3

Interatomic forces, metallic crystals and their elastic properties, elementary theory of structural imperfections in crystals, plastic deformation of single crystals, plastic deformation of polycrystals. Deformation textures, characteristics and driving forces of softening process in deformed crystals. Fracture, resistance of metal to plastic deformation, ductility and deformability of metals and alloys, thermo-mechanical treatment, superplasticity and its applications.

G. E. Dieter, Mechanical Metallurgy, McGraw Hill, 1988.

MT906 Structure and Properties of Alloys 3

Structure of pure metal, properties of pure metal, solidification solid solution, working and annealing, two phase alloy Aluminum alloys and age hardening, magnesium and berrylium, theory of heat treatment of steels, steels for structural applications, carbon and alloy tool steels, stainless steels, cast iron, reactive and refractory metals for high temperature applications, failure of materials, non-destructive testing.

MT907 Alloy Design 3

Introduction, structure property correlation, electron basis of structure, composition control, phase diagrams, second phase particles, grain boundary modification, strengthening mechanisms, mechanical working, texture, behaviour of second phase particles, design for creep resistance, high temperature materials, super alloys, design for fracture resistance, design for fatigue resistance fatigue – fracture, creep fatigue interaction, super alloys superplastic forming. HSLA steels, TRIP steels, maraging steels, stainless steels. Aluminium alloys, titanium and its alloys, zirconium and its alloys, magnesium based alloys, quasicrystals.

MT908 Heat Transfer 3

Modes of heat transfer, one dimensional, steady state conduction, transient conduction, external flow (convection), internal flow (convection), free (natural, buoyant) convection, boiling and condensation, radiation, radiation exchange between surfaces.

J. P. Holman, 'Heat Transfer', 9th Edition, McGraw Hill, 2002.

DEPARTMENT OF CHEMISTRY

CY900 Polymer Chemistry 4

Introduction. Classification. Elastomers, Fibres and Plastics. Copolymers. Types of polymerization, mechanisms and kinetics. Metathesis. Group-Transfer polymerization. Solution Properties, Thermodynamics, and Molecular-weight determination. Thermal properties and Degradation, Stability, & environmental issues. Polymer recycling. Biodegradation. Polymer additives, blends, interpenetrating networks & composites. Applications for polymers in separations, biotechnology, and electronics - Membrane separations, Biomedical applications. Applications in electronics. Photonic polymers.

Joel R. Fried, Polymer Science and Technology, Prentice Hall 1999.
Fred W. Billmeyer, Jr, Text Book of Polymer Science, Wiley-Interscience 1985.

CY901 Advanced Organic Chemistry 4

Stereochemistry: Asymmetric carbon atoms. Configuration. Racemic modification. Properties. Resolution. Conformations. O R D. and Circular Dichroism. Named Organic reactions, Rearrangements and Reagents. Photochemistry: Photochemical reactions. Woodward-Hoffmann rules. Proteins and Enzymes. Structure. Vitamins and Nucleic acids. Biosynthesis of pyrimidines, purines and proteins, Haemoglobin.

Ernest L. Eliel, Stereochemistry of carbon compounds, Tata McGraw-Hill 1976.
I. L. Finar,Organic Chemistry, Vol. 1 and 2, ELBS and Longman 1975.

CY902 Spectroscopy of Organic Compounds 4

UV-Visible Spectroscopy: Principle, Instrumentation, and its applications in structural elucidation of organic compounds. Quantitative analysis. IR-Spectroscopy and Raman spectroscopy: Theory and FT Raman Spectrometer. Applications. NMR Spectroscopy: Quantum description of NMR. NMR spectrometer. Sample handling. Applications to structure determination. Carbon-13 NMR. Nuclear Overhauser enchancement. Applications of NMR to P-31 and F-19 nuclei, 2-D NMR. Mass spectrometry: Principle. Double focusing spectrometer. Identification of organic compounds. Structural information and fragmentation patterns. Rearrangements. GCMS and its applications.

J. R. Dyer, Applications of absorption spectroscopy of organic compounds, Prentice Hall 1974.
D. A. Skoog, F. J. Holler, T. A. Nieman, Principles of Instrumental Analysis, Harcourt Asia PTE Ltd., V Ed., 1992.

CY903 Chromatography 4

Classification and Principles of Chromatography: Theory and general description of various types and applications. Gas Chromatography: Instrumentation and applications. Gas-solid chromatography. Liquid Chromatography: Types-Liquid-solid. Liquid-liquid. Instrumentation. HPLC: Instrumentation, Components, and applications. Partition chromatography, Ion chromatography and Gel Permeation chromatography: Theoretical plate theory and applications. Ion Chromatography: Ion-exchange resins, ion selectivity, Applications, Gel permeation chromatography: Theory & applications in polymer analysis. Paper chromatography, Thin layer chromatography. Adsorption chromatography: Solvents, development of chromatogram.

Lloyd R Snyder, Principles of Adsorption Chromatography, Marcel Dekker Inc, 1968.
R. Stock and C. Rice, Chromatographic Methods, II Ed, Chapman and Hall, 1967.

CY904 Advanced Physical Chemistry 4

Quantum Mechanics: Schrodinger wave equation: Solutions for simple systems. Particle in a 3-d.box. Radial probability distribution. Wave mechanical treatment of probability distribution. Chemical Kinetics and Catalysis: Kinetics and mechanism of complex reactions, Molecular reaction dynamics. Acid-base and Enzyme catalysis. Quantitative correlations of reaction rates and equilibria. The Hannut and Taft equations. Ionic equilibria and Electrolytic Conductance: The theory of electrolytic conductance. Debye- Huckel limiting equations. Instrumental Methods of Electrochemistry: Polarization. Overvoltage. Electroanalysis and coulometry-principles & applications. Voltametry and Polarography: Principles. Kinetics of electrochemical reactions.

Samuel Glestone, An introduction to Electrochemistry, East-West edition, New Delhi.
Paul Delahay, New Instrumental methods is electrochemistry, Interscience .

CY905 Advanced Inorganic Chemistry 4

Acids and Bases: Acid-base concepts. Strengths. Solvents: Theory and factors affecting solubility. Energy change. Born equation. Coordination Chemistry-I: Valence Bond Theory for Complexes, Inner and outer orbital complexes. Magnetic properties, Crystal Field Theory. Molecular Orbital Theory- for sigma bonding complexes and pi-bonding complexes. Coordination Chemistry II: Spectral properties. Magnetic permeability and

susceptibility. Factors affecting stability, Kinetics and mechanism of reactions of complexes. Organometallic Chemistry: Metal carbonyls, Nitrosyls, Metallocenes, Dinitrogen compounds.

J.E. Huhuy, E.A. Keiter, R.L. Keiter, Inorganic Chemistry: Principle of Reactivity and Structure, Addison Wesley Pub.1993.
H.J. Emeleces and A.G. Sharpe, Modern Aspects of Inorganic Chemistry, Universal Book Stall, New Delhi, 1989.

CY906 Environmental Chemistry 4

Concept and scope of Environmental Chemistry. The hydrological, oxygen, nitrogen, phosphate and sulphur cycle. Atmosphere: Composition, structure and evolution. Chemical and photochemical reactions. Water resources, Physical Chemistry of sea and fresh water. Composition of Lithosphere, water, air, organic and inorganic components in soil. Air pollutants: CO, NO_X , Hydrocarbons, Photochemical smog, SO_2, acid rain, particulates, radioactivity. Tropospheric chemistry. Water pollution. Water quality parameters, sampling, preservation, monitoring techniques and methodology. Chemical toxicology: Toxic chemicals and their impact on the environment.

A.K.De, Environmental Chemistry, New Age Intl.(Pvt) Ltd.,1998.
Peter O'neil, Environmental Chemistry, Chapman and Hall, 1985.

CY907 Electroanalytical & Thermal Methods 4

Conductometry: Conductivity. Measurement. Conductometric titrations – principle of different types. High frequency titrations. Potentiometry: Theory. Various types of Potentiometric titrations. Voltammetry: Polarography. Principle and applications. Sinusoidal a.c. polarography. Stripping voltammetry. Amperometric titrations. Biamperometric titrations. Chronopotentiometry. Electrogravimetry. Coulometry. Thermogravimetry. Theory and Instrumentation. Differential thermal analysis. Instrument, applications. DSC. Instrument and applications. Thermometric titrations.

G.H.Jeffery & others, Vogels Textbook of quantitative Chemical analysis, V Ed. Longman,
Willard, Merritt, Dean and Settle, Instrumental methods of analysis, VI Ed., CBS Publishers and Distributors, Delhi, 1986.

DEPARTMENT OF MATHEMATICAL AND COMPUTATIONAL SCIENCES

SY701 Computer Organization And Architecture (3-0-0) 3
Data representation, error detection and correction, logic gates, combinational circuits, sequential circuits. Memory Organisation: Caching, virtual memory. CPU Architecture: Instruction sequencing, control units. I/O Architecture: I/O techniques, Interrupt handling, I/O processors.
Morris Mano, Logic Design
Hamachar ,V.C. et all., Computer Organization, McGraw Hill

SY702 Computer Networks (3-0-0) 3
Reference models; Physical Layer: Transmission media. Data Link Layer: Error correction and detection, data link layer protocols; Medium Access Sublayer: Multiple Access Protocols, IEEE 802 standards, Bridges. N/W Layer: Routing algorithms, congestion control algorithms, internetworking. Transport Layer: Transport services, transport protocols. Application layer, Cryptography.
Tannenbaum, "Computer Networks"Prentice Hall
J. Martin, "Computer Networks and Distributed Processing"PHI

SY703 Data Structures and Algorithms (3-0-0) 3
Introduction to Object Oriented Concepts. Linear Data Structure: arrays, stacks, queues, pointers, associative and skip lists. Non-Linear Data Structures: Trees; multi-linked structures; Graphs; dynamic storage management; Sorting and searching techniques.
A.M.Tanenbaum, "Data structures using C"
Tremblay and Sorenson, "An Introduction to Data Structures with Applications"

SY704 Operating System (3-0-0) 3
Type of Operating Systems; Process Management; threads; CPU scheduling algorithms, Process synchronization, Deadlocks; Contiguous and Non-Contiguous allocations, Virtual memory; File system implementation; Protection and Security: Access matrix, authentication, cryptography
Silberschatz,Galvin, "Operating System Concepts" John Wiley, Sixth Edition
Milan MilanKovic, "Operating System Concepts and Design" Mc Graw Hill

SY706 Data Structures Lab (0-0-3) 2
Programming assignments on stacks, queues, linked lists, pointers, trees, multi-linked structures, graphs, sorting and searching techniques

SY707 Operating Systems Lab (0-0-3) 2
Implementation of Operating system concepts like processes, threads, CPU scheduling algorithms, socket programming, semaphores, banker's algorithms, page replacement algorithms.

SY751 Computer Graphics (3-0-0) 3
Display Devices; display processors, color display generators. 2D transformation; Interactive graphics; raster graphics algorithms, graphics hardware, interactive graphical techniques, dynamic graphics; 3D graphics: 3D viewing and transformations, hidden surface and hidden line algorithms. Graphics standards, user interface software
Foley, Van Dam, " Fundamentals of Interactive Computer Graphics" Addison Wesley
Hearn D. Baker, "Computer Graphics" PHI

SY752 Database System (3-0-0) 3
Three level architecture of databases. Data Models, architecture of RDBMS, ER diagrams, database languages and query languages, relational database design, normal forms, file structures. Concurrency control and database recovery techniques, security and authorization.
Elmasri and Navathe, "Fundamentals of Database Systems" Addison Wesley
Silberschatz, Korth, and Sudarshan, "Database System Concepts" McGraw Hill

SY753 Object Oriented Software Engineering (3-0-0) 3
Introduction; software system complexity and architecture; OO Modeling; OO s/w development process; OOT concepts; Unified S/w Development Process; Development Phases; UML, structural and behavioural modeling, architectural modeling. OO programming.
Grady Booch, "OO Analysis and Design with Applications" Pearson Education Asia
Jacobson, Booch and Rambaugh, "The Unified Software Development Process" Pearson Education Asia

SY756 Computer Graphics Lab. (0-0-3) 2
A mini project to implement graphical concepts like 2D and 3D transformations, animations, clipping, windowing and polygon filling.

SY757 Database Systems Lab (0-0-3) 2
A mini project to design and implement a database package incorporating all the relevant concepts learnt in the course.

SY801 Advanced Client Server Computing (3-0-0) 3
Introduction to client/server computing; Architecture of RPC Process; Data access, Execution, Vertical Slice, Two tier Client/Server architecture, Stored procedures and Three tier architecture. Client characteristics and Tools; Server Characteristics and Functionality; Connectivity Interface Technology; Applications Layer Services; IPC Services. Application partitioning: Task Allocations Server and Client side.
Robert Orfalietall - Essential Client/Server Survival guide
Larry T. Vaughn: Client /Server System Design & Implementation.

SY802 Advanced Database Systems (3-0-0) 3 PREREQ SY 752
Software architecture for data sharing, federated database management system, distributed transactions, client - server architecture, multimedia databases, object oriented DBMS; Foundations of pattern clustering, clustering paradigms, clustering for data mining, Data mining using neural networks and genetic algorithms, Fast discovery of association rules; Applications of data mining.
Tamer Ozsu Patrick valduring, Principles of Distributed Database systems, PHI
Ceri S. Pelagatti S., Distributed Databases, Principles and Systems, Mc Graw Hill

SY803 Advanced Operating Systems (3-0-0) 3 PREREQ SY 704
Distributed shared memory, distributed scheduling algorithms, recovery and reference. Protection and Security; Multiprocessor Operating Systems; Database Operating Systems; concurrency control algorithms. Object oriented operating systems and its characteristics.
Mukesh Singhal Niranjan, G.Shivorothri, Advanced Concepts in Operating Systems
Andrew S Tannenbaum, Distributed Operating Systems

SY804 Artificial Neural Networks (3-0-0) 3
Introduction, perceptron convergence theorem. Single and multi layer perceptrons; Back propagation algorithm; convolution network; Radial Basis Function network: Properties, comparison of RBF networks and Multilayer perceptrons. Kernel Regression and its relation to RBF network .SVM for Nonlinear Regression. Principle Component Analysis. Applications of Neural Networks.
Simon Haykin, Neural Networks: A comprehensive Foundation, Prentice-Hall 1999.
Fredic M. Ham and Ivika Kostanic, Principles of Neurocomputing for science and Engineering, Tata Mc-Graw-Hill, 2001.

SY805 Computational Combinatorics (3-0-0) 3
Generating Functions; Recurrence Relations; Generalized Permutations and Combinations; Inclusion-Exclusion; Inversion Formulae; The Vander Waerden Conjecture; Partitions; Projective and Combinatorial Geometries; The Burnside-Frobenius Theorem; Group Theory in Combinatorics; Permutation Groups and their Cyclic Indices; Polya's Enumeration Theorem;(0-1) Matrices; Latin Squares; Hadamard Matrices; Reed-Muller Codes; Coding Theory and Cryptology; Orthogonality; Combinatorial Problems; Combinatorial Optimization Algorithms.
B. Bollobas; Combinatorics; Cambridge Univ Press.
I. Anderson; Combinatorics of Finite Sets; Dover.

SY806 Compiler Design (3-0-0) 3
Lexical Analysis; Lex compiler, Conversion from a regular expression to an NFA and DFA. Syntax Analysis; Parser generators. Syntax directed Translation; Run time Environments: Storage- allocation strategies, Parameter passing, Symbol tables. Intermediate Code generation: Intermediate languages. Code Optimization: optimization of basic blocks, loops in flow graphs, peephole optimization. Code generation; Register allocation and assignment.
A.V. Aho, Ravi Sethi, J.D. Ullman: Compilers - Principles, techniques and Tools, Pearson Education Asia.
A.V.Aho, J.D. Ullman: Principles of compiler Design, Addison Wesley, 1985.

SY807 Cryptography and Network Secuirty (3-0-0) 3

Conventional Encryption; Finite Fields; AES; Contemporary Symmetric Ciphers; Confidentiality Using Conventional Encryption. Public-Key Cryptography; Key Management; Message Authentication and Hash Functions; Hash and Mac Algorithms; Digital Signatures and Authentication Protocols. Network security; System security;

William Stallings; Cryptography and Network Security; Pearson Education India.
R.E. Smith; Internet Cryptography; Pearson Education India.

SY808 Distributed Computing Systems (3-0-0) 3

Principles of distributed computing, distributed databases, distributed query processing, distributed concurrency control, commit protocols, distributed deadlock detection and resolution, distributed algorithms, load balancing techniques, distributed operating systems and network operating systems, distributed programming, clock synchronization.

G.F. Coulouries, J.D. Dollimore and T.Kindberg, Distributed Systems: Concepts and Design Addison Wesley, 1994 (II Edn)
Parker Y and Verjus J.P., Distributed computing systems, Synchronization, control and communication, Academic press

SY809 Fuzzy System Models (3-0-0) 3

Characteristics of Fuzzy System Models, Classification, Problems; Modeling of system uncertainties; parametric uncertainties; scope and validity of results. From Classical (Crisp) Sets to Fuzzy Sets: Fuzzy Numbers, Fuzzy Arithmetic, Fuzzy Measures, Operations on Fuzzy Sets, Fuzzy Relations, Multi-valued Logic, Fuzzy Logic; Uniqueness of Uncertainty Measure; Possibility Theory; Approximate Reasoning; Fuzzy Decision Making.

Klir and Folger, Fuzzy Sets, Uncertainty and Information, Prentice Hall of India.
Klir and Yuan, Fuzzy Sets and Fuzzy Logic, Prentice Hall of India.

SY810 General Systems Theory Concepts (3-0-0) 3

Boundary, interface, structure, behaviour and description of a system; state transitions. General systems approach to problem solving; Primary dimensions in systems studies. Problem Classification: Analysis; Design; Optimization; Control; Simulation; etc. System Models; Modeling of system uncertainties; parametric uncertainties.

G.M. Weinberg, "General Systems Thinking-An Introduction", Dorset House
H.A. Simon, "The Sciences of the Artificial" MIT Press

SY811 Genetic Algorithms (3-0-0) 3

Mathematical Foundations; 2 - armed and K-armed bandit problem, building block hypothesis, minimal deceptive, similarity templates as hyper planes; Advanced operators and techniques in genetic algorithm search; multi objective optimization, knowledge based techniques, genetic algorithms and parallel processors, genetic based machine learning, classifier systems. Application of genetic Algorithms;

David Goldberg, "Genetic Algorithm in search, optimization and machine learning", Addison Wesley International 1999
Charles L Karr and L. Michael Freeman, Industrial applications of Genetic Algorithms, CRC press Washington DC 1998

SY812 Information and Coding Theory (3-0-0) 3

Noiseless Coding; Construction of Optimal Codes; Discrete Memoryless Channel; Error-Correcting Codes; Convolution Encoding: Gilbert Bound; Threshold Decoding for Block Codes; Cyclic Binary Codes; Optimum Codes; Non-Cyclic Codes; Residue Codes; Reed-Muller Codes; Orthogonizable Codes; Non-binary BCH Codes

R. Ash, Information Theory, Dover.
A. Khinchin, Mathematical Foundations of Information Theory, Dover.

SY813 Internet Technology and Applications (3-0-0) 3

Web Programming; HTML, CGI, Client and Server side Scripting, DHTML, ASP, PHP Development platforms and Tools, Web Server Management. E- Commerce aspects, Automatic file exchanges, Buying and selling strategies; B2B B2C, C2C and other supply chain management, web-enabled MRP application, Web-enabled forms, Mobile e-business and related issues connected with mobile services.

Szeto, Designing Interactive Web Sites. Allied Publishing
Hahn, The Internet Complete Reference, 2/ed, Tata McGraw Hill

SY814 Image Processing (3-0-0) 3

Image presentation: Digitization – Image compression and coding problems – Data structure for Picture representation, quod trees – spatial smoothing, template matching, region analysis – contour following – frequency domain operations – descriptions of line and shape – descriptive methods in scene analysis, Image-Enhancement Statistical and syntactic models picture classification.

Rafel C. Gonzalez and Richard E Woods, Digital Image Processing, Addison – Wesley.
Anil K Jain, Fundamentals of Digital Image Processing, Prentice Hall of India.

SY815 Natural Language Processing (3-0-0) 3

Role of Lexicon in NLP, Lexical Resources; Basic parsing techniques; Handling Anaphora and Ellipsis, Thematic Roles, Knowledge Representation. Zipf's laws, Term Distribution models, Introduction to probabilistic models (HMM, Bayesian), Vector space document model. Advanced Topics: Page Ranking Algorithms, Singular Value Decomposition (SVD), Latent Semantic Indexing (LSI).

Allen J., Natural Language Understanding, The Benjamins/Cummings Publishing Company Inc, 1994. ISBN 0-8053-0334-0. (for parts I and II)

Manning C. D. and H. Schutze, Foundations of Statistical Natural Language Processing, The MIT Press, 1999. ISBN 0-262-13360-1. (for parts III, IV and V)

SY816 Pattern Recognition (3-0-0) 3

Machine perception: Continuous and Discrete, Baye's Decision Theory, Maximum likelihood parameter estimation, Problems of Dimensionality, Nearest Neighbor non parametric estimation, Fisher's linear discriminant analysis, Linear Discriminant Functions and Decision Surfaces, Clustering and Dimensionality Reduction, Linear and Nonlinear Methods of Features transformation. Application of pattern recognition to real world problems.

Duda and Hart, Pattern Classification, Prentice-Hall of India.

K. Fukunaga, Introduction to Statistical Pattern Recognition, Academic Press.

SY817 Stochastic System Models (3-0-0) 3

Characteristics of Stochastic System Models. Classification. Problems. Examples. Modeling of System Uncertainties; Parametric Uncertainties. Scope and Validity of Results.

http://pespmc1.vub.ac.be/CYBSYSTH.html

Mesarovic & Takahara; General Systems Theory; Academic Press.

SY818 System Modelling and Simulation (3-0-0) 3

Structure and Classification of simulation models; Discrete – Event Simulation: Input Probability Distributions, Generating random variables for standard distributions, Output Analysis for a single system, Comparing Alternative system configurations, Experimental Design and Optimization. System Software: GPSS; MATLAB; Modeling and Simulation of Continuous Systems

J. Banks and J.S. Carson, Discrete event system simulation, Ph- 1984

G. Gordon, System Simulation, P-H-I

SY819 Theory of Computation (3-0-0) 3

Abstract Models for Computation; Theory of Recursive Functions; Finite Automata; Push-down Automata; Linear Bounded Automata; Turing Machines; Formal Language Models; Generative Grammars, Recognition Procedures; Chomsky Hierarchy; Normal Forms; Derivation Graphs; Pumping Lemma; Undecidability; Recursive Functions and Computability; Reducibility; Complexity Classes.

Hopcroft and Ullman, Introduction to Automata Theory, Languages and Computation,Narosa.

Gyorgy E. Revesz, Introduction to Formal Languages, Dover.

SY820 Web Technology (3-0-0) 3

The Web Design Environment; Web design principles; HTML: Structural HTML Tags, Tables, Frames, forms, Image mapping, cascading style sheets; Using Web design Tools; Multimedia and Client side scripting: Audio and Video on the web, DHTML, Introduction to java script, Java Applets. Server-side scripting: Active Server Pages, XML.

Web Design in a nutshell - Jennifer Niederst, Orielly publications

XML and Java Developing Web Applications. Hiroshi Maruyama, Kent Tamura, Naohiko Uramoto.

SY821 Selected Topics in Systems Analysis and Computer Applications (3-0-0) 3

CA602 Computer Organisation and Architecture (3-0-0) 3

Data Representation. Number systems. Error detection and correction. Logic design. Memory organization. CPU architecture and organization. Microprogramming. Instruction formats. Addressing modes. I/O architecture. Multiprocessing, Parallel processing.

VC Hamachar, ZG Vranesic and SG Zaky, Computer Organisation, McGraw Hill, 1996.

Moris Mano, Computer System Architecture, Prentice Hall, 1992.

CA603 Computer Oriented Numerical Methods (3-0-0) 3

Numerical solution of algebraic and transcendental equations. Numerical linear algebra. Interpolation. Curve fitting by method of least squares. Numerical differentiation and Integration. Solution of ordinary differential

equations. Solution of boundary value problems in ordinary differential equations. Solution of Partial Differential equations.

MK Jain, SRK Iyengar and RK Jain, Numerical Methods for Scientific and Engineering Computation, Wiely Eastern, 1985.
MK Jain., Numerical Solution of Differential Equations, Wiley Eastern, 1984.

CA604 Discrete Mathematics (3-0-0) 3

Propositional and predicate calculus. Group theory. Lattice theory. Graph theory: Trees, Matrices, Spanning tree and shortest path algorithms, Planarity, Connectivity, Traversability, Colourability, Network flow algorithms. Combinatorics. Recurrence relations and generating functions.

JP Trembley and R Manohar, Discrete Mathematical Structures with applications to Computer Science,.Mcgraw Hill, 1975.
CL Liu, Elements of Discrete Mathematics, McGraw Hill, 1985.

CA605 Programming Using C (3-0-0) 3

Introduction to algorithms. Flow charts. C character set, Data types. Operators and expressions. Input/Output statements. Control statements. Functions. Arrays and Pointers. Structures. Unions. Files. Dynamic memory allocation.

B Kernighan and D Ritchie, The C Programming Language Prentice Hall, 1990.
E Balagurusamy, Programming in ANSI C, Tata Mc-Graw Hill, 2004.

CA606 Logic Design Lab (0-0-3) 2

Verification of Boolean Theorems. Implementation of Boolean Function. Design of combinational and sequential circuits. Design of counters and registers. Study of flip flops using gates and ICs.

M Morris Mano, Digital Design, Prentice Hall, 1996.

CA607 Programming Lab (0-0-3) 2

MS-DOS editor commands. Unix commands. Simple programs using I/O. Implementation of programs using control statements, Functions, Arrays, Pointers, Structures, Unions, File handling, Graphics function and animation.

Brian W.Kernigham and Pike R., The Practice of Programming, Addison Wesley, 1999.

CA611 Computer Oriented Statistical Methods (3-0-0) 3

Introduction of Probability. Conditional probability. Independent events. Bayes' theorem. One and two dimensional random variables. Probability distributions. Sampling distributions. Statistical Inference. Methods of estimation. Tests of statistical hypothesis. Goodness of fit tests. Data analysis.

PL Mayer, Introductory Probability and Statistical Applications, Oxford & IB H, 1979.
RV Hogg and AT Craig, Introduction to Mathematical Statistics, Mac Milan, 1975.

CA612 Data Structures and Algorithms (3-0-0) 3 PREREQ CA605

Linear Data structure. Concepts of nonprimitive data structures. Sequential storage representation of arrays, stacks, queues, priority queues, and their applications. Pointers and linked allocation. Linked lists. Associative lists. Skip lists. Non-linear Data Structures. Trees. Graphs. Sorting and Searching. Introduction to algorithm analysis for time and space requirements.

JP Trembley and PG Sorenson, An Introduction to data Structures with Applications, Tata Mc Graw Hill, 1984.
AV Aho, Hopcraft and Ullman, Data structures and Algorithms, Addison Wilsey,2001.

CA614 Microprocessors (3-0-0) 3 PREREQ CA602

Introduction to microprocessors. Architecture of 8086/8088. Assembly language programming. Addressing modes of 8086. Instruction set. Subroutines. Modular programming. Macros and conditional assembly. Interrupt processing. Hardware architecture of 8086/8088. Memory System Design and peripherals. Introduction to 80386, 80486. Hardware details of PENTIUM.

BB Barry, The Intel Microprocessors, Prentice Hall of India,1996.
Liu and Gibson, Microcomputer System, the 8086/8088 family, Prentice Hall 1989.

CA615 Operating Systems (3-0-0) 3 PREREQ CA602

Evolution of operating systems. Types of operating systems. Process Management. CPU Scheduling algorithms. Process synchronization mechanisms. Deadlocks. Memory Management: File management. Input output systems. Protection and security.

Silberschatz and Galvin, Operating System Concepts, John Wiley 2001.

CA616 Data Structures and Algorithms Lab (0-0-3) 2 PREREQ CA607

Implementation of stacks and queues using arrays and Linked lists. Implementation of operations on linked lists and its applications. Implementation of operations on binary trees. Implementation of graph algorithms, sorting, searching and hash methods.

AM Tenenbaum and MJ Augenstein, Data Structures using C AND C++, Prentice Hall 1997.

CA617 Operating Systems & Assembly Langauage Lab (0-0-3) 2 PREREQ CA607
Basic UNIX commands. Shell Programming. Implementation of scheduling, process synchronization, deadlock and disk scheduling algorithms. Simulation of paging and segmentation. 8086 Assembly programming.

CA701 Database Management Systems (3-0-0) 3 PREREQ CA617, CA612
Files versus database systems. Three-level architecture of databases. Data Models. ER-diagram. Relational model. Relational algebra and calculus. Query languages. SQL. Embedded SQL. Relational database design algorithms. Normalization. Physical database organization. Indexing and hashing. Transaction processing. Database security and authorization.
Ramez Elmasri, Shamkant B Navathe, Fundamentals of database system, Addison Wesley, McGraw-Hill, 2000.

CA702 Object Oriented Programming (3-0-0) 3 PREREQ CA605
Key concepts of Object Oriented Programming. Overview Of C++. Classes. Inheritance. Polymorphism. Overloading. Virtual functions. Templates. Exception handling. I/O stream. File I/O. Java Programming
Herbert Schild, C++ The complete References, 1999.
HM.Deitel and PE Deitel, Java How to Program, Prentice Hall, 1998.

CA703 Software Engineering (3-0-0) 3
Software engineering paradigms. Planning. Cost estimation. Organization structure. Software project scheduling. Risk analysis and management. Requirements and specification. Rapid prototyping. Software design. Software metrics. Software testing and maintenance. Software configuration management and case tools.
Roger S.Pressman, Software Engineering: A Practitioner Approach, McGraw Hill, 1999.
L Sommerville, Software Engineering, Addison Wesley, 1996.

CA704 Database Management Systems Lab (0-0-3) 2
Creation of tables, Views, Insertion, Modification and deletion of elements. Implementation of queries. Implementation of joins. Implementation of PL/SQL, triggers, cursors and sub programs. Implementation of database connectivity through front end tools. Database design and implementation. Mini project.

CA705 Object Oriented Programming Lab (0-0-3) 2 PREREQ CA607
Simple C++ Program. Dynamic memory allocation. Constructor/Destructor. Friend function. Function overloading. Operator overloading. Inheritance. Virtual functions and Dynamic binding. Templates. File Handling. Exception handling. Simple Java programs. Inheritance. Event handling programs.

CA711 Computer Graphics (3-0-0) 3 PREREQ CA612
Graphics hardware. Display devices. I/O devices. Basic raster graphics algorithms. Introduction to simple raster graphics package (SRGP). 2D and 3D transformations. Curves. Surfaces and solids. Hidden line and surface elimination. Illumination and shading. Animation.
Hearn D and Baker MP, Computer graphics, PHI, New Delhi, 2002.
Rogers DF, Procedural Elements of Computer Graphics, McGraw Hill 2002.

CA712 Computer Networks (3-0-0) 3 PREREQ CA615
Hierarchical reference models. Physical layer. Data communication and transmission. Data link layer. Design issues. Error detection and correction, Elementary data link layer protocols. Medium access sublayer. Network layer. Network layer design issues. Routing algorithms. Congestion control algorithms. Internetworking. Transport layer. TCP/IP.UDP. Session layer. Presentation layer and application Layer. Network security.
AS Tannenbaum, Computer Networks, Prentice- Hall, 2003.
William Stallings, Data and Computer Communications, PHI, 1997.

CA713 Computer Graphics Lab (0-0-3) 2 PREREQ CA616
Implementation of raster graphics algorithms, 2D and 3D transformations. Clipping and windowing. Segmentation and animation. Mini project.

CA714 Computer Networks Lab (0-0-3) 2 PREREQ CA617
Implementation of techniques based on computer networks. Client/ server computation. Internetworking of LANs. File transfer-using TCP/IP. Remote command execution. UNIX socket programming.

CA721 Compiler Design (3-0-0) 3 PREREQ CA612
Phases of a compiler. Lexical analysis. Syntax analysis. LEX and YACC utility. Syntax directed translation. Run time Environments. Intermediate code generation. Code optimization. Code generation.
AV Aho, Ravi Sethi, and JD Ullman, Compilers: Principles, techniques and tools, Pearson education Asia, 2001.

CA722 Internet Technology and Applications (3-0-0) 3 PREREQ CA712
History of Internet. Internet addressing. TCP/IP. DNS and directory services. Internet resources and applications. WWW Overview. Advanced java programming. Applet Programming. N/w programming, JDBC. Servlet programming.
Deitel & Deitel, Internet & World wide Web, How to program, Prentice hall 2000.
D Norton and H Schild, Java2: The complete reference, TMH 2000.

CA723 Compiler Lab (0-0-3) 2 PREREQ CA616, CA617
Implementation of the following using any High Level Languages: Recognizer for a regular expression, Lexical analyzer, Top down parsing, Parser with error recovery. Programs using compiler tools LEX and YACC. Implementation of the following using tools: Intermediate code generator, Simulator. Mini project.
AI Holub, Compiler Design in C, Prentice Hall of India, 1993.

CA724 Internet Technology & Applications Lab (0-0-3) 2 PREREQ CA705, CA714
Client and Server Side Scripting Programs. Use of Components. Creating dynamic web pages. Experiments with ASP/ACTIVEX / JAVA Server Pages. Socket programming and applications. Java servlets. On-line transactions. Database connectivity. Mini project.

CA801 Computer Algorithms (3-0-0) 3 PREREQ CA612
Mathematical Background. Design and Analysis of algorithms. Complexity measures. Worst-case and average-case complexity. Sorting and selection. Searching and set manipulation. Hashing. Union-Find problem. Design techniques: Divide and conquer, Dynamic programming, Greedy method, Backtracking, Branch & bound. Graph and parallel algorithms. Algebraic problems. String processing. NP-completeness.
A Aho, J Hopcroft, and J Ullman, The design and analysis of computer algorithms, Pearson Education 2001.
Thomas H. Cormen, Charles E Leiserson, and Ronald L. Rivest, Introduction to Algorithms, Prentice Hall 1998.

CA802 Fuzzy System Models (3-0-0) 3
Classical (Crisp) sets versus fuzzy Sets. Fuzzy Numbers. Fuzzy arithmetic. Fuzzy measures. Operations on fuzzy sets. Fuzzy relations. Multi-valued logic. Fuzzy logic. Uncertainty and information. Uniqueness of uncertainty measure. Possibility theory. Approximate reasoning. Fuzzy decision making.
Klir and Folger, Fuzzy Sets, Uncertainty and Information, Prentice Hall 2001.
Klir and Yuan, Fuzzy Sets and Fuzzy Logic, Prentice Hall of India 2001.

CA803 Management Information Systems (3-0-0) 3
Definition of management information systems. Information systems for decision making process. Information-based support systems. Information system requirements. Planning, designing and implementing MIS. Case study.
GB Davis and MH Olson, Management Information Systems, Mc-Graw Hill, 1984.
Murdick RG and Ross JE, Information systems for modern management, Prentice Hall.

CA804 Operations Research (3-0-0) 3
Linear Programming. Formulation and graphical solutions. Simplex Algorithm. Quality and sensitivity analysis. Dual simplex method. Transportation and assignment problems. Games and their solution by linear programming. Network Analysis. Queuing Theory. Basic structure of a queuing Model. M/M/1 and M/M/S models and their variants.
Hamdy A Taha, Operations Research, Prentice Hall of India, 1997.
Hiller and Liberman: Introduction to Operations Research, Prentice Hall 1995.

CA805 Optimization Techniques and Statistical methods (3-0-0) 3
Linear programming problem. Simplex method. Two-Phase method. Duality theory. Transportation problem. Assignment problem. Reliability. Concepts of hazard, Bath-tub curve, MTTF , MTBF. System reliability for series, parallel and mixed configurations. Data Analysis. Time series analysis Time series models. Method of moving averages. Seasonal movements. Cyclical movements.
Kanthi Swarup, PK Gupta and Man Mohan, Operations Research, Sultan chand & Sons, 1978.
J Medhi, Statistical Methods, Wiley Eastern, 1987.

CA806 Theory of Computation (3-0-0) 3 PREREQ CA604

Finite automata. Moore and Melay machines. Regular Expressions. Pumping lemma. Minimizing the automata. Formal Languages. Regular languages. Context free languages (CFL). Chomsky and Greibach Normal forms. Pushdown automata (PDA). Equivalence of PDA and CFL. Turing machines. Theory of recursive functions. Complexity theory. NP-completeness.

Aho, Hopcraft & Ullman, Automata, Languages and Computation, Narosa,1986
Mishra and Chandrashekar, Theory of Computer Science, Prentice Hall 1998.

CA807 Artificial Intelligence (3-0-0) 3 PREREQ CA604

Foundation and history of AI. AI Problems and techniques. Heuristic search techniques. Knowledge representation. Reasoning under uncertainty. Planning and learning. Genetic algorithms. Applications of AI. Principles of natural language processing. Expert systems. Current trends in intelligent systems. AI programming languages. Introduction to LISP and PROLOG.

Elain Rich and Kevin Knight, Artificial Intelligence, Tata McGraw Hill Publishing Company Limited, 1995.
Stuart Russel and Peter Norvig, Artificial Intelligence: A Modern Approach, Prentice Hall, 1995.

CA808 Artificial Neural Networks (3-0-0) 3 PREREQ CA712

Introduction to artificial neural network. Learning process. Single layer and multilayer perceptrons. Back propagation algorithm. Convolution network. Radial basis function network. Kernel regression and its relation to RBF network. Learning strategies. Support vector machines. Linearly separable patterns. Non-separable patterns. SVM for nonlinear regression. Principal component analysis. Pattern classification. Hierarchical vector quantization.

Simon Haykin, Neural Networks: A comprehensive Foundation, Prentice-Hall International, New Jersey, 1999.
B Yegnanarayana, Artificial Neural Networks, Prentice-Hall of India, New Delhi.

CA809 Computer Simulation and Modelling (3-0-0) 3 PREREQ CA611

Components of a system. Models of system. Random number generation. Probabilistic distribution. Simulation languages. Applications

Jerry Banks and John Carson. S, Discrete Event System Simulation, PHInc, 1984.
Gotifried B, Elements of Stochastic process simulation, PHInc, 1984.

CA810 Genetic Algorithms (3-0-0) 3 PREREQ CA612

Robustness of traditional optimization and search techniques. Goals of optimization. A simple genetic algorithm. Similarity templates. Mathematical Foundations. Computer Implementation of Genetic Algorithms. Advanced operators and techniques in genetic algorithm search. Industrial application of genetic algorithms.

David Goldberg, Genetic Algorithms in search, optimization and machine learning, Addision Wesley International,1999.
Charles L Karr and L Michael Freeman, Industrial applications of Genetic Algorithms, CRC Press, 1998.

CA811 Knowledge Management (3-0-0) 3

Introduction to knowledge Management. Types of knowledge within an organization. Intellectual capital. KM Architecture and Tools. ERP for KM. Knowledge sharing tools. Data ware housing. Knowledge strategy creation. KM practices. KM Process. Integrating knowledge sharing and learning. The chief knowledge Officer (CKO) and his/her job. Training programmes for organization. Wide learning. Making KM work across various segments of industry and business firms. Case studies of KM practices in successful companies, Future challenges in KM.

Ratnja Gogula (Ed), Knowledge Management: A New Down., The Institute of Hartered Financial Analysts of India, Hyderabad 2002.

CA812 Natural Language Processing (3-0-0) 3 PREREQ CA604

Issues and difficulties in NLP. Language understanding systems. Types of NLP Systems. Grammars and parsing. Semantic Interpretation. Language communication. Typical Systems. Current trends in NLP.

James Allen, Natural Language Understanding, Benjamin / Cummings Publishing Co, 1995.
Ronald Hausser, Foundations of Computational Linguistics, Springer-Verleg, 1999.

CA813 Network Optimization (3-0-0) 3 PREREQ CA604

Net work models. Minimal spanning trees. Shortest route problem. Matching and coloring problems. Max flow min-cut theorem. Capaciated network model. Network simplex method. PERT and CPM. Resource analysis in network scheduling. Precedence planning. Resource allocation and scheduling.

CH Papadimitriou and K Steiglitz, Combinatorial optimization: Algorithms and Complexity, Prentice Hall,1982.
Hamdy A Taha, operations research, PHI, 1997.

CA814 Object Oriented Analysis and Design (3-0-0) 3 PREREQ CA702

Object oriented design fundamentals. OOSD life cycle. Object oriented analysis. UML. Object oriented design methods. Design patterns and frameworks. Object oriented development. Coding. Testing. Maintenance. Case studies in object oriented development.

Grady Booch, James Rumbaugh and Ivar Jacobson, The Unified Modeling Language User Guide, Addison Wesley Long man, 1999.

Erich Gamna, Design Patterns, Addison Wesley, 1994.

CA815 Performance Modelling (3-0-0) 3 PREREQ CA611

Performance evaluation methods. Analytical versus simulation modelling. Performance measurement and benchmarking. Workload modelling. Random variables. Commonly used distributions. Stochastic processes. Markov chain models of computer systems. Queuing models. Discrete event simulation. Simulation Languages. Confidence intervals. Variance reduction techniques. Case studies of analytical and simulation studies of computer systems.

Raj Jain, The Art of Computer Systems Performance Analysis, John Wiley and Sons, New York, USA, 1991.

KS Trivedi, Probability and Statistics with Reliability, Queuing and computer science, PHI, 1982.

CA816 Stochastic and Queuing Systems (3-0-0) 3 PREREQ CA611

Probability concepts. Random variables. Functions of random variable. Distributions. Moment generating function. Stationary process. Markov process. Binominal process. Poisson process. Birth and death process. Renewal process. Markov chains. Chapman-Kolmogorov equations. Transition probabilities. Series and parallel systems. Reliability and Availability of Markovian systems. Maintainability. Preventive maintenance. Markovian queuing models. Little's formula. Multi-server queues. M/G/1 Queues. Pollaczek-Khintchine formula. Decision theory and games.

Trivedi KS, Probability and Statistics with reliability, Queuing and Computer Science Applications, Prentice-Hall 1984.

J Medhi, Stochastic process, Wiley eastern 1987.

CA817 UNIX and Network Programming (3-0-0) 3 PREREQ CA615

Overview of UNIX OS. File I/O. Files and directories. Standard I/O library. System data files and information. Processes. Process relationships. Terminal I/O. Advanced I/O. Threads. Interprocess communication. Message passing. Synchronization. Shared memory. Sockets. Name and address conversions. Applications: TCP echo client server, UDP echo client server.

W Richard Stevens, Advanced programming in the UNIX environment, Addison Wesley,1999.

W Richard Stevens, UNIX Network Programming Volume 1 and 2, Prentice Hall, 1998.

CA818 Advanced Client Server Computing (3-0-0) 3 PREREQ CA615, CA712

Development of Client/Server computing. Architecture of client/server. Three tired architecture. Client characteristics and tools. Use of GUI and local processing with examples. Services like file, database, communication and security. Platforms: LAN, WAN and enterprise wide services. Network operating system. Connectivity: SWMP, NFS, SMPT, IPC. Services: pipes, semaphores, shared memory, DDE, RPC, OLE. Application development. Management and risk issues.

Robert Orfalietall, Essential Client/Server Survival guide.

Larry T. Vaughn, Client /Server System Design & Implementation.

CA819 Advanced Database Management Systems (3-0-0) 3 PREREQ CA701

Basic concepts. Architecture for data sharing, Federated DBMS. Distributed databases. Client/server architecture. Multimedia databases. Object oriented data bases. Data mining and knowledge discovery. Pattern clustering abstraction and similarity. Clustering for data mining. Data mining using neural networks and genetic algorithms. Discovery of association rules. Frequent episodes in event sequences. Applications of data mining.

Ramez Elmasri, Shamkant B Navathe, Fundamentals of Database Systems, Addison Wesley, 2000.

Stefano Ceri & Giuesppe Pelagatti, Distributed Databases - Principles and Systems, McGraw Hill 1987.

CA820 Advanced Operating Systems (3-0-0) 3 PREREQ CA615

An overview of operating system functions. Distributed operating systems. Design issues. Distributed shared memory. Scheduling algorithms. Recovery. Protection and Security. Cryptography. Architecture of multiprocessor operating systems. Database operating systems.Transaction processing. Serializibility. Concurrency control algorithms. Object oriented operating systems. Case studies: UNIX, LINUX, Windows.

Mukesh Singhal Niranjan, G.Shivorothri, Advanced concepts in Operating Systems, Tata Mc-Graw Hill, 1994.

Andrew S Tenanbaum, Modern Operating Systems, PHI, 1995.

CA821 Cryptography and Network Security (3-0-0) 3 PREREQ CA712

Conventional encryption. Introduction to Finite Fields. Contemporary symmetric ciphers. Confidentiality using conventional encryption. Public-Key Encryption. Hash Functions. Introduction to Number Theory. Public-Key Cryptography. Message authentication. Hash and Mac algorithms. Digital signatures and authentication protocols. Network security. System security.

William Stallings, Cryptography and Network Security, Pearson Education India 2002.
RE Smith, Internet Cryptography, Pearson Education India.

CA822 Data Mining and Warehousing (3-0-0) 3 PREREQ CA701

Overview of data mining techniques. Taxonomy of data mining tasks. Steps in data mining process. Predictive modeling. Association rules. Statistical perspective. Clustering. Regression analysis. Time series analysis. Bayesian learning. Data warehousing. Dimensional modeling. Performance issues and indexing. Development life cycle. Case studies.

Jiawei Han, Micheline Kamber, Data Mining : Concepts and Techniques, Motgan Kaufmann Publishers, 2000.
Usama M Fayyad, Gregory Piatetsky-Shapiro, Padhrai Smyth and Ramasamy Uthurusamy, Advances in knowledge discover and data mining, The M.I.T. press, 1996.

CA823 Digital Image Processing (3-0-0) 3 PREREQ CA711

Digital image fundamentals. Elements of visual perception. Colour models. Mathematical preliminaries of 2D systems. Image transforms. Image enhancement and restoration. Image compression. Image segmentation.

Gonzalez C and Woods RE, Digital image processing Addition Wesley, 2000.
Anil K Jain, Fundamentals of digital image processing, PHI, 1997.
William. K Pratt, Digital image processing, Wiley International, 2000.

CA824 Distributed Computing System (3-0-0) 3 PREREQ CA712 , CA721

Introduction to distributed Systems. Design Goals. Fundamental issues in distributed systems. Basics of networking, Temporal ordering of events. Lamport's logical Clocks. Vector clocks. Global state detection. Physical clocks. Process Synchronization. Distributed mutual exclusion. Performance matrix. Interprocess communication. RPCs. Deadlocks in distributed systems. Load balancing techniques. Distributed databases.

GF Coulouries, JD Dollimore and T Kindberg, Distributed Systems: Concepts and Design, Addison Wlesley, 1994.
Mukesh singhal and Niranjan G.Shivaratri, Advanced concepts in Operating system, Tata McGraw Hill 1994.

CA825 Information and Coding Theory (3-0-0) 3 PREREQ CA611

Entropy and its characterizations. Huffman codes. Shannon-Fano coding. Information measure-noiseless coding. Fundamental theorem of information theory. Error correcting codes. Minimum distance principles. Hamming bound. General binary code. Group code. Covolution encoding. Algebraic structure. Gilbert bound. Threshold decoding. Cyclic binary codes. BCH codes. Decoding. Optimum codes. Concepts of non-cyclic codes.

R Ash, Information theory, Interscience publication, Singapore, 1965.
N Abrahamson, Information theory and coding, Mc Graw Hill, 1963.

CA826 Parallel Processing (3-0-0) 3 PREREQ CA 602, CA614

Theory of Parallelism. Multiprocessors and Multicomputer. Conditions for Parallelism. Data and resource dependencies. Hardware and software Parallelism. Program Flow Mechanisms. Control Flow versus data flow. Hardware technologies. Instruction set Architectures, CISC, RISC. Scalar Processors, Memory Hierarchy and Virtual Memory. Cache Memory organizations. Hardware synchronization mechanisms. Vector processing principles.

K Hwang & Briggs FA, Computer Architecture and Parallel Processing, McGraw Hill, 1985.
Kai Hwang, Advanced Computer Architecture, McGraw Hill 1993.

CA827 Pattern Recognition and Scene Analysis (3-0-0) 3 PREREQ CA611

Pattern and features. Pattern recognition approaches. Discriminant functions. Statistical pattern recognition. Gaussian model. Parametric estimation. Bayesian parameter estimation. Pattern classification by distance functions Cluster analysis. Syntactics pattern recognition. Features extraction and recent advances.

Earl Gose, Richard Johnsonbaugh, Steve Jost, Pattern Recognition and Image Analysis, Prentice Hall 1999.
Duda RO and Hart PE, Pattern Classification and Scene Analysis, Wiley, 1973.

CA828 Web Design (3-0-0) 3 PREREQ CA702

HTML overview. HTML tags. Formatting text. Cascading style sheets. DHTML. Web design tools. MS Front page. Dreamviewer Multimedia. Client side scripting. Introduction to java script. VB script. Server side scripting. Active server pages. Java server pages. Database connectivity. Web applications.

Thomas powell, Fritz Schneider, Java script:The complete reference, Tata Mc Graw Hill, 2002.
David crowder, Rhonda crowder, Web design, IDG books India Pvt. Ltd., 2001.

CA829 Selected Topics in Computer Applications (3-0-0) 3

MA701 Applied Statistics and Numerical Analysis (3-0-0) 3
Introduction to probability, probability distributions, Sampling theory, Hypothesis testing, Analysis of variances of one-way and two way classified data, Numerical solutions of ordinary differential equations, Numerical solution of partial differential equations, Introduction to finite element methods.
Sheldon Ross M., Introduction to Probability and Statistics for Engineers and Scientists, John Wiley.
Hogg R. V., Craig A. T., Introduction to Mathematical Statistics McMillan.
Smith G. D., Numerical Solution of Partial Differential Equations, Oxford University Press.

MA702 Design and Analysis of Experiments (3-0-0) 3
Introduction to Probability, one – dimensional random variables, two and higher dimensional random variables, probability distributions, Sampling theory, moments, mgf and their properties, Parameter Estimation, point estimation, interval estimation of means and variances, Hypothesis testing, goodness of fit tests, Analysis of variances of one-way and two way classified data, experimental design.
Douglas Montogomery, Design and Analysis of Experiments, 3rd Edition, John Wiley.
Sheldon Ross M., Introduction to Probability & Statistics for Engineers & Scientists, John Wiley
Hogg R. V., Craig A. T., Introduction to Mathematical Statistics, 4th Edition, McMillan

MA703 Linear Algebra (3-0-0) 3
Finite dimensional vector spaces, Algebra of transformations, matrix algebra, solution sets of linear system of equations, eigenvectors, Real symmetric / Complex Hermitian matrices, Algebra of polynomial matrices, Inner product spaces, singular value decomposition, polar decomposition, Applications of linear algebra in signal processing, coding theory and control theory.
Gilbert Strang, "Linear Algebra and Its Applications", 3rd ed., Brooks/Cole, 1998.
David C. Lay, "Linear algebra and its applications", 2nd ed., Pearson, 2000.

MA704 Numerical Analysis (3-0-0) 3
Solution of algebraic transcendental and polynomial equations, Interpolation, Numerical differentiation, Numerical Integration, Integration over infinite intervals, Error analysis, Numerical solution of ordinary differential equations, Numerical solution of partial differential equations, Introduction to finite elements
Jain M.K., Iyengar S.R.K., Jain R.K., Numerical Methods for Scientific and Engineering Computation
Jain M.K., Numerical Solutions of Differential Equations
Mitchell A.R., Wait R., Finite Element Method in Partial Differential Equations

MA705 Operation Research (3-0-0) 3
Introduction and formulation of models: simplex method, duality in LP, Dual Simplex method, sensitivity analysis, transportation and assignment problems, Integer programming, Classical optimization methods, Lagrangian Multipliers and Khun-Tucker Conditions, quadratic programming.
Hamy A. Taha, Operations Research: An Introduction, PHI.

MA706 Probability and Statistical Applications (3-0-0) 3
Probability & Statistics: Introduction, one – dimensional random variables, two and higher dimensional random variable, marginal and conditional distributions, independence of random variables, variances and correlations, Distributions: Sampling Theory. Parameter Estimation: Hypothesis testing, goodness of fit tests, Data Analysis, Linear regression.
Meyer P.L. Introduction to Probability & Statistical Applications –, Amerind Publishing Co
Sheldon Ross M., Introduction to Probability & Statistics for Engineers & Scientists, John Wiley
Jain M K.. Iyengar S R K., Jain R K., Numerical Methods for Scientific and Engineering Computation, Wiley Eastern Publi.

MA707 Random Processes (3-0-0) 3
Overview of Probability, Random variables, Probability functions, Functions of Random variables some important probability distributions, sequence of random variables, limit theorem, Random Correlation function, power spectral densities, linear systems with random inputs, Gaussian and Poisson process.
Gray R.M. and Davisson L.D., "An Introduction to Signal Processing" (downloadable from internet)
Papoulis A, Probability, "Random variables and Stochastic Processes". McGraw Hill, 1984.

MA708 Statistical Methods (3-0-0) 3
Probability and Statistics, Introduction , One dimensional random variables, Two and higher dimensional, random variables, marginal and conditional distributions, independence of random variables, variances and correlations. Distributions: Sampling theory. Parameter estimation: Hypothesis testing, Goodness of fit tests. Data Analysis, Linear regression.

Meyer P.L. Introduction to Probability & Statistical Applications –, Amerind Publishing Co
Sheldon Ross M., Introduction to Probability & Statistics for Engineers & Scientists, John Wiley
Jain M. K.. Iyengar S. R. K., Jain R. K., Numerical Methods for Scientific and Engineering Computation, Wiley Eastern

CA900 Advanced Database Management Systems 3
Basic concepts and terminology, software architecture for data sharing, federated database management system, designing distributed databases, distributed transactions, client server architecture, multimedia databases, object oriented DBMS
Tamer Ozsu, Patrick Valduring: Principles of Distributed Database systems, PHI
Ceri S, Pelagatti S: Distributed Databases: Principles and Systems, McGraw Hill, New York

CA901 Advanced Operating Systems 3
An overview of operating system functions, Distributed operating systems, Protection and security, Multiprocessor operating systems, Database operating systems, Concurrency control, Object oriented operating systems and its characteristics, Case studies of OS such as UNIX OS, Netware OS, Windows etc,
Mukesh Singhal Niranjan, Shivorothri G: Advanced concepts in Operating Systems
Andrew S Tenanbaum: Distributed Operating systems

CA902 Analysis and Design of Algorithms 3
Fundamentals of Algorithmic Problem Solving, Fundamental data Structures, Fundamentals of the Analysis of Algorithm Efficiency, Brute Force, Divide-and-Conquer, Decrease and Conquer, Transform and Conquer, Space and Time Tradeoffs, Dynamic Programming, Greedy Technique, Limitations of Algorithm Power , Coping with the Limitations of Algorithm Power.
Anany Levitin, Introduction To The Design And Analysis Of Algorithms,2003, Pearson Education

CA 903 Data Warehousing and Data Mining 3
Data Warehousing, Data Mining, Association Rules, Classification, Clustering, Decision Trees, Other Techniques for Data Mining, Web Mining, Searching Techniques.
Jiawei Han, Micheline Kamber: Data Mining: Concepts and Techniques, 2001, Harcourt India Pvt.
Arun Poojary K., Data Mining Concepts, 2001, Hyderabad Press

CA 904 Distributed Systems 3
Evolution of modern operating systems, Design Goals, transparencies and fundamental issues in Distributed systems, Temporal ordering of events, Global state detection, Physical clocks, Mutual Exclusion Algorithms, Interprocess Communication, Deadlocks in distributed systems, Load balancing techniques, Distributed databases
Shivarathi & Shingal, Advanced Operating Systems
Randy Chow, Distributed Operating Systems and Algorithms

MA900 Advanced Graph Theory 3
Trees, Eulerian Graphs and Digraphs, Matchings, Connectivity, Coloring, Perfect graphs, Domination
Douglas West B.: Introduction to Graph Theory, 2001, Prentice Hall of India
Harary F.: New Directions in the Theory of graphs, Academic Press, New York.

MA901 Advanced Mathematical Methods 3
Ordinary Differential Equations, Local Analysis, Difference equations, Perturbation Method, Global Analysis
Earl A Coddington: An Introduction to Ordinary Differential Equations, PHI.
Carl Bender M.,Steven Orszag A:Advanced Mathematical Methods for Scientists & Engineers,McGraw Hill

MA902 Computational Fluid Dynamics 3
Basic concepts and equations of fluid dynamics, non-dimensional forms, boundary layer equation, grid generation, grid refinement, adaptive grids, finite difference methods, explicit and implicit methods, fundamentals of fluid flow modeling, upwind scheme
Yuan S.W., Fluid Mechanics, PHI
Patankar S.V., Numerical Heat Transfer, McGraw Hill
White F.M., Viscous Fluid Flow, McGraw Hill

MA903 Life Testing and Reliability Estimation 3
Exponential failure models, Gamma and Weibull distributions, Normal and related distribution, Mixtures and Compound distributions
Sinha S.K.,Kale B.K.: Life Testing and Reliability Estimation , Wiley Eastern Ltd.
Lewis E.E: Introduction to Reliability Engineering, John Wiley & Sons Inc.

MA904 Linear Algebra and Matrix Theory 3

Matrices and linear Equations, Types of Matrices, Vector Spaces and linear transformations, Inner Products, Orthonormal basis, Gram–Scharidt Orthogonalization Process, Vector Norms, Matrix Norms, Eigen values and Eigen Vectors, Triangular, Jordon and Rational Canonical forms and applications, Perturbation theory.

David Lewis W.: Matrix Theory, Allied Publications Ltd

Gilbert Strange: Linear Algebra and Its Applications III Edition, Thomson Leaning(Int.Student Edition)

MA905 Number Theory 3

Divisibility and Congruences, Some functions of Number Theory, Some Diophantine Equations, Primes and Multiplicative Number Theory, Algebraic Numbers.

Niven I,Zuckermann H,Montgomery H.L: An Introduction to the Theory of Numbers, 2000,Vth Edition, John Wiley .

HardyG.H., Wright E.L: Introduction to the Theory of Numbers, 1980, Vth Edition, Oxford University Press

Koblitz N.: Introduction to Number Theory and Cryptography, 1994, II Edition, Springer- Verlag

MA906 Numerical Methods 3

Finite difference discretization, consistency and stability, explicit and implicit methods, finite difference applications in heat transfer, finite volume method, application of FVM in diffusion and convection problems, finite volume methods for unsteady problems, Finite Element Method: Weighted Residual and Variational formulations, applications of FEM to 1D and 2D problems in fluid flow and heat transfer.

Smith G.D., Numerical Solution of Partial Differential Equations, Clarendan Press

Jain M.K., Numerical Solution of Differential Equations, Wiley Eastern

Patanker S.V., Numerical Heat Transfer and Fluid Flow, McGraw Hill

MA907 Numerical Solution of Differential Equations 3

Elements of Ordinary Differential IVP Approximation, Single Step Methods, Systems of differential Equations, Higher order differential equations, Multistep methods, Implicit methods, General linear multistep methods, Difference methods for boundary value problems in ordinary differential equations, Difference methods for Parabolic Partial Differential Equations, *Hyperbolic Partial Differential Equations, Elliptic Partial Difference Equations.*

Jain M.K.: Numerical Solution of Differential Equations,1984, Wiley Easter

MA908 Operations Research 3

Linear Programming, Network Analysis, Queuing Theory

Hamdy Taha A.: Operations Research, Vth Edition Prentice Hall of India

Hiller, Liberman : Introduction to Operations Research, Prentice Hall of India

MA909 Stochastic Processes, Queueing Theory and Reliability 3

Preliminaries of Probability, random variables, probability distributions, Stochastic processes Queueing Models, Reliability Theory

Medhi J.: Stochastic Processes, New Age International Publishers

LEWIS E.E.: Introduction to Reliability Engineering, John Wiley & Sons Inc.

MA910 Data Structures and Network Algorithms 3

Trees and Graphs, Disjoint sets and compressed Trees, Heaps, Search Trees, Self-Adjusting Binary trees, Linking and cutting Trees, Minimum spanning trees, shortest path trees, flows, cuts, minimum cost flows, bipastite matching, network flows. Algorithms for Non-Bipartite Matching.

MA911 Network Flow Optimization 3

Networks, Paths and cuts, flows and capacities, Analysis of flows, Matching Theory and assignment problems, potentials and spans, networks with linear costs, optimal flows and potentials algorithms for convex costs, Linear systems of variables.

MA912 Monotropic Optimization 3

Optimization and equilibrium, examples of Monotropic programming, duality and existence of solutions, boundedness property, decomposition, applications to network flow optimization, Basic Descent algorithms, Fortified and Discretised Descent, Simplex methods, Generalised out-of-kilter algorithm, Parametric monotropic programming.

MA913 Combinatorics 3

Study of known configurations; Investigation of unknown configurations; Counting of configurations; Enumeration of configurations; optimization of configurations.

MA914 Combinatorial Problems 3
Basic enumeration; the sieve; permutations; Labelled and Unlabelled Trees; spanning Trees; 1-factors; the Ising problem; restricted permutations; Parity and Duality; connectivity Factors of graphs; Independent sets of Points; chromatic number; external problems for graphs; spectra of graphs; Automorphisms of graphs; Hypergraphs; Ramsey theory; the Reconstruction Problem.

MA915 Combinatorial Optimization 3
Polynomial Boundedness; network optimization problems; Greedy algorithms; Matroid theory ; Matroid Intersections; Matroid Partitious; Primal weighted Intersection algorithm; Duality Theory; Motroid polyhedra ; Primal-Dual weighted Intersection Algorithm; Matroid Parity; Generalizations.

MA916 Convex Analysis 3
Definitions, Algebra of convex sets, Topological properties, Duality Correspondences, representation and inequalities, differential theory, constrained extremum Problems, Saddle Functions and Minimax Theory, Convex Algebra.

MA917 Conjugate Duality and Optimization 3
Convexity and Duality, Examples of convex optimization Problems, conjugate convex Functions in paired spaces, Dual Problems and lagrangiens Examples of Duality schemes, continuity and derivatives of convex functions, solutions to optimization Problems, computation of conjugates and subgradients, Integral Functionals, Applications.

MA918 Nonlinear Programming 3
Linear Inequalities and Theorems of the Alternative; Convex sets; Convex and concave Functions; Saddle Point Optimality criteria of Nonlinear Programming without Differentially; Differential convex and concave Functions; optimality criteria in nonlinear Programming with differentiability; Duality in nonlinear Programming; generalizations of convex functions; Quasi convex, strictly quasi convex; Pseudoconvex; Optimality and Duality for generalized convex and concave Functions; Optimality and Duality in the presence of nonlinear equality constraints.

MA919 Selected Topics in Computational Systems Science and Engineering. 3

MA920 Non-smooth Analysis 3
Generalised Gradients; Generalized Jacobians; Differential Inclusions; Calculus of Variations; Finite Lagrangians; the Maximum Principle in Optimal Control; Implicit Functions; Directional Contractions and Fixed Points. Hamiltonian Trajectories and Boundary Value Problems.

MA921 The Theory of Subgradients 3
Non-differentiable Functions; Tangent Cones; Normal vectors; subderivatives; subgradients; lipschitzian cases; subgradients as limits; Stationary Points; Sub differential Calculus; Duality and Marginal Functions; Monotonicity of subgradient Multifunctions.

MA922 The Theory of Max-Min or Minimax 3
Best approximation by algebraic polynomials-discrete as well as continuous cases; The discrete minimax problem unconstrained as well as constrained cases; the generalized Problem of Nonlinear Programming. The continuous minimax problem; special cases.

MA923 Non-Differentiable Optimization 3
Aggregate subgradient Methods for unconstrained convex minimization; Methods with subgradient locality Measures for Minimizing non-convex functions; methods with subgradient deletion rules for unconstrained non-convex minimization; Feasible point methods for convex constrained minimization problems; Methods of feasible directions for non-convex constrained problems; Bundle Methods; Numerical examples; subgradient methods with space dilation; computational algorithms.

DEPARTMENT OF PHYSICS

PH900 Advanced Solid State Physics 4

Crystal Structure, Symmetry operations; Symmetry elements, Point groups, and space group. Lattice Vibration and Phonons; optical properties in the infrared phonons; inelastic scattering Thermal Properties of Solid-Various theories of lattice specific heat; Free Electron Theory of Solid Heat capacity of the electron gas; spin paramagnetism of free electron; Band Theory of Solid-Nearly free electron model; origin of energy gap; Bloch theorem; Kronig and – Penney model; concepts of hole; effective mass of electron in crystals; tight band electron approximation; application to a simple cubic lattice; Brillouin zone; density of state; overlapping energy levels. Semiconductors, Superconductivity, theoretical and experimental aspects.

Solid State Physics – Asheroft and Mermin
Introduction to Solid State Physics C. Kittel

PH901 Advanced Crystallography 4

Symmetry of crystals, crystal projection , reciprocal lattice, diffraction of x-rays, Factors affecting intensity of diffraction beams, experimental techniques of structure analysis.

Elements of x-ray crystallography – L.V. Azaroff, Mc Graw Hill

PH902 Materials Preparation Techniques 4

Crystal growth equilibrium, growth methods – solid-solid, liquid-solid and vapour-solid transformation, Growth from aqueous solutions, hydrothermal, high temperature solution and zone melting techniques.

Growth of single crystals – R.A. Laudise

PH903 High and Ultra High Vacuum Technology 4

Production and measurement of vacuum, behaviour of gases at low pressure, vacuum materials, vacuum assembly techniques, design of vacuum systems and ultra high vacuum systems.

Hand book of thin film technology – L.I. Maissel & R. Glang, Mc Graw Hill Publ.
Design & construction of small vacuum system – G.W. Green, Chapman & Hall publ.

PH904 Crystal Growth and Characterization 4

Basic concepts, Nucleation phenomena, Mechanisms of Crystal Growth, Dislocations, Crystal dissolution, Materials preparation and phase diagrams. Experimental methods of crystal growth, Growth from liquid-solid equilibria, Growth from vapor-solid equilibria. Mono-component and multi-component techniques. Thin film growth methods including LPE, MOCVD, MBE, PLD, etc. Crystal characterization.

Crystal Growth for Beginners : Fundamentals of Nucleation, Crystal Growth and Epitaxy by Ivan V. Markov, World Scientific, Singapore, 1996.
Growth of Single Crystals by R. A. Laudise, Prentice-Hall, 1970

PH905 Properties of Materials 4

Structure of metals – elements and simple alloys. Semiconductors – properties and structure – junctions, metal-metal, metal-semiconductor and p-n junctions. Properties of insulators – electrical, optical and magnetic.

Introduction to solids – LV Azaroff – Tata Mc Graw Hill, New Delhi.

PH906 Electronic Thin Film Science 4

Thin film deposition and Layered structures, Surface energies, diffusion in solids, stress in thin films, Surface Kinetic Processes, Homoepitaxy : Si and GaAs, Heteroepitaxy and Superlattices, Electrical and Optical Properties of heterostructures, Quantum wells, Barriers, Schottky barriers and Interface Potentials, Interdiffusion, Thin film reactions, Morphological changes in thin films.

Electronic Thin Film Science for Electrical Engineers and Materials Scientists by King-Ning Tu, James W. Mayer and Leonard C. Feldmann, Macmillan Pub. Co, New York, 1987
Thin Film Physics by O. S. Heavens, Methuen & Co. Ltd, London, 1970

PH907 Experimental Techniques for Characterisation of Materials 4

Metallographic Techniques – Optical Microscopy, Image Analysis. Diffraction Method – Characterisation of X-ray diffraction. Crystallographic Texture Measurement and Analysis, X-ray diffraction residual stress techniques, Neutron Diffraction. Resonance Methods – Electron Spin Resonance, Ferromagnetic Resonance, Nuclear Magnetic Resonance, Mossbauer Spectroscopy.

Electron Optical Methods – Analytical Transmission Electron Microscopy, Scanning Electron Microscopy, Scanning Tunneling Electron Microscopy (STEM), Electron Probe X-ray Micro-analysis. Classical,

Electrochemical and Radiochemical Analysis- Classical Wet Analytical Chemistry, Volummetry, Electrogravimetry, Electrometric Titration, Radio Analysis.
Spectroscopy and Other Methods-Atomic Absorption Spectrometry, X-ray Spectrometry, Infrared Spectrometry, Raman Spectroscopy, Augar Electron Spectroscopy, Field Ion Microscopy, Atom Probe Micro-analysis, Electric, Dielectric and Magnetic Properties characterisation.
Practical Electron Microscopy, Vol-1 by Edington J.W.
Elements of X-ray diffraction by B.D. Cullity.

PH908 Thin Film Technology and Devices 4
Methods of preparation, theories of growth, measurement of film thickness, properties – mechanical, electrical, structural characterization, Pattern generation, thin film devices.
Hand book of thin film technology – L.I. Maissel & R. Glang, Mc Graw Hill Publ.
Thin film phenomena – K L Chopra, Mc Grew Hill Publ.

PH909 Modern Optics 4
Propagation of light; Ray optics. Plane harmonic waves. Polarization, Fresnel's Equations. Coherence and Interference-Multiple beam Interference. Diffraction. Optics of solids. Thermal radiation and light quanta, optical spectra-Amplification of Light and lasers. Fibre Optics- Modes in step-index fibers and their Intensity patterns, LP modes, Dispersion and mode cut-off.
Introduction to Modern Optics by Grant R. Fowles, (2nd Ed.), Dover Pub. Inc. New York, 1989.
Optics by Eugene Hecht, (4th Ed.) Pearson Ed. Indian Ed. 2002

PH910 Laser Physics 4
The Einstein coefficients, Optical amplification and population inversion; Line shape functions:
Laser Rate Equations: Theshold condition for laser oscillation, Optimum output coupling; Q-switching and mode locking in lasers, Single longitudinal and single transverse mode oscillation; Laser systems: Ruby, Nd:YAG, Nd: Glass lasers; Tunable lasers: Ti-Sapphire laser; Semiconductor lasers: quantum well lasers,
Lasers: Theory and Applications, Thyagarajan K and Chatak A.K. – Plenum Press New York.
Introduction to Laser Physics, Koichi Shimoda. Spriger – Verlag new York Tokyo 1984.

PH911 Numerical Methods and Programming 4
Interpolation - Neuton's Langrange's Aitken - Neville's, Hermite's, spline techniques. Incurse interpolation-solution of transcendental and polynomial equations – Neuton – Rapson method-Iterative methods-Successive bisection. Numerical differentiation and integration methods- Simpsons's rule- Gaussion quadrature formula-Monte-Carlo method.
Linear systems and Matrices-Cramer's rule-Jacobi method-Eigen value problems. Solution of differential equations- Euler, Picard, Runge-Kutta methods. Polynomial and trigonometric approximations.
Numerical Methods for Scientists and Engineers, H.M. Antia – Tata Mc Graw-Hill.
Numerical Methods for Methetics, Science and Engineering. Yohn H. Mathews – Prentice-Hall.

PH912 Advanced Magnetic Resonance 4
Resonance theory, relaxation times. Nuclear Magnetic Resonance (NMR): Bloch equations,
Wide-line and high resolution NMR. Electron Spin Resonance (ESR): Zeeman interaction (g- tensor), Nuclear hyperfine interaction, Nuclear quadrupole interaction, Application to transition metal ions and free radicals. Principles of Nuclear Quadruplole Resonance (NQR): Zeeman effect, Phase transition. Double resonance: Electron Nuclear Double Resonance (ENDOR), Electron Electron Double Resonance (ELDOR), Nuclear Magnetic Double Resonance (NMDR), Optical Detection of Magnetic Resonance (ODMR). Zero Field Nuclear Magnetic Resonance, Ferromagnetic Resonance, Spin Wave Resonance. Practical aspects of resonance spectrometers: NMR, ESR and ENDR. Pulsed spectrometers: Measurement of relaxation times.
Introduction to Magnetic Resonance and Application to Chemistry and Chemical Physics. A. Carrinton and A.D. McLechlan Chapman & Hall 1979
Electron Spin Resonance, J.E. Wertzd and J.R.Bolton, Chapman and Hall, New York 1972.

PH913 Semiconductor Materials and Devices 4
Review of atomic structure and statistical mechanics : Schrodinger wave equation- Particle in a periodic potential well. Crystalline and amorphous; inorganic and organic; elemental and compound semiconductors. Band models. Impurities and Defects. Bulk and thin film preparation methods. Equilibrium and non-equilibrium characteristics. Carrier transport phenomena. Optical and dielectric properties. Oxidation methods, Diffusion, Ion implantation, Metallization and Etching processes. The PN Junction Diode: Basic device technology; Heterojunction. Bipolar transistor, Microwave and power transistor and related devices. Metal-semiconductor

contacts. JFET, MESFET, MOSFETs : Device structures and characteristics. Transferred-electron devices - Gunn effect. Principles of Photonic devices - LEDs, Diode, LASERs, Photodiodes. APDs and Solar Cells.
Semiconductor Materials and Devices by M. S. Thyagi, John Wiley & Sons, 1991
Principles of Growth and Processing of Semiconductors by S Mahajan and K S Sree Harsha, McGraw-Hill, 1998.

PH914 Applied Quantum Mechanics 4
Schrodinger wave equation and applications: free electrons in 3-dimensions, harmonic oscillator, Hamilton's equations, Hydrogen atom, Many electron atoms, Molecules, Crystals, Bonds in solids. Transitions, Tunneling, Statistical Physics, Bosons and Fermions, Electrons and Phonons, Electron Dynamics, Lattice vibrations, Operators,
Quantum Optics: Coherent states, Many body effects, Magnetism.
Applied Quantum Mechanics by Walter A. Harrison, World Scientific, 2000
Quantum Mechanics : Theory and Applications (fourth edition) by Ajoy Ghatak and S Lokanathan, Macmillan, 1975

PH915 Electronic Materials and Devices 4
The Crystalline nature of materials, bonding, Space lattices and X-ray diffraction. Wave mechanics of electrons, quantum wells and tunneling, particle in a box, Periodic Potentials, Electrical transport, Quantum statistics, Semiconductor Devices, PN Junction, BJT, MOSFET. Dielectric effects - Piezoelectric, Pyroelectric and Ferroelectric materials. Optoelectronic devices : Photodiodes and Lasers. Magnetic materials: dia, para, ferro and ferrimagnetism. Superconductivity. London's equations and BCS Theory.
Electronic Materials and Devices by David K Ferry and J.P. Bird, Academic Press, 2001
Electronic Properties of Materials by Rolf E Hummel , Narosa Pub. House 1994.

DEPARTMENT OF HUMANITIES, SOCIAL SCIENCES AND MANAGEMENT

HU601 Accounting and Financial Management (3-0-0) 3

Principles of accounting. Management of business. Accounting system as source of financial information for decision making. Managerial uses of Accounting System. Financial Accounting. Financial Analysis. Accounting Systems for planning, Control and decisions. Costing. Budgeting.

IM Pandey, Elements of Management Accounting, Vikas Publishing House, 1978.

HU613 Managerial Economics (3-0-0) 3

Business objectives and business decisions. Demand Analysis, forecasting and market structure. Production and cost analysis. Pricing and profit Management. Decision techniques and capital budgeting. National Income. Money System.

VL More, Paul Samuel and GS Gupta, Managerial Economics, McGraw-Hill, 1985.
Joel Dean, Managerial Economics, Prentice Hall, 1987.

HU900 Quantitative Methods for managerial Decisions 4

Basic concepts of probability, probability distributions, decision trees and different decision criterion. Linear Programming: Sensitivity analysis. Transportation problem. Integer programming, goal programming and dynamic programming. Introduction to Queueing theory, Simulation and Game theory. Nonlinear programming.

H.M. Wagner, Principle of Operations Research, Prentice Hall.
F.S. Hiller and G.J. Liebermann, Introduction to Operations Research, Holden Day, 1967.
H.A. Taha, Operations Research, 2nd edition, Macmillian, 1982.

HU901 Marketing Research 4

Introduction to Market/ Marketing Research, Research Components, Identification of Research Variables, Qualitative, Quantitative Research; Issues in Market Research, Research Problem definition, Research Methodology, Research Design, Data collection approaches, Sampling, Measurement and scaling, Data Processing, Hypothesis Testing, Statistical analysis of data; Analysis of Variance, Application of Computers in Market Research, Software Packages, Market Research Report Writing, Case studies, Mini Project.

G.A. Churchill, Marketing Research, Chicago Drydin Press, 1983.
P.E. Green and D.S. Tull, Research for Marketing Decision, PHI, 1982.
D.J. Luck, R.S. Rubin: Marketing Research (Seventh Edition), Prentice Hall, 1987.

HU902 Marketing Management 4

Marketing concept. Marketing management process. Marketing environment. Organizational market and buyer behaviour. Marketing Information System and research. Market segmentation, targeting and positioning. Planning marketing tactics. Product, price distribution and promotion decisions, E-Commerce, Ethnic Marketing, E-Marketing, Issues related to IPR, Case studies.

P. Kotler : Marketing Management, Prentice, Hall of India, 1984.
D.J. Dalrymple and L.J. Parsons, Marketing Management, John Wiley, 1982.
R.W. Haas: Industrial Marketing Management, Petrocelli / Charter, 1974.

HU903 Managerial Accounting 4

An overview of the accounting process, Nature and scope of corporate accounting, Elements of cost; Classification and distribution of overheads, Cost accounting flows, Financial accounting concepts, Impact of exchange rates, Balance sheet preparation, Financial statement analysis, Cost and management decisions: Product costing. Break-even analysis and cost profit relationships. Capital and cash budgeting for return on capital, periodic and continuous budgeting, budgetary control. Reporting systems for control: Scope for computerization.

R.N. Anthony, Management Accounting Principles, Irwing-Taraporewala.
Taylor & Shearing, Financial and Cost Accounting for Management, ELBS.
Horngren, Accounting for Management Control, Prentice Hall.

HU904 Management of Human resources in Organizations 4

An introduction of the personal and interpersonal dynamics of the organization – Managing high performance: A challenge – Work motivation: Theoretical and behavioural framework. Improving work motivation in organizations. Human Resources Development (HRD): Behaviour scientist's view. Human capacity: Organizational change and development. T group and sensitivity training, management by objectives (MBO), transactional analysis (TA), quality circles (QC), performance appraisal (PA), AND training programmes. Managing human resources and organizational development: The present status.

C.R. Anderson, Management : Skills, Functions, and Organizational Performance, Wm. C. Brown, 1984.
W.L. French, C.H. Bell, and R.A. Zawacki, Organizational development: Theory, Practice and Research, Irwin, 1989.
P. Hersey and K.H. Blanchard, Management of Organizational Behaviour: Utilizing Human Resources. Prentice Hall, 1988.

HU905 Organizational Behaviour and Implications for Management 4

An Introduction of Organizational Behaviour, Historical development and basic concepts, Understanding a social system, Mainsprings of motivation, Human needs and motivating employees. Interpreting motivational models of Maslow, Herzberg, Vroom, and McClelland. Job satisfaction and work performance. Appraising and rewarding performance. Leadership and organizational development. Supervision and participation. Interpersonal and communication problems within the organizations. Organizational Development Techniques: Their applications in Indian Organizations. Japanese Management: Basic philosophy and features. Comparative analysis of American and Japanese management. Organizational behaviour in perspective.

Davis, K. Human behaviour at work:Organizational behaviour. NY: The GrollerBusiness Library, 1987.
Luthans, F. Organizational behaviour. NY: McGraw, 1995.
Hersey, P. & Blanchard, K.H. Management of organizational behaviour: Utilising human resources. Prentice- Hall, 1988.

HU906 Research Methodology – Methods & Techniques 4

Research Methodology: An introduction. Defining the Research Problem. Research Design. Sampling Design. Measurement and Scaling Techniques. Methods of Data Collection. Processing and Analysis of Data. Sampling Fundamentals. Testing of Hypotheses – I (Parametric or Standard tests of Hypotheses). CHI- Square Test. Analysis of Variance and Covariance. Testing of Hypotheses- II (Non-parametric or Distribution-Free Tests). Multivariate Analysis Techniques. Interpretation and Report Writing. The Computer: Its Role in Research.

Kothari C.R. – Research Methodology- Methods and Techniques, Wiley Eastern, 1990.

HU907 Management Information System4

Various issues revolving around the strategic role of managing information - Purposes of various hardware components comprising the computer system - Internet, Intranet and Extranet - Strategic role of major business applications software - Current operating systems and network support utilities commonly found in a variety of IS environments - Methodologies used to redesign the information infrastructure of the organizational enterprise - Managing systems security and implementing systems wide information controls - Factors to consider when managing international information systems.

Kenneth C. Laudon and Jane Price Laudon, Management Information Systems, Prentice Hall
O'Brien, Irwin, Management Information Systems: Managing Information Technology in the E-Business Enterprise, 2002.

HU908 Strategic Management 4

Introduction to Business Strategy; Industry and Firm Analysis – Industry, Organization, Stakeholders, Market Environment Analysis; Formulation of Business Policy and Strategy; Evaluation and Choice of Business Policy; Strategy Alternatives and Selection; Competitive Dynamics - Game Theory; Corporate and Global Strategy; Strategy Implementation. Case Analysis -The cases are about real world business situations, which provide an opportunity to apply the concepts, discussed in class as well as further develop ability to think about business strategy.

Hitt, Michael A., R. Duane Ireland, and Robert E. Hoskisson (2002), Strategic Management:Competitiveness and Globalization, Cincinnati, Ohio, South- Western College Publishing.
George A. Steiner, John R. Miner and Edmund R. Gray (1989), Management Policy and Strategy, Maxwell MacMillan International Editions.