

## EC2K 301 : ENGINEERING MATHEMATICS III.

### Module I: Linear algebra I (13 hours)

Vector spaces - Subspaces - Linear dependence and independence - Bases and dimension Linear transformations - Sums, products and inverses of linear transformations - Linear operator equations

### Module II: Linear algebra II (13 hours)

Rank and equivalence of matrices - Quadratic forms - Characteristic values and characteristic vectors of a matrix - Transformation of matrices - Functions of a square matrix

### Module III: Probability distributions (13 hours)

Random variables - Binomial distribution - Hypergeometric distribution - Poisson distribution - Mean and variance of probability distribution - Chebyshev's theorem - Poisson processes - Geometric distribution - Continuous random variables - Normal distribution - Uniform, log-normal, gamma, beta and Weibull distributions

### Module IV: Statistical inference (13 hours)

Populations and samples - Sampling distributions of mean and variance - Point estimation Interval estimation - Bayesian estimation - Null hypotheses and significance tests - Hypothesis concerning one mean - Relation between tests and confidence intervals - Operating characteristic curves - Inferences concerning two means - Randomization and pairing Estimation of variances - Hypotheses concerning one variance - Hypotheses concerning two variances - Test of goodness of fit

## EC2K 302 : ELECTRICAL CIRCUITS & NETWORK THEORY

### Module I (10 hours)

Circuit elements and sources - Dependent and independent sources - Network theorems - Review of Thevenin's & Norton's theorem - Superposition theorem - Maximum power transfer theorem - First and second order circuits - Zero state response - Zero input response Complete Response - Step Response and Impulse response of first and second order circuits

## Module II (13 hours)

S-Domain Analysis of Circuits, Review of Laplace transform - Convolution theorem and convolution integral- Transformation of a circuit into S-domain - Transformed equivalent of Inductance, capacitance and mutual inductance - Impedance and admittance in the transform domain - Node analysis and mesh analysis of the transformed circuit - Nodal admittance Matrix- mutually coupled circuits - Input and transfer immittance functions - Transfer functions - Impulse response and Transfer function - Poles and Zeros - Pole Zero plots - Sinusoidal steady state~ from Laplace transform inversion, - Frequency response. by transform evaluation on j-axis - Frequency response from pole-zero plot by geometrical interpretation

## Module III (16 hours)

*Two port networks:* Two port networks - Characterization in terms of impedance - Admittance-Hybrid and transmission parameters - Inter relationships among parameter sets Reciprocity Theorem - Interconnection of two port networks - Series, parallel and cascade Network functions - Pole zero plots and steady response from pole ~ zero plots.

port network Characteristic impedance of a symmetrical two port network - Image impedance - of a symmetrical two port network - Properties of a symmetrical two port network - Propagation constant *Symmetrical two port networks:* T and  $T^{-1}$  Equivalent of

*Symmetrical Two Port Reactive Filters:* Filter fundamentals - Pass and stop bands - Behavior of iterative impedance - Constant - k low pass filter - Constant - k high pass filter - I derived T and  $T^{-1}$  sections and their applications for infinite attenuation and filter terminations - I .pBand pass and band elimination filters '

## Module IV (13 hours)

Synthesis: Positive real functions - Driving point functions - Brune's positive real functions - Properties of positive real functions - Testilg driving point functions - Application of maximum module theorems., Properties of Hurwitz polynomials - Even and odd functions., Strum's theorem - Driving point synthesis - RC elementary synthesis operations - LC net.: work synthesis - Properties of RC network functions - Foster and Cauer forms of RC and RL networks

## EC2K 303 : SOLID STATE DEVICES

### Module I (13 hours)

Energy bands and charge carriers in semiconductors., Direct and indirect band gap semiconductors - Concept of effective mass - Intrinsic and extrinsic semiconductors - Fermi level - Electron and hole concentrations at equilibrium - Temperature dependence of carrier concentrations - Conductivity and mobility - Quasi Fermi level- Diffusion and drift of carriers -

Einstein relation.- Continuity equation

Module II (13 hours)

PN junctions - Contact potential - Space charge at a Junction - Current flow at a junction Carrier injection - Diode equation - Minority and majority carrier currents - Capacitance of pn junctions - Reverse bias breakdown - Zener and avalanche breakdown - Abrupt and graded junctions - Schottky barrier - Rectifying and ohmic contacts - Tunnel diode - Varactor diode - Zener diode - GaAs isotype diodes .

Module III (13 hours)

Charge transport in a bipolar junction transistor - Current and voltage amplification - Concept of load line - Analysis of transistor currents - Ebers-Moll model- Early effect - Concept of Early voltage - Avalanche breakdown in transistors - Transit time effects - Kirk effect- Hetero junction GaAs BJTs - UJT - Concept of dynamic negative resistance

Module IV (13 hours)

Junction FET - Pinch off and saturation - Gate control- VI characteristics - MOS capacitor- Accumulation, depletion and strong inversion - threshold voltage - MOSFET - p channel and n channel MOSFETs - Depletion and Enhancement mode MOSFETs' - Substrate bias effects - Floating gate MOSFETs - Short channel effects - GaAs MESFET

EC 2K 304 : BASIC ELECTRONICS

Module I (10 hours)

Thermionic emission - High field emission - Secondary emission - Richardson's equation Child-Langmuir law - Vacuum tubes - Diodes, triodes and pentodes - Their characteristics & parameters - Amplification .

Module II (13 hours)

Resistors - Types and tolerance - AF and RF chokes - Transformers - Types of capacitors - Specifications & constructional details - Rectifiers & filters - Halfwave, full wave and bridge rectifier configurations (analysis & design) - Ripple factor - Rectification efficiency - Peak inverse voltage - Transformer utilization factor - Analysis & design of C, LC, CLC and CRC filters, m - phase rectifiers

Module III (12 hours)

Diode circuit models - DC - low frequency small signal and high frequency small signal' models - Voltage multiplier circuits, diode clipping and clamping circuits - Regulators - Zener diode regulator - Series pass transistor feedback voltage-regulator - Emitter follower output regulator - Short circuit protection - Load and voltage regulation curves

#### Module IV (17 hours)

BJT circuit models - Hybrid  $\pi$  model" Small signal low frequency and small signal high frequency models of BJT - Effect of temperature on BJT model parameters -  $h$  parameter equivalent circuits of CC, CE and CB configurations - Current gain - voltage gain - input and output impedances - Small signal low frequency and small signal high frequency models of MOSFET - Effect of temperature on MOSFET model parameters - Equivalent circuits of CS and CD configurations

### **EC2K 305: DIGITAL ELECTRONICS**

#### Module I (12 hours)

Basic digital circuits - Review of number systems and Boolean algebra - Simplification of functions using Karnaugh map and Quine McCluskey methods - Boolean function implementation - Code converters - Encoders and decoders - Multiplexers and demultiplexers ROMs - Combinational logic design using decoders - Multiplexers and ROMs

#### Module II (12 hours)

Arithmetic circuits - Half and full adders and subtractors - Carry look ahead adders - BCD adder - Multiplier and divider circuits - Sequential circuits - Latches and flip flops (RS, JK, D, T and Master Slave) - Design and analysis of ripple counters - Shift registers - Johnson and ring counters

#### Module III (14 hours)

Design and analysis of sequential circuits - General model of sequential networks - State diagrams" Synchronous counter design - Analysis of sequential networks - Derivation of state graphs and tables - Reduction of state table - Sequential network design

#### Module IV (14 hours)

Logic families - Fundamentals of RTL, HL, DTL and ECL gates - TTL logic family - TTL transfer characteristics - TTL input and output characteristics - Tristate logic - Schottky and other TTL gates - MOS gates - MOS inverter - CMOS inverter - Rise and fall time in MOS and CMOS gates - Speed power product - Interfacing BJT and CMOS gates - Semiconductor memories

### **EC2K 306 : ELECTRICAL ENGINEERING**

#### Module I: DC machines (10 hours)

Types of DC machines - DC generators - emf equation - Open circuit and load characteristics of different types of DC generators - DC motors - Principle of operation - Types - Torque equation - Characteristics - Starters

### Module II: Transformers (10 hours)

Principle of operation - emf equation - Phasor diagram - Equivalent circuit - OC and SC tests - Basic principles of auto transformer and three phase transformer

### Module III: AC machines (17 hours)

Alternator - Rotating field - Frequency effect of distribution of winding - emf equation Losses and efficiency of synchronous motor - Torque equation - Starting methods - Induction motor - Constructional features - Principle of operation of 3 phase induction motor - . Vector diagram and equivalent circuits - Starting and speed control of squirrel cage and wound rotor induction motor

### Module IV: Electrical measurements (15 hours)

Principle of moving coil, moving iron and dynamometer type instruments - Extension of range of voltmeter and ammeter - Measurement of 3 phase power by two wattmeter method ~ DC slidewire, potentiometer - ,Wheat stone bridge - Kelvin's double bridge' - AC bridges - Schering bridge, Maxwell's bridge - Principle of energy meter

### EC2K 307(P) : BASIC ELECTRONIC ENGINEERING LAB

1. . . Series resonant and parallel resonant circuits - voltage and current amplification
2. Diode & Zener diode characteristics - dc and dynamic resistance
3. Constant-k low pass and high pass filters
4. First and second order LPF /HPF /BPF with R and C for a given cut-off frequency,
5. Clipping circuits with diodes
6. Clamping circuits & voltage multipliers
7. Half wave rectifier with C, LC & CRC filters
8. Full wave rectifiers with C, LC & CRC filters
9. Zener diode regulator with emitter follower output - regulation curves
10. UJT characteristics & the relaxation oscillator
11. CB configuration.. determination of parameters
12. MC!;: configuration - determination of parameters
13. SFET characteristics in CS and CD modes

### EC2K 308(P) : ELECTRICAL ENGINEERING LAB

1. Plot open circuit characteristics of DC shunt generator for rated speed - Predetermine O.C.C. for other speeds - Determine critical field resistance for different speeds
2. Load test on DC shunt generator - Plot external characteristics - Deduce internal characteristics
3. Load test On DC series motor - Plot the performance characteristics

4. OC and SC tests on single phase transformer': Determine equivalent circuit parameters
  - Predetermine efficiency and regulation at various loads and different power factors
  - verify for unity power factor with a load test
5. Load test on 3 phase cage induction motor - Plot performance curves
6. Resistance measurement using a) Wheatstone's bridge b) Kelvin's double bridge
7. Measurement of selfinductance, mutual inductance and coupling coefficient of a) Transformer windings b) air cored coil
8. Power measurement
9. Three voltmeter method b) three ammeter method
10. Power measurement in 3 phase circuit - Two wattmeter method
11. Extension of ranges of ammeter and voltmeter using shunt and series resistances

#### ENGINEERINEC2K 401 G MATHEMATIGS IV

##### Module I: Functions of a complex variable & applications I (13 hour~)

Functions of a complex variable - Analytic funct~ons,~ Cauchy-Riemann equations - Elemen- ' tary functions ofz - Conformal mapping - Bilinear transformation - Schwarz-Christoffel trans- formation - Transformation by other functions

##### Module II: Functions, of a complex variable & applications II (13 hours) ,

Integration in the complex plane - Cauchy's integral theorem - Cauchy's integral formula Series of complex terms -Taylor's series - Laurent's series - Residue theorem - Evaluation of real definite integrals - Complex inverse int'egral

##### Module III: Ordinary differential equations & special functions (13 hours)

Power series method of solving ordinary differential equations - Theoretical preliminaries - ' Series solution of Bessel's equation - Modified Bessel functions - Equations solvable in terms of Bessel functions - Identities for Bessel functions - Orthogonality of ;Bessel functions - Applicati(;ms - Legendre polynomials

##### Module IV: Partial differential equations (13 hours)

Derivation of equations - D' Alembert's solution of the wave equation - Characteristic and the classification equations - Separation of variables - Orthogonal functions and the general expansion problem - Further applications - Laplaof partial differential ce transform methods

#### EC 2K 402 ,: PULSE CIRCUITS

##### Module I (13 hours)

RC circuit as integrator and differentiator - Compensated attenuators - Pulse transformer Pulse response. switching characteristics of a BIT- BIT switches with inductive and capacitive loads - Non saturating switches- Emitter follower with capacitive loading - Switching characteristics of a MOS inverter - Resistive load & active load configurations - CMOS inverter - Dynamic power dissipation

Module II (13 hours)

Monostable and astable multivibrators - Collector coupled monoshot - Emitter coupled monoshot - triggering the monoshot - Collector coupled and emitter coupled astable . multi vibrator - Astable - monostable and bistable operations using negative resistance devices - Multivibrators with 555 IC timer . . .

Module III (13 hours)

Digital Phase Locked Loops - Phase detector (XOR & phase frequency detectors) - Voltage Controlled Oscillator (Current starved & source coupled CMOS configurations) - Loop filter - Analysis of PLL -, Typical applications of PLL - Voltage and current time base generators - Linearization- Miller & bootstrap configurations .

Module IV (13 hours)

Digital to analog converters - R-2R ladder - Binary weighted - Current steering - Charge scaling - Cyclic & pipeline DACs - Accuracy - Resolution - Conversion speed - Offset error - Gain error - Integral and differential nonlinearity - Analog to digital converters~ Track and hold operation - Track and hold errors - ADC conversion techniques - Flash converter - Two step flash - Pipeline- Integrating - Staircase converter - Successive approximation converter - Dual slope & oversampling ADCs - .Sigma - Delta ADC

EC 2K 402 ,: SIGNALS AND SYSTEMS

Module I (12 hours)

Introduction to signals and systems - Classification of signals - Basic operations on signals - Elementary signals - Concept of system - Properties of systems - Stability, invertability, time invariance - Linearity - Causality - Memory -Time domain description - Convolution - Impulseresponse - Representation of LTI systems -Differential equation and difference equation representations of LTI systems

Module II (15 hours)

Fourier representation of ,continuous time signals - Fourier transform - Existence of the 'Fourier integral - FT theorems - Energy spectral density and power spectral. density - Frequency response of LTI systems - Correlation theory of deterministic signals - Condition for distortion

less transmission through an LTI system - Transmission of a rectangular pulse through an ideal low pass filter - Hilbert transform - Sampling and reconstruction

Module IU(13 hours)

Fourier representation of discrete time signals - Discrete Fourier series and Discrete Fourier transform - Laplace transform analysis of systems - Relation between the transfer function and differential equation - Causality and stability - Inverse system ~ Determining the frequency response from poles and zeros

Module IV (12 hours)

Z Transform - Definition - Properties of the region of convergence- Properties of the Z transform - Analysis of LTI systems - Relating the transfer function and difference equation - Stability and

EC 2K 404 : ELECTRONIC CIRCUITS

Module I(13 hours)

BJT amplifiers: Biasing - Load line - Bias stabilization -Stability factor - Bias compensation- Analyses and design of CC, CE and CB configurations - RC coupled and transformer coupled multistage amplifiers - High frequency response

Module II(13 hours)

FET amplifiers: Biasing of JFET - Self bias and fixed bias - Biasing of MOSFETS - Feedback biasing and fixed biasing for enhancement and depletion mode MOSFETs - Analyses of common source - Common drain and common gate amplifier configurations

ModuleIII (13 hours)

Feedback - Effect of feedback on amplifier-performance - Voltage shunt - Voltage series Current series and current shunt feedback configurations - Positive feedback and oscillators -Analysis of RC Phase Shift, Wein bridge, Colpitts, Hartley and crystal oscillators Stabilization of oscillations

Module IV(13 hours)

Power amplifiers - Class A, B, AS, C, D & S power amplifiers - Harmonic distortion -Efficiency - Wide band amplifiers - Broad banding techniques - Low frequency and high frequency compensation - Cascode amplifier - Broadbanding using inductive loads

EC2K 405 : MICROPROCESSORS & MICROCONTROLLERS

Module I(15 hours)

Intel 8086 processor - Architecture - Memory addressing - Addressing modes - Instruction set- Assembly language programming - Assemblers - Interrupts - Pin configuration - Timing diagrams - Minimum and maximum mode - Multiprocessor configuration

Module II (12 hours)

Interfacing - Address decoding - Interfacing chips - Programmable peripheral interface (8255) - Programmable communication interface (8251) - Programmable timer (8253) - DMA controller (8259) - Programmable interrupt controller (8257) - Keyboard display interface (8279) , Module III (12 hours)

Introduction to 80386 - Memory management unit - Descriptors, selectors, description tables and TSS - Real and protected mode - Memory paging - Special features of the pentium processor - Branch prediction logic - Superscalar architecture

Module IV (13 hours)

Intel 80196 microcontroller - CPU operation - Memory space - Software overview - Peripheral overview - Interrupts - PWM timers - High speed inputs and outputs - Serial port - Special modes of operation

EC2K406: ELECTRONIC INSTRUMENTATION

Module I (13 hours)

Basic concept of measurements - Accuracy - Precision - Error - Linearity Voltage and current measurements - Basic principles of electronic voltmeters - Ammeters - Principles of digital multimeters .

Module II (13 hours)

Transducers - Principles of Piezo electric - Photo electric - Thermo electric and magneto electric type transducers - Strain gage - Thermister - Pressure and flow transducers Typical Instrumentation system .

Module III (13 hours)

Principles and applications of digital storage oscilloscope - Spectrum analyser - IC tester - synthesised signal generator - Electronic LCR meter - Power meter - Q meter

Module IV (13 hours)

Frequency and time measurements - Digital frequency and time interval counters - Principles and application's - Microprocessor based Instrumentation - Temperature control system Data acquisition system - Logic analyser

EC2K 407(P) : ELECTRONIC CmCUITS LAB

1. Feed back voltage regulator with short circuit protection
2. Voltage regulation with Zener diode and pass transistor
3. Emitter follower with & without complementary transistors - Frequency and phase

- response for a capacitive load
4. Phase shift oscillator using BJT/FET
  5. Hartley / Colpitts oscillator using BJT/FET
  6. Power amplifier-ClassA
  7. Power amplifier- ClassAB
  8. Cascode amplifier - Frequency response
  9. 2 stage RC coupled amplifier - Frequency response Active load MOS amplifier .
  10. Wide band single BJT/MOS voltage amplifier with inductance
  11. Single BJT crystal oscillator
  12. Narrow band, high gain tuned amplifier

#### EC2K 408(P) : DIGITAL ELECTRONICS LAB

##### *List of experiments:*

1. Familiarization with TTL ICs
2. Characteristics of TTL NAND gate 3. Universal gates
4. Arithmetic circuits
5. Flip-Flops
6. Counters 7. Registers 8. Decoders 9. Encoders
10. Multiplexers and demultiplexers 11. ADC and DAC
12. CMOS logic circuits

#### EC2K 501 SOFTWARE ENGINEERING

##### Module I (13 hours)

*Introduction* - FAQs about software engineering - professional, and ethical responsibility system modeling - system engineering process - *the software process* - life cycle models iteration - specification - design and implementation - validation - evolution - automated process support - *software requirements* - functional and non-functional requirements - user requirements - system requirements.; SRS - *requirements engineering processes* - feasibility studies - elicitation and analysis - validation - management - *system models* - context models - behavior models - data models - object models - CASE workbenches

##### Module II (13 hours)

*Software prototyping* - prototyping in the software process - rapid prototyping techniques - *formal specification* - formal specification in the software process - interface specification - behavior

specification - *architectural design* - system structuring - control models - modular decomposition - domain-specific architectures - distributed systems architecture - *object-oriented design* - objects and classes - an object oriented design process case study design evolution - *real-time software design* - system design - real time executives - *design with reuse*.. component-based development - application families - design patterns; *user interface design* - design principles - user interaction - information presentation - user support - interface evaluation

Module III (13 hours)

*Dependability* - critical systems - availability and reliability - safety - security - critical systems specifications- critical system development - *verification and validation* - planning - software inspection - automated static analysis - clean room software development *software testing* - defect testing - integration testing - object-oriented testing - testing workbenches - critical system validation - *software evolution* -legacy systems - software change - software maintenance - architectural evolution - software re-engineering - data re-engineering ,

Module IV (13 hours)

*Software project management* - project planning .. scheduling - risk management - *managing people* - group working - choosing and keeping people - the people capability maturity model - *software cost estimation* - productivity estimation techniques- algorithmic cost modeling, project duration and staffing *quality management* - quality assurance and standards - quality planning - quality control - software measurement and metrics - *process improvement* - process and product quality - process analysis and modeling - process measurement - process CMM - *configuration management* - planning - change management - version and release management ~ system building - CASE tools for configuration management

EC2K 502 : ELECTROMAGNETIC FIELD THEORY

Module I: The electric field (12 hours)

Co-ordinate transformations - vector fields - divergence theorem - stokes theorem - static electric field - electric flux - gauss's law - electric scalar potential - electric dipole - field polarization in dielectrics - electrostatic boundary conditions - Laplace's and Poisson's equations - method of images - capacitance - capacitance of isolated sphere - capacitance between coaxial cylinders ~ capacitance between parallel wires - energy stored in electric field

Module II: The magnetic field (12 hours)

Steady current and current density in a conductor - steady magnetic field - Biot Savart's law and ampere's law - scalar and vector magnetic potentials - magnetic boundary conditions magnetic torque and moment - magnetic dipole - magnetisation in materials - inductance - self and mutual

inductance - inductance of solenoids, toroids and transmission lines - energy stored in magnetic field - Faraday's law of electromagnetic induction - motional and transformer emf

Module III: Maxwell's equations (14 hours)

Current continuity equation - displacement current - dielectric hysteresis.: Maxwell's equations - wave and wave equations - solutions for free space conditions - uniform plane wave - sinusoidal time variations - Poynting's vector and Poynting's theorem - wave equations for conducting medium - wave polarization

Module IV: Wave propagation & transmission lines (14 hours)

Propagation of waves through conductors and dielectrics - wave incidence normally and obliquely on a perfect conductor - wave incidence on the surface of a perfect dielectric Brewster angle - transmission lines - wave equations on transmission lines - phase velocity and group velocity - characteristic impedance - standing wave ratio - impedance matching Smith chart

EC2K 503 :ANALOG COMMUNICATIONS

Module I (12 hours)

Random process: review of the theory of continuous random variables - joint distribution and density functions - conditional distribution functions - random process - ensemble average - stationarity - wide sense stationarity - time averages - ergodicity - correlation theory for WSS random process - power spectral density - Wiener - Khinchin theorem - response of LTI systems to random process - gaussian random process - filtered gaussian random process - white gaussian noise

Module II (10 hours)

Noise: sources of noise - thermal noise - shot noise and flicker noise - filtered white noise narrow band noise - quadrature representation - envelope and phase representation - signal to noise ratio - noise equivalent bandwidth - effective noise temperature - noise calculations for cascaded stages

Module III (15 hours)

Amplitude modulation: spectrum of amplitude modulated signal - power relations - AM generation and detection - DSB-SC generation and detection - SSB-SC generation and detection - VSB modulation - AM transmitter and receiver - TRF and superheterodyne receivers noise analysis of AM receivers - ANR for envelope detection and coherent detection - SNR in DSB-SC and SSB-SC systems

Module IV (15 hours)

Frequency modulation: angle modulation - frequency modulation - narrow band FM - wide band

FM - transmission bandwidth - generation of FM signals - direct and indirect methods - FM demodulators - noise in FM reception - threshold effect - pre-emphasis and de-emphasis

## EC2K 504 : LINEAR INTEGRATED CIRCUITS

### Module I (13 hours)

BIT differential amplifier analysis - concept of CMRR - methods to improve CMRR - constant current source - active load - current mirror - Darlington pair - differential input impedance - various stages of an operational amplifier - simplified schematic circuit of op-amp 741 - need for compensation - lead, lag and lead lag compensation schemes - typical op-amp parameters - slew rate - power supply rejection ratio - open loop gain - unity gain bandwidth - offset current & offset voltage

### Module II (12 hours)

MOS differential amplifier - source coupled pair - source cross coupled pair - current source load and cascode loads - wide swing current differential amplifier - wide swing constant transconductance differential amplifier - CMOS opamp with and without compensation cascode input opamp - typical CMOS opamp parameters

### Module III (11 hours)

Linear: opamp circuits - inverting and noninverting configurations - analysis for closed loop gain - input and output impedances - virtual short concept - current to voltage and voltage to current converters - instrumentation amplifier - nonlinear opamp circuits - log and antilog amplifiers - 4 quadrant multipliers and dividers - phase shift and wein bridge oscillators comparators - astable and monostable circuits - linear sweep circuits

### Module IV (16 hours)

Butterworth, Chebyshev and Bessel approximations to ideal low pass filter characteristics - frequency transformations to obtain HPF, BPF and BEF from normalized prototype LPF active biquad filters - LPF & HPF using Sallen-Key configuration - BPF realization using the Sallen-Key configuration - BEF using twin T configuration - all pass filter (first & second orders) realizations - inductance simulation using Antoniou's gyrator

## EC2K 505 : COMPUTER ORGANISATION & ARCHITECTURE

### Module I (13 hours)

Evolution of computer systems - different types of computer systems and their interfaces

complexity of computing - design of a computer system - RTL, schematic and logic circuit level structure - central processing unit - data path and control path - execution of instruction - ALU - arithmetic processor - interrupt cycle

#### Module II (13 hours)

Controller and memory design - control transfer - fetch cycle - instruction interpretation and control- hardwired control- microprogrammed control- memory subsystems - CPU memory interaction - memory array organization and technology - speed mismatch problem - multiple module memory - associative and virtual memory

#### Module III (13 hours)

Secondary storage and I/O processing - magnetic medium and magnetic head - digital recording methods - magnetic tape drive and controller - disk drive and controller - I/O data transfer techniques - bus interface - I/O accessing and data transfer - I/O interrupt - I/O channel processor

#### Module IV (13 hours)

Computer system architecture - performance and cost - instruction set architecture - microarchitecture - architecture of memory subsystem - I/O subsystem architecture (SCSI, ISA, PCA and MCA bus) - parallel processing system architecture - (pipeline hazards – SIMD and MIMD systems - crossbar and multiple interconnection networks)

### EC2K 506A : NUMERICAL ANALYSIS

#### Module I: Errors in numerical calculations (13 hours)

Sources of errors, significant digits and numerical instability - numerical solution of polynomial and transcendental equations - bisection method - method of false position - Newton-Raphson method - fixed-point iteration - rate of convergence of these methods - iteration based on second degree equation - the Muller's method - Chebyshev method - Graeffe's root squaring method for polynomial equations - Bairstow's method for quadratic factors in the case of polynomial equations

#### Module II: Solutions of system of linear algebraic equations (13 hours)

Direct methods - Gauss and Gauss-Jordan methods - Crout's reduction method - error analysis - iterative methods - Jacobi's iteration - Gauss-Seidel iteration - the relaxation method - convergence analysis - solution of system of nonlinear equations by Newton-Raphson method - power method for the determination of eigen values - convergence of power method

#### Module III: Polynomial interpolation (13 hours)

Lagrange's interpolation polynomial- divided differences Newton's divided difference inter-

polation polynomial - error of interpolation - finite difference operators - Gregory - Newton forward and backward interpolations - Stirling's interpolation formula - interpolation with a cubic spline - numerical differentiation - differential formulas in the case of equally spaced points - numerical integration - trapezoidal and Simpson's rules - Gaussian integration-s errors of integration formula. .

#### Module IV: Numerical solution of ordinary differential equations (13 hours)

The Taylor series method - Euler and modified Euler methods - Runge-Kutta methods (2nd order and 4th order only) - multistep methods - Milne's predictor - corrector formulas - Adams-Bashforth & Adams-Moulton formulas - solution of boundary value problems in ordinary differential equations - finite difference methods for solving two dimensional Laplace's equation for a rectangular region - finite difference method of solving heat equation and wave equation with given initial and boundary conditions .

### EC2K 506B: POWER ELECTRONICS

#### Module I (13 hours) .

Power diodes- basic structure and V-I characteristics - various types - power transistors - BJT, MOSFET and IGBT - basic structure and V-I characteristics - thyristors- basic structure - static and dynamic characteristics - device specifications and ratings - methods of turning on - gate triggering circuit using UJT - methods of turning off - commutation circuits - TRIAC Module II (13 hours)

Line frequency phase controlled rectifiers using SCR - single phase rectifier with R and RL loads - half controlled and fully controlled converters with continuous and constant currents - SCR inverters - circuits for single phase inverters - series, parallel and bridge inverters.- pulse width modulated inverters - basic circuit operation .

#### Module III (12 hours)

AC regulators - single phase ac regulator with R and RL loads - sequence control of ac regulators - cycloconverter .. basic principle of operation - single phase to single phase cycloconverter - choppers.~ principle of operation - step-up and step-down choppers - speed control of DC motors and induction motors

#### Module IV (14 hours)

. Switching regulators - buck regulators - boost regulators - buck-boost regulators - Cuk regulators - switched mode power supply - principle of operation and analysis - comparison with linear power supply - uninterruptible power supply; basic circuit operation - different configurations - characteristics and applications

## EC2K 506C : DIGITAL MOS CIRCUITS

### Module I (11 hours)

Short and narrow channel effects in MOS transistor (MOST) - subthreshold current - channel length modulation - drain induced barrier lowering - hot electron effects - velocity saturation of charge carriers Scaling of MOST - constant voltage and constant field scaling - digital MOSFET model series connection of MOSFETs .

### Module II (15 hours)

MOS inverters - resistive load - NMOS load - pseudo NMOS and CMOS inverters - calculation of input high and low and output high and low levels - power dissipation - calculation of delay times for CMOS inverter - CMOS ring oscillator - design of super buffer - estimation of interconnect parasitics and calculation of interconnect delay

### Module III (13 hours)

CMOS logic circuits - CMOS NOR, NAND, AOI and OAI gates - full adder - SR and JK latches - C2MOS latch - transmission gates - simple circuits using TG - basic principles of pass transistor logic - voltage boot strapping - BiCMOS logic circuits.- BiCMOS inverter with resistive base pull down and active base pull down - BiCMOS switching transients - simple gates using BiCMOS

### Module IV (13 hours)

Dynamic CMOS Logic - precharge/evaluate logic - cascading problem - domino logic cascading domino logic gates - charge sharing in domino logic - solutions to charge sharing problem - realisation of simple functions using domino logic - NORA logic, - true single phase clock dynamic logic - basic ideas of adiabatic logic

## EC2K 506D -- DIGITAL SYSTEM DESIGN

### Module I (12 hours)

Review of logic design: logic design issues - hazards in combinational networks - hazards in sequential networks - synchronous design method - clock skew - asynchronous inputs - synchroniser failure and metastability.

### Module II (14 hours)

Hardware description languages: introduction to VHDL - behavioral modeling - transport Vs inertial delay - simulation deltas - sequential processing - process statement - signal assignment Vs variable assignment - sequential statements - data types - subprograms and packages - predefined attributes - configurations - subprogram overloading - YHDL synthesis - design

examples

Module III (13 hours)

Designing with programmable devices: programmable LSI techniques - programmable logic alTays - programmable array logic - sequential PLDs - sequential circuit design using PLDs- complex programmable logic devices and filed programmable gate arrays - altera series FPGAs and Xilinx series FPGAs (typical internal structure)

Module IV (13 hours)

Design issues for testability: design for testability - bed of nails and in-circuit testing - scan methods - testing combinational circuits - testing sequential circuits - boundary scan - builtin self test - estimating system reliability - transmission line reflections and termination

EC2K 506E : OBJECT ORIENTED PROGRAMMING'

Module I (12 hours)

OOPS and Java basics - Java virtual machine - Java platform API - extended security model- applet dasses - exceptions and abstract classes - Java applet writing basics - GUI building with canvas - applet security - creating window applications - writing console applications'utility and math packages

Module II (10 hours)

Swing programming - working with swing components - using the clipboard - input/output streams - printing - working with 2D and 3D Graphics - using audio and video - creating animations '

Module III (10 hours)

Java beans development kit - developing beans - notable beans - network programmingclient and server Programs - naming and directory services - working with Java management APIS .

Module IV (20 hours)

Distributed application architecture.. CORBA - RMI and distributed applications – working with remote objects- object serialization and Javaspace - Java IDL and ORBs, connecting to database - using JDBC - integrating database - support into web applications - Java servlets - JSDK - JAR tiles - Java native interface .

EC2K 507(P):MICROPROCESSOR & MICROCONTROLLER LAB

1. . List of exoeriments
2. 8068 kit familiarization and basic experiments
3. Addition and Subtraction of Binary and unpacked BCD numbers

4. Double precision multiplication
5. Multiplication of 16 byte ASCII string by single ASCII string
5. Sorting algorithms
6. Searching algorithms
7. Interfacing with *A/D* converters'
8. Interfacing with *D/A* converters
9. PWM motor control circuits
10. Serial communication between two kits
11. General purpose clock design
12. Interfacing with PCs

#### EC2K 508(P) : LINEAR INTEGRATED CIRCUITS LAB

1. Measurement of op-amp parameters - CMRR, slew rate, open loop gain; input and output impedances
- 2 Inverting and non-inverting amplifiers, integrators and differentiators - frequency response
3. Instrumentation. amplifier - gain, CMRR and input impedance
4. Single op-amp second order LFF and HPF - Sallen-Key configuration'
5. Narrow band active BPF - Delyiannis configuration .
6. Active notch filter realization using op-amps .
7. Wein bridge oscillator with amplitude stabilization
8. Astable and monostable multivibrators using op-amps
9. Square, triangular and ramp generation using op-amps
10. Voltage regulation using IC723 .
11. Astable and monostable multivibrators using IC 555 .
12. Design of PLL for given lock and capture ranges & frequency multiplication
13. Precision limiter using op-amps .
14. Multipliers using op-amps - 1,2 & 4 quadrant multipliers

#### EC2K 601 : CONTROL SYSTEMS

##### Module I (12 hours)

General schematic diagram of control systems - open loop and closed loop systems - concept of feedback - role of computers in 'automatic control - modeling of continuous time systems - laplace transform - properties - application in solution of differential equations transfer function-

block diagrams - signal flow graph - mason's gain formula - block diagram reduction using direct techniques and signal flow graphs- examples - derivation of transfer function of simple systems from physical relations - low pass RC filter - RLC series network - spring mass damper - DC servomotor for position and speed control - low pass active filter - definitions of poles, zeros, order and type

#### Module-II (14 hrs:)

Analysis of continuous time systems - time domain solution of first order systems – time constant - time domain solution of second order systems - determination of response for standard inputs using transfer functions - steady state error - concept of stability - Routh-Hurwitz techniques - construction of bode diagrams - phase margin - gain margin - construction of root locus - polar plots and theory of Nyquist criterion - theory of lag, - lead and laglead compensators

#### Module III (16 hours)

Modeling of discrete - time systems - sampling - mathematical derivations for sampling sample and hold - Z-transforms-properties - solution of difference equations using Z – transforms - examples of sampled data systems - mapping between s plane and z plane - cyclic and multi-rate sampling (definitions only) - analysis of discrete time systems - pulse transfer function'- examples - stability - Jury's criterion - bilinear transformation - stability analysis after bilinear transformation - Routh-Hurwitz techniques - construction of bode diagrams phase margin - gain margin - digital redesign of continuous time systems

#### Module IV (10 hours)

State variable methods - introduction to the state variable concept - state space models physical variable - phase variable and diagonal forms from time domain (up to third order only) - diagonalisation - solution of state equations - homogenous and non homogenous cases (up to second order only) - properties of state transition matrix - state space representation of discrete time systems - solution techniques - relation between transfer function and state space models for continuous and discrete cases-relation between poles and Eigen values "

### EC2K 602 : RADIATION & PROPAGATION

#### Module I: Antenna fundamentals (13 hours)

Source of radiation - radiation from accelerated charges - oscillating electric dipole... power radiated by a current element - radiation from a half wave dipole - antenna field zones (analysis) - antenna parameters - patterns - beam area - radiation intensity - beam efficiency - directivity - gain - effective aperture - effective height - self impedance - mutual impedance - antenna theorems - reciprocity theorem - Babinet's principle

### Module II: Antenna arrays (14 hours)

Linear antenna arrays - two element array of isotropic point sources - amplitude and phase characteristics - pattern multiplication - N-element array - analysis and design of broad-side array - end-fire array - binomial array and Dolph-Tchebyscheff array

### Module III: Special antennas (13 hours)

Travelling wave antenna - long wire - V and rhombic antennas - broad band dipole... folded, dipole antenna - broad band antennas - Yagi-Uda antenna and horn antenna - reflector antenna - parabolic reflector antenna - cassegrain antenna - frequency independent antenna - log periodic antenna microstrip antenna .

### Module IV: Radio wave propagation (12 hours)

Ground wave propagation - reflection from earth - space wave - surface wave - spherical earth propagation - tropospheric waves - ionospheric propagation - ionosphere... plasma oscillations - wave propagation in plasma - reflection and refraction of waves by the ionosphere - critical frequency - virtual height

## EC2K 603 : DIGITAL COMMUNICATIONS

### Module I (10 hours)

Analog pulse modulation - sampling theorem for bandpass signals - pulse amplitude modulation - generation and demodulation - PAM/TDM system - PPM generation and demodulation - PWM - spectra of pulse modulated signals - SNR calculations for pulse modulation systems - waveform coding - quantization- PCM - DPCM - delta modulation - adaptive delta modulation - line coding schemes - ON-OFF, NRZ, Bipolar - Manchester signaling and differential encoding .

### Module II (12 hours)

Shaping - Nyquist criterion for zero ISI - signalling with duobinary pulses - eye diagram - equalizer, scrambling and descrambling - signal space concepts - geometric structure of the signal space - U space - distance, norm and inner product... orthogonality" Gram-base band data transmission - matched filter receiver - inter symbol interference - Gram - Schmidt orthogonalization procedure

### Module III (15 hours)

Review of Gaussian random process - optimum threshold detection - optimum receiver for AWGN channel - matched filter and correlation receivers - decision procedure - maximum a posteriori probability detector - maximum likelihood detector ~ probability of error - bit error rate... optimum receiver for coloured noise - carrier and symbol synchronization

#### Module IV (15 hours)

Digital modulation schemes - coherent binary schemes - ASK, FSK, PSK, MSK coherent M-ary schemes - calculation of average probability of error for different modulation schemes power spectrum of digitally modulated signals - performance comparison of different digital modulation schemes

#### EC2K 604 : DIGITAL SIGNAL PROCESSING

##### Module I: Discrete Fourier transform (12 hours)

Discrete Fourier series - properties of DFS - periodic convolution - DFT - properties ;..linear convolution using DFT - computation of DIT - circular convolution - decimation in time and decimation in frequency algorithms - FFT algorithm for a composite number

##### Module II (14 hours)

Signal flow graph representation - basic filter structures - structures for linear phase – finite word-length effects in digital filters - quantizer characteristics - saturation overflow - quantization in implementing systems - zero input limit cycles' .

##### Module III: Digital filter design (14 hours)

Design of IIR digital filters from analog filters - Butterworth and Chebyshev filters – design examples - impulse invariant and bilinear transformation methods - spectral transformation of IIR filters - FIR filter design - linear phase characteristics - window method

##### Module IV: General and special purpose hardware for DSP (12 hours)

Computer architecture for signal processing - hardware architecture - pipelining - hardware multiplier - accumulator - special instructions - general purpose digital signal processors Texas Instruments - TMS 320 family - Motorola DSP 56000 family - analog devices ADSP2100 family - implementation of DSP algorithm on general purpose digital signal processors

#### EC2K 605 : MECHANICAL ENGINEERING

##### Module I (13 hours)

Thermodynamics - thermodynamics systems - thermodynamic properties and processes heat and work - equation of state - properties of ideal gases - properties of pure substances Zeroth law of thermodynamics - temperature scales - first law of thermodynamics - heat, work and energy of closed and open systems - concept of internal energy - enthalpy - second law of thermodynamics - concept of entropy - availability of work and energy

##### Module II (13 hours)

Engineering applications of thermodynamics - air cycles - carnot cycle - otto and diesel cycle – principle of operation of 2 stroke and 4 stroke engine vapour power cycle – Mollier diagram – ranking cycle

Module III (13 hours)

Head transfer - basic modes of heat transfer - conduction, convection and radiation - conduction - Fourier law of conduction - general conduction equation - convection - forced and free convection - heat transfer relations - radiation - laws of radiation - concepts of black body .

Module IV (13 hours)

Fluid mechanics - laws of fluid motion, continuity, momentum and energy equations Bernoulli's equation and its application to flow and velocity measuring devices - capillary flow and viscous flow

EC2K 606A : OPTIMIZATION TECHNIQUES

Module I: Linear programming I (13 hours)

Systems of linear equations and inequalities - convex sets - convex functions - formulation of linear programming problems - theory of simplex method - simplex algorithm - Charne's M method - two phase method - duality in linear programming - dual simplex method

Module II: Linear programming II (13 hours).

Sensitivity analysis - parametric programming - bounded variable problems - transportation problem - development of the method - integrality property - degeneracy - unbalanced problems - assignment problem - development of the Hungarian method - routing problems

Module III: Nonlinear programming (13 hours)

Mathematical preliminaries of non-linear programming - gradient and Hessian - unimodal functions - convex and concave functions - role of convexity - unconstrained optimization - fibonacci search - golden section search - optimal gradient method - classical optimization - Lagrange multiplier method - Kuhn-tucker conditions - quadratic programming; separable convex programming - frank and wolfe method

Module IV: Dynamic programming & game theory (13 hours)

Nature of dynamic programming problem - Bellman's optimality principle - cargo loading problem - replacement problems - multistage production planning and allocation problems - rectangular games - two person zero sum games - pure and mixed strategies -  $2 \times m$  and  $m \times 2$  games - relation between theory of games and linear programming

EC2K 606B : HIGH SPEED DIGITAL DESIGN

### Module I (14 hours)

Introduction to high-speed digital design - frequency, time and distance - capacitance and inductance effects - high speed properties of logic gates - speed and power - measurement techniques - rise time and bandwidth of oscilloscope probes - selfinductance, signal pickup and loading effects of probes - observing crosstalk

### Module II (14 hours)

Transmission line effects and crosstalk - transmission lines - point to point wiring- infinite uniform transmission lines - effects of source and load impedance - special transmission line cases - line impedance and propagation delay - ground planes and layer stacking - crosstalk in solid ground planes, slotted ground planes and cross-hatched ground planes - near and far end crosstalk

### Module III (12 hours)

Terminations and vias - terminations - end, source and middle terminations - AC biasing for end terminations - resistor selection - crosstalk in terminators - properties of vias - mechanical properties of vias - capacitance of vias - inductance of vias - return current and its relation to vias

### Module IV (12 hours)

Stable reference voltage and clock distribution - stable voltage reference - distribution of uniform voltage - choosing a bypass capacitor - clock distribution - clock skew and methods to reduce skew - controlling crosstalk on clock lines... delay adjustments, - clock oscillators and clockjitter

## EC2K 606C : DATA STRUCTURES & ALGORITHMS

### Module I (12 hours)-

Review of data types - scalar types - primitive types - enumerated types - subranges structures types - character strings - arrays - records - sets - trees - data abstraction - complexity of algorithms - time and space complexity of algorithms using "big oh" notation. - recursion - recursive algorithms - analysis of recursive algorithms

### Module II (12 hours)

Linear data structures - stacks - queues - lists - stack and queue implementation using array-linked list - linked list implementation using pointers

### Module III (12 hours)

Non linear structures - graphs - trees ~ sets - graph and tree implementation using array linked list - set implementation using bit string~ linked list

#### Module IV (16 hours)

Searching - sequential search - searching arrays and linked lists - binary search – searching arrays and binary search trees - hashing - introduction to simple hash functions – resolution of collisions - sorting:  $n^2$  sorts - bubble sort - insertion sort - selection sort -  $N \log N$  sorts quick 's011- heap sort - merge sort - external sort - merge files

#### EC2K 606D : ANALOG MOS CIRCUITS

##### Module I (11 hours)

Analog MOS models - low frequency model - MOS in saturation - high frequency model variation of transconductance with frequency - temperature effects in MOST ~ noise in MOST (shot, flicker and thermal noise) - MOS resistors and resistor circuits - super MOST

##### Module II (14 hours)

cascode current source - transient response of simple current mirror - Wilson current mirror - regulated cascode current source/sink - voltage references - resistor MOSFET and MOSFET only voltage references.. band gap references various biasing schemes for voltage references

##### Module III (12 hours)

Common source - common gate and source follower amplifiers - class AS amplifier - active load configuration - transimpedance amplifier - cascode amplifier - push pull amplifier amplifier bases:l signal processing - the differential difference amplifier (DDA) - adder, multiplier, divider and filters using DDA

##### , Module IV (15 hours)

Mixed signal circuits - CMOS comparator design - pre amplification - decision and post amplification stages - transient response - clocked comparators - analog Rmultiplier - the ~ultiplying quad -level shifting in multipliers - dynamic analog circuits - charge injection and capacitive feed through in MOS switch - sample and hold circuits - switched capacitor filters - switched capacitor implementation of ladder filters

#### EC2K 606E : LINEAR SYSTEMS ANALYSIS

##### Module I: System concepts and modelling of systems (II hours)

Systems - subsystems - elements - systems approach - classification of systems -static and dynamic systems.. linear and nonlinear systems - distributed and lumped systems.. time invariant and time varying systems - stochastic and deterministic systems - system modeling and approximations - superposition principle - homogeneity and additivity - modelling of electrical systems - active and passive elements - resistance inductance and capacitance dynamic equations

using Kirchhoff's current and voltage laws. RL, RC and RLC circuits and their dynamic equations  
- block diagrams and signal flow graphs - Mason's gain formula

Module II: Modelling of non-electrical systems (11 hours). Modelling of translational and rotational mechanical systems - differential equations for mass spring dashpot elements - d'Alembert's principle - rotational inertia - stiffness and bearing friction - gear trains - equivalent inertia and friction referred to primary and secondary shafts - dynamic equations for typical mechanical systems - electromechanical analogues - force-current and force-voltage analogue - capacitance and resistance of thermal, hydraulic pneumatic systems - dynamic equations for simple systems - comparison of electrical, electromechanical, hydraulic and pneumatic systems

Module III: Transfer function and time domain analysis (15 hours) ..

.Use of Laplace transforms- concept of transfer function - impulse response - convolution integral  
- response to arbitrary inputs - transfer function of typical systems discussed in Module I - time domain analysis - test inputs - step - velocity and ramp inputs- transient and steady state response  
- first and second order - under damped and over damped responses - maximum overshoot - settling time - rise time and time constant - higher order systems steady state error - error constants and error different types of inputs - Fourier series expansion of periodic functions - symmetry conditions - exponential form of Fourier series - Fourier integrals and Fourier transform - spectral properties of signals - analysis by Fourier methods

Module IV: State space analysis and stability of systems (15 hours) .

Concept of state - state space and state variables - advantage over transfer function approach - state equations for typical electrical and mechanical and electromechanical systems - representation for linear time varying and time invariant systems.. solution of state equation for typical test inputs - zero state and zero input response - concept of stability bounded input bounded output stability - Lyapunov's definition of stability - asymptotic stability - stability in the sense of Lyapunov-Routh Hurwitz criterion of stability for single input single output linear systems described by transfer function model

## EC2K 606F : INTRODUCTION TO SOCIAL SCIENCES

Module I (8 hours)

Introduction -The history of social sciences - The beginnings - "The Two Cultures". Renaissance - Development of the various Social Sciences - History, Sociology, Economics, Psychology, Philosophy, Political Science, Geography - The method of social sciences – early figures - Plato, Aristotle, Auguste Comte

Module II (14 hours)

Philosophy and history - Philosophy as the mother of all sciences - history of Philosophy . issues in ancient, medieval and modern philosophy - Aristotle and Plato - renaissance thinkers .. the Political System & socio-cultural environment of Renaissance - different thinkers Plato, Sc'openhauer, Kant, Sartre HL ~ory - historiography, classical history - readings from classics of historical writing current debates in history (India World) - Modern Indian history

### Module III (15 hours)

Sociology and psychology - the evolution of 'Sociology.' - society - terms in Sociology *Society, individual, caste, race, religion, class, tribe* .Social thinkers - Auguste Comte, Emile Durkheim , Karl Marx, Max Weber, Mahatma Gandhi Sociologists - M.N. Sri,nivas, Y. Singh Social evils and concerns - Dowry system, Indian caste system, Communalism, Globalisation Psychology.:. the ancient views on human mind.- the mind vs matter debate - terms in Psychology - different branches of Psychology - behavioral sciences - motivation – theory and practice - personality development - stress management - counseling - cognitive science - an introduction

### Module IV(15 hours)

Polity and international affairs - concept of *State, Government and Polity* - various forms of government - relation of technology to politics Indian polity - constitution.. systems of governance - post independence policies – political and economic - rights and duties of citizens - secularism and national integrati<;m International affairs - global politics, geography and geopolitics - Power zones – alliances and treaties UNO - international law - India's role in the next millennium

### EC2K 607(1)>) : ANALOG COMMUNICATION LAB

1. AM generation
2. 2.AM detection with simple. and delayedAGC
3. Balanced modulator *for* DSB-SC signal
4. Mixer using JFET/BJT
5. FM generation (reactance modulator)
6. FM demodulation
7. PAM generation and demodulation
8. Generation and demodulation ofPWM and PPM
9. Implementation of intermediate frequency amplifier
10. PLL characteristics and demodulation using PLL
11. A~ generation and demodulation using opamps and IC multiplierS

## 12. SSB generation and demodulation using integrated circuits

### EC2K 608(P) : MINI PROJECT

Each group consisting of four members is expected to design and develop a moderately complex hardware system - a working model of the hardware system should be fabricated and tested - the assessment of all the mini-projects will be done by a committee consisting of three faculty members, specialized in various fields of electronics and communication engineering - the students will present and demonstrate the project work before the committee - a detailed report is also to be submitted

### EC2K 701 : INDUSTRIAL MANAGEMENT

#### Module I (13 hours)

Principles of management - management functions", planning - organising - organisation structures - span of control- delegation - directing" leadership and motivation - controlling - decision making - single stage decision making under risk - multistage decision making decision tree - decision making under uncertainty - equally likely, minimax and maximin criteria guide and the remaining forty percent will be awarded by the evaluation committee

#### Module II ( 14 hours)

Operation management - production systems and functions - product design and selection - concept of total quality management and ISO 9000 system of standards - concept of supply chain management - project management - projects and management - network analysis. critical path method (CPM) network - finding critical path - slacks - crashing (time-cost trade off) - PERT network

#### Module III (12 hours)

Marketing management - concept of market and marketing - marketing function - marketing mix - market research - advertising and sales promotion - human resources management manpower requirement analysis - recruitment and training - job analysis - job evaluation . wages and incentives

#### Module IV (13 hours)

Financial management - objectives/functions - concept of time value of money - basics of financial accounting - profit and loss account.; balance sheet - costing - elements of costs cost sheet - allocation of overheads - break-even analysis depreciation - significance and methods of depreciation

## EC2K 702 : MICROWAVE DEVICES & COMMUNICATION

### Module I (12 hours)

Theory of waveguide transmission - rectangular waveguides - TE modes - TM modes  
waveguide components - rectangular cavity resonator - circular cavity resonator (only basic ideas)  
- E-plane tee - magic tee - isolator - circulator - directional coupler - S matrix

### Module II (12 hours)

Microwave linear beam tubes - klystron (bunching, output power and loading),.. reflex klystron -  
traveling wave tube (amplification process, convection current, axial, electric field, gain)-  
microwave crossed field tubes - magnetron (operation, characteristics and applications)

### Module III (14 hours)

Semiconductor microwave devices - microwave transistors - tunnel diodes and FETs transferred  
electron devices ~ Gunn effect diodes - (Gunn effect, operation, modes of operation)-  
microwave generation and amplification - LSA diodes - InP - LEDs - Cd Te diodes -  
avalanche transit time devices - read diodes - impurity diodes - trapatt diodes - baritt diodes

### Module IV (14 hours)

Terrestrial microwave communication - basic principles of microwave links -link analysis -  
microwave relay systems - choice of frequency., line of sight and over the horizon, systems -  
modulation methods - block schematic of terminal transmitters and receivers - effect of  
polarization - diversity receivers - digital microwave links - digital modulation schemes fading -  
digital link design - satellite communication - orbit of communication satellites angle of  
elevation - propagation delay - orbital spacing - satellite construction - transponders - antennas -  
multiple spot beams - earth station -link analysis - multiple access schemes - digital satellite links'

## EC2K 703 : INFORMATION THEORY & CODING

### Module I (14 hours)

Information theory- information and entropy - properties of entropy of a binary memoryless  
source - extension of a binary memoryless source - source coding theorem - Shannon fano coding  
- Huffman coding - Lempel ziv coding - discrete memoryless source - binary symmetric channel  
- mutual information - properties - channel capacity - channel coding theorem

### Module II (14 hours)

coding -linear block codes - generator matrices - parity check matrices - encoder – syndrome and  
error correction - minimum distance - error correction and error detection capabilities cyclic  
codes - coding and decoding'

### Module III (14 hours)

Introduction to algebra - groups - fields - binary field arithmetic - construction of Galois field - basic properties - computations - vector spaces - matrices - BCH codes - description decoding - ree~ solomon codes

Module IV (10 hours)

Coding - convolutional codes - encoder - generator matrix - transform domain representation - state diagram - distance properties - maximum likelihood decoding - viterbi decoding sequential decoding - interleaved convolutional codes

**EC2K 704 : COMPUTER COMMUNICATION & NETWORKING**

Module I (15 hours)

Characteristics of communication networks - traffic characterization and quality of service, CBR, VBR, UBR traffic - network services - flow control - congestion control - error control error detection - ARQ retransmission strategies - analysis - OSI model - Ethernet - token ring - FDDI - DQDB - frame relay - IPV 4, IPV6

Module II (12 hours)

P - TCP congestion control - congestion avoidance - window adjustment in TCP routing optimization in, datagram networks - circuit switched networks - SONET - SDH routing optimization in circuit switched networks

Module III (15 hours)

Introduction to queueing theory - Markov chain - discrete time and continuous time Markov chains - poisson process - queueing models for datagram networks - Little's theorem - MIMI1 queueing system - MIMIim queueing models - infinite server case - M/G/1 queue - mean value analysis

Module IV (10 hours)

ATM networks - main features - statistical multiplexing - addressing, signaling and routing ATM header structure - ATM adaptation layer - IP over ATM

EC2K 705A : BIOMEDICAL INSTRUMENTATION Module I (13 hours)

Electrical activity of excitable cells - SD curve - functional organization of the peripheral nervous system - electrocardiogram (in detail with all lead systems) - electroencephalogram - electromyogram - electroencephalogram - electrode - electrolyte interface - polarisation polarisable and non-polarisable electrodes - surface electrodes - needle electrodes - micro electrodes - practical hints for using electrodes - skin electrode; equivalent circuit - characteristics of bio-amplifiers

Module II (13 hours) .

Blood pressure - direct measurements - harmonic analysis of blood pressure waveform systems for measuring venous pressure - heart sounds - phonocardiography - cardiac catheterisation - indirect blood pressure measurement - electromagnetic blood flow meters ultrasonic blood flow meters - impedance plethysmography - photo plethysmography . 'indicator-dilution' method for blood flow determination - spirometry - measurement of various respiratory parameters - respiratory plethysmography - chamber plethysmography

Module III (13 hours)

Measurement of gas flow rate - cardiac pacemakers and other electric stimulators- defibrillators and cardio converters - blood pumps - hemodialysis - ventilators - infant incubators - drug delivery devices - lithotripsy - therapeutic applications of laser ~ .

Module IV (13 hours).

Physiological effects of electricity - important susceptibility parameters - macro shock hazards - micro shock hazards - protection against shock - electrical isolation - electrical safety analyzers - measurement of pH, pCO<sub>2</sub> and PO<sub>2</sub> .

EC2K 705B : INDUSTRIAL PSYCHOLOGY

Module I (13 hours)

Introduction - psychology as a science - areas of applications - study of individual - individual differences - study of behavior - stimulus - response behavior - heredity and environment - human mind - cognition - character - thinking - attention - memory- emotion - traits attitude - personality

Module II (13 hours)

Organizational behavior - definition - development - fundamental concept - nature of people - nature of organization - an organizational behavior system - models - autocratic model hybrid model - understanding a social - system social culture - managing communication downward, upward and other forms of communication

Module III (13 hours) . ,

Motivation - motivation driver - human needs - behavior modification ~ goal setting - expectancy model- comparison models - interpreting motivational models - leadership - path goal model - style - contingency approach

Module IV (13 hours)

Special topics in industrial psychology - managing group organization - group and inter group dynamics - managing change and organizational development - nature planned change - resistance - characteristic of OD - OD process

## EC2K 705C : ARTIFICIAL INTELLIGENCE & EXPERT SYSTEMS

### Module I (16 hours)

Definition - history and applications - propositional calculus - predicate calculus - inference rules - structures and strategies for state space search - heuristic search algorithms - heuristics in games - complexity issues - control and implementation of state space search - production systems - planning - the blackboard architecture

### Module II (14 hours)

- Knowledge intensive problem solving - expert system technology - rule-based expert systems - model based reasoning - case based reasoning - knowledge representation problem reasoning with uncertain or incomplete information - statistical approach - non-monotonic systems - .fuzzy sets - knowledge representation - languages - issues ~ network representation - conceptual graphs - structured representation

### Module III (12 hours)

Languages and programming techniques for AI - overview of LISP - search - higher order functions and procedural abstractions - search strategies - pattern matching - recursion - interpreters - logic programming in LISP - streams and delayed evaluation - expert system shell in LISP - network representations and inheritance - CLOS

### Module IV (10 hours)

Introduction to understanding natural language - introduction to automated reasoning introduction to machine learning

### Text book

Luger G.F. & Stubblefield W.A., *Artificial Intelligence*, 3/e, Addison Wesley

## EC2K 705D : DIGITAL SIGNAL PROCESSORS

### Module I (12 hours)

High level overview of digital signal processing - DSP system features and .applications - introduction to DSP processors - common features of DSP processors - numeric representations and arithmetic - fixed point versus floating point - extended precision - floating point and block floating point - data path - fixed and floating point data paths

### Module II (12 hours)

Memory architecture - harvard architectures - multiple access memories - program caches wait states - ROM - external memory interfaces - multiprocessor support - dynamic memory - OMA - different addressing modes used in DSP processors



### Module I (20 hours)

Entrepreneurial perspectives - understanding of entrepreneurship process - entrepreneurial decision process - entrepreneurship and economic development - characteristics of entrepreneur - entrepreneurial process - entrepreneurial competencies - managerial functions for enterprise

### Module II (to hours)

Process of business opportunity identification and evaluation - industrial policy - environment - market survey and market assessment - project report preparation - *study* of feasibility and viability of a project - assessment of risk in the industry

### Module III (12 hours)

Process and strategies for starting a venture - stages of small business growth - entrepreneurship in international environment - entrepreneurship - achievement motivation - time management creativity and innovation structure of the enterprise - planning, implementation and growth

### Module IV (10 hours)

Technology acquisition for small units - formalities to be completed for setting up a small scale unit - forms of organizations for small scale units - financing of project and working capital - venture capital and other equity assistance available - break even analysis and economic ratios technology transfer and business incubation

## EC2K 705G : WAVELETS

### Module I (10 hours)

Fundamentals of signal decomposition - brief overview of Fourier transform and short term Fourier transform - introduction to wavelets - continuous wavelet transform - definition CWT as a correlation - time frequency resolution

### Module II (12 hours)

Introduction to the DWT and orthogonal wavelet decomposition - approximation of vectors in nested linear vector spaces - example of an MRA - orthogonal wavelet decomposition based on the Haar wavelet - digital filter implementation of the Haar wavelet decomposition (Mallat's algorithm)

### Module III (15 hours)

Construction of a general orthonormal MRA - formal definition - implication of the dilation equation and orthogonality - two scale relation for the wavelet function - digital filter implementation - reconstruction of the signal - introductory concepts of biorthogonal wavelet basis and wavelet packets - two-dimensional wavelet decomposition - regularity - vanishing

moments ' Module IV (15 hours)

Applications - image compression - EZW algorithm - audio compression - signal denoising - edge detection.. object isolation - image fusion - medical applications

EC2K 706(P) : DIGITAL COMMUNICATION LAB

- 1.Sampling and reconstruction of low pass signals
- 2.PCM generation
- 3.Differential PCM generation
4. Implementation of Delta modulator and demodulator
5. Implementation of line coding schemes: bipolar, Manchester and differential codes
6. Equalization and Digital Regeneration
- 7.Matched filter receiver for rectangular pulse
- 8.Generation and detection of BASK and BFSK signals
- 9.Generation and detection of BPSK signals
- 10.Generation and detection of QAM using IC multipliers
- 11.Implementation of Analog to Digital Converters
- 12.Implementation of Digital to Analog Converters

EC2K 707(P) : SEMINAR

Each student is expected to give a seminar on a topic of current relevance in electronics and communication engineering - they have to refer published papers from standard journals  
the seminar report must not be the reproduction of the original paper

EC2K 708(P) : PROJECT

This project work is for a duration of two semesters - each student group consisting of not more than five members is expected to develop a complete product - the design and development of which may include hardware and/or software - the assessment of all projects will be done semester by a committee consisting of four faculty members of the department – an interim report is to be submitted at the end of 7th semester ~ student will present their project work before the committee

Sessional work assessment

- |              |      |
|--------------|------|
| . Progress   | = 35 |
| Presentation | = 10 |

Report	= 5
Total marks	= 50

## EC2K 801 : ECONOMICS

### Module I (13 hours)

Definition of economics - nature and scope of economic science - nature and scope of managerial economics - basic terms and concepts - goods - utility - value - wealth - factors of production - land - its peculiarities - labour - its peculiarities and division of labour - capital and capital formation - organisation or enterprise - economic~ of large and small scale consumption - wants - its characteristics and classification - law of diminishing marginal utility - relation between economic decision and technical decision - economic efficiency and technical efficiency

### Module II (13 hours)

Demand - demand schedule - demand curve -law of demand - elasticity of demand - types of elasticity - factors determining elasticity - measurement - its significance - supply - supply schedule - supply curve -law of supply - elasticity of supply - time element in the determination of value - market price and nonnal price - perfect competition - monopoly - monopolistic competition. \

### Module III (13 hours)

Forms of business - .proprietorship - partnership - joint stock company - cooperative organisation - state enterprise - mixed economy - money and banking - nature and functions' of money - theory of money - inflation and deflation - banking - kinds - commercial banks central banking functions - control of credit - monetary policy - credit instrument

### Module IV (13 hours)

International trade - distinction between internal and international trade - theory of international trade - free trade vis protection - balance of trade. and balance of payments – exchange . control - trade policy of the Government of India - national inc6me - concepts - measurement - difficulties in the measurement its significant - features of underdeveloped economy with special reference to India - taxation - canons of taxation - direct and indirect tax - impact and incidence of the tax - working capital- factors affecting - sources

## EC2K 802 : OPTICAL COMMUNICATION

### Module I (15 hours)

Solution to Maxwell's equation in a circularly symmetric step index optical fiber -linearly polarized modes - single mode and multimode fibers - concept of V number - graded index

fibers - total number of guided modes (no derivation) - polarization maintaining fibers - attenuation mechanisms in fibers - dispersion in single mode and multimode fibers - dispersion shifted and dispersion flattened fibers - attenuation and dispersion limits in fibers nonlinear self phase modulation effect in single mode fibers

Module II (11 hours) .

Optical sources - LED and laser diode - principles of operation- concepts of line width phase noise - switching and modulation characteristics - typical LED and LD structures optical detectors - pn detector - pin detector - avalanche photodiode - principles of operation -concepts of responsivity - sensitivity and quantum efficiency - noise in detection - typical receiver configurations (high impedance and transimpedance receivers)

Module III (14 hours)

Intensity modulated direct detection systems - quantum limit to receiver sensitivity - detected signal & shot noise - ISI and equalization - coherent systems - homodyne and heterodyne systems - system structures.- coherent systems using PSK, FSK,ASK and DPSK modulations - related noise effects - performance degradation induced by laser phase and intensity noise - degradation due to fiber dispersion - degradation induced by nonlinear effects in fiber propagation

Module IV (12 hours)

Optical amplifiers - semiconductor amplifier -rare earth doped fiber amplifier (with special reference to erbium doped fibers) - Raman amplifier - Brillouin amplifier -principles of operation - amplifier noise - signal to noise ratio - gain - gain bandwidth - gain and noise dependencies ~ intermodulation effects - saturation induced crosstalk - wavelength range of operation

EC2K 803 : MICROELECTRONICS TECHNOLOGY

Module I (15 hours)

Wafer processing - diffusion - Fick's law - analytic solutions for predeposition and drive-in diffusion - oxidation - deal-grove model - ion implantation - vertical and lateral projected ranges - channeling - stopping power -.optical lithography - optical exposures - modulation transfer function - proximity and projection printing - photoresists - types - contrast curves - etching - wet, plasma and ion etching - epitaxial growth - MOCVD and molecular beam epitaxy "

Module II (12 hours)

Device isolation - contacts and metallization - junction and oxide isolation - LOCOS - SILO - SWAMI process -. trench isolation - silicon on insulator isolation - schottky contacts - implanted ohmic contacts - alloyed contacts - refractory metal contact technology - multi

level metallization

Module III (12 hours)

CMOS and bipolar technologies - early bipolar process - advanced bipolar processes CMOS process - p well process - twin tub process - hot carrier effects in BJT and CMOS BiCMOS fabrication process sequence

Module IV (13 hours)

VLSI design fundamentals - layout and design rules for well, pads, metal layers, poly 1, poly 2 - layout using cell hierarchy - layout of MOSFET - layout of the inverter - NOR and NAND gates - layout of junction isolated BJT

**EC2K 804 : COMMUNICATION SWITCHING SYSTEMS**

Module I (12 hours)

Electronic switching systems: basics of a switching system - electronic space division switching - stored program control - time division switching - time multiplexed space switching - time multiplexed time switching - two stage, three stage and N-stage combination switching

Module II (14 hours)

Digital circuit switching networks: two-stage network - three-stage network - n-stage network - non-blocking switches - blocking probability analysis of multistage switches - Lee's approximation - improved approximate analysis of blocking switch - examples of digital switching systems - AT & T 5ESS and NTI-DMS 100 switching systems

Module III (14 hours)

Elements of traffic engineering: network traffic load and parameters - grade of service and blocking probability - incoming traffic and service time characterization - blocking models and loss estimates - delay systems

Module IV (12 hours)

Signaling: customer line signaling - outband signaling - inband signaling - PCM signaling - inter-register signaling - common channel signaling principles - CCITT signaling system No. 7 - digital customer line signaling Introduction to ATM switching - Strict sense non block switch - self routing switches Bense network - ATM routers - Design of typical switches.

**EC2K 805A : WIRELESS MOBILE COMMUNICATION**

Module I (12 hours)

Mobne radio propagation - free space propagation model - ground reflection model - large scale path loss - small scale fading and multi path propagation - impulse response model of a multi

path channel - parameters of a mobile multipath channel - multipath delay spread  
Doppler spread - coherence bandwidth - coherence time - time dispersion and frequency.  
selective fading - frequency dispersion and time selective fading - concepts of level crossing rate  
and average fade duration

Module II (14 hours)

Digital communication through fading multipath channels - frequency non selective, slowly  
fading channels - frequency selective, slowly fading channels- calculation of error probabilities  
- tapped delay line model - the RAKE demodulator performance - diversity techniques for  
mobile wireless radio systems concept of diversity branch and signal paths - combining  
methods - selective diversity combining - pre-detection and post detection combining switched  
combining - maximal ratio combining- equal gain combining

Module III (12 hours)

Cellular concept - frequency reuse - cochannel interference - adjacent channel interference -  
power control for reducing interference - improving capacity in cellular systems - cell splitting -  
sectoring - hand off strategies - channel assignment strategies - call blocking in cellular networks

Module IV (14 hours)

Fundamental concepts of spread spectrum systems - pseudo noise sequence - performance of  
direct sequence spread spectrum systems - analysis of direct sequence spread spectrum systems  
- the processing gain and anti jamming margin - frequency hopped spread spectrum  
systems - time hopped spread spectrum systems - synchronization of spread spectrum  
systems

EC2K 805B : INTERNET TECHNOLOGIES

Module I (12 hours)

*Computer networks and the internet* - principles of application-layer protocols - HTTP - FTP -  
e-mail- DNS - socket programming with TCP/UDP - web servers - web pages design using  
HTML and XML

Module II (13 hours)

*Multimedia networking*.. applications - streaming stored audio and video - internet telephony -  
RTP -scheduling and policing mechanisms - integrated services - RSVP - differentiated services -  
*network management* - the internet network management framework

Module III (14 hours)

*Network security* - *E-mail security* - privacy - S/MIME - *IP security* - overview – architecture -

authentication - header and payload - combining security.associations - key management *web security* - SSL and transport layer security - SET - *systems security* - intruders and viruses - *firewalls* - design - trusted systems

Module IV.<13 hours)

*Mobile internet - mobile netWork layer* - mobile IP - dynamic host configuration protocolad hoc networks - *mobile transport layer* .. implications ofTCP on mobility - indirect TCP snooping TCP - mobile TCP - transmission - selective retransmission - transaction-oriented TCP - *support/or mobility* - file systems - WAP protocols - WML - WMLscript – wireless . telephony applications .

EC2K 805C : NEURAL NETWORKS & FUZZY LOGIC

Module I (13 hours)

Introduction to artificial neural networks - biological neurons - Mc Culloch and Pitts modals of neuron - types of activation function. - network architectures - knowledge representation . - learning process - error-correction learning - supervised learning - unsupervised learning single unit mappings and the perceptron - perceptron convergence theorem (with out proof) - method of steepest descent - least mean square algorithms - adaline/m.edaline units multilayer perceptrons - derivation of the back-propagation algorithm

Module II (13 hours)

Radial basis and recurrent neural networks - RBF network structure - covers theorem and the separability of patterns - RBF learning strategies - K-means and LMS algorithms - com parison ofRBF and MLP networks - recurrent networks - Hopfield networks - energy func tion - spurious states - error performance.. simulated annealing - the Boltzman .machine Boltzman learning rule - the mean field theory machine - MFT learning algorithm – applications of neural network - the XOR problem -traveling salesman problem - image compression using MLPs - character retrieval using Hoptfield networks

Module 111(13 hours)

Fuzzy logic - fuzzy sets - properties - operations on fuzzy sets - fuzzy relations - operations on fuzzy relations - the extension principle - 'fuzzy measures - membership functions fuzzification and defuzzification methods - fuzzy controllers - Mamdani and Sugeno types design parameters - choice of membership functions - fuzzification and defuzzification methods - applications.

Module IV (13 hours)

. Introduction to genetic algorithm and hybrid systems - genetic algorithms - natural evolution - properties - classification - GA features - coding - selection - reproduction - cross over and

mutation operators basic GA and structure .Introduction to Hybrid systems - concept ofneuro-fuzzy and neuro-genetic systems

## EC2K 805D : IMAGE PROCESSING

### Module I(13 hours)

Basic ideas in digital image processing - problems and applications - image representation and modeling - two dimensional systems - shift in variant linear systems - two dimensional Fourier transform and its properties - optical theory and modulation transfer functions matrix theory - block matrices and Kronecker products- random fields - spectral density function

### Module II(13 hours)

Image perception - light, luminance, brightness and contrast - MTF of the visual system visibility function - monochrome vision models - image fidelity criteria - colour representation - colour matching and reproduction - colour co-ordinate systems - colour difference measures - colour vision models - temporal properties of vision - image sampling and quantization - image scanning - display and recording - two dimensional sampling - practical limitations - image quantization basic ideas

### Module III(13 hours)

Unitary image transforms - basic ideas - two dimensional DFT - cosine transform - sine transforms- hardamard transform - harr transform - slant transform - KL transform – SVD transform - image enhancement - point operations - histogram equalization and modification - spatial operations - transforms operations - multispectral image enhancement – colour image enhancement

### Module IV(13 hours)

Image restoration - image observation models - inverse filtering - wiener filtering Image compression - pixel coding - predictive coding - transform coding - basic ideas

## EC2K 805E : SATELLITE COMMUNICATION SYSTEMS

### Module I(13 hours)

Satellite orbits - solar day and sidereal day - orbital parameters - satellite trajectory - period, velocity and position of a satellite - geostationary satellites - non-geostationary constellations - launching of geostationary satellites - Hohmann transfer - effect of earth's shape other heavenly bodies - atmospheric drag and radiation pressure on the satellite's orbit

### Module II(13 hours)

Communication satellites.. spacecraft subsystems - payload - repeater, antenna, attitude

and control systems - telemetry, tracking and command - power sub system and thermal control Earth stations - antenna and feed systems - satellite tracking system - amplifiers - fixed and mobile satellite service earth stations

Module III (13 hours)

Communication link design, - frequency bands used - antenna parameters - transmission equations - noise considerations - link design - very small aperture terminals (VSAT) – VSAT design issues

Module IV (13 hours)

Multiple access techniques - frequency division multiple access - time division multiple access - code division multiple access - access protocols for data traffic

EC2K 805F : ELECTRONIC COMMERCE

Module I (14 hours)

Web commerce concepts - electronic commerce environment - electronic marketplace technologies - web based tools for e-commerce - e-commerce softwares - hosting services and packages - modes of e-commerce - EDI - commerce with WWW/ internet

Module II (12 hours).

Security issues - threats to e-commerce - approaches to safe e-commerce - secure transactions and protocols - intruder approaches - security strategies and tools - encryption security teams - protecting e-commerce assets - protecting client machines - servers and channels - transaction integrity

Module III (12 hours)

Electronic payment systems - types of payment - internet monetary payment and security requirements - payment and purchase order process - electronic cash - electronic wallets - smart cards - credit and charge cards - risks - design of e-payment systems

Module IV (14 hours)

Strategies for marketing - creating web presence - identifying and reaching customers - web branding - sales on the web - strategies for purchasing and support activities - EDI - supply chain management - softwares for purchasing - strategies for web auctions - virtual communities and web portals - international - legal- ethical and tax issues - planning and managing e-commerce projects

EC2K 805G : SPEECH PROCESSING

Module I (15 hours)

Digital models for the speech signal - mechanism of speech production - acoustic theory lossless tube models - digital models - linear predictive coding of speech - auto correlation formulation of LPC equation - solution of LPC equations - Levinson Durbin algorithm - Levinson recursion - Schur algorithm - lattice formulations and solutions - PARCOR coefficients

#### Module II (15 hours)

Spectral analysis of speech - short time Fourier analysis - filter bank design - speech coding - subband coding of speech - transform coding - channel vocoder - formant vocoder cepstral vocoder - vector quantizer coder.

#### Module III (12 hours)

Speech synthesis - pitch extraction algorithms - Gold-Rabiner pitch trackers - autocorrelation pitch trackers - voice/unvoiced detection - homomorphic speech processing - homomorphic systems for convolution - complex cepstrums - pitch extraction using homomorphic speech processing

#### Module IV (10 hours)

Automatic speech recognition systems - isolated word recognition - connected word recognition - large vocabulary word recognition systems - pattern classification - DTW, HMM speaker recognition systems - speaker verification systems - speaker identification systems

### EC2K 806(P) : ADVANCED COMMUNICATION ENGG. LAB.

#### Microwave and optical experiments

1. Klystron characteristics of power & frequency versus repeller voltage
2. Slotted line measurements. VSWR & Impedance
3. Antenna radiation pattern measurements
4. Directional coupler and isolator
5. Optical fibre experiments. Analog & digital

#### Experiments using MATLAB/ DSP kit

6. IIR filter-low pass & high pass
7. FIR filter-low pass & high pass
8. MMSE Equalizer implementations

#### Hardware experiments

9. PN and Orthogonal code generators
10. Digital TDM
11. Cyclic encoder and decoder

## 12. Spreader and de-spreader for CDMA

### EC2K 807(P) : PROJECT

There is only university examination for this - examiners will be appointed by the university for conducting the viva voce - the viva voce exam will be based on the subjects studied for the B. Tech course, mini project, project and seminar reports of the student - the relative weightages would be as follows

#### Sessional work assessment'

Subjects	: 30
Mini project	: 20
Project	: 30
Seminar	: 20
Total marks	: 100