



UNIVERSITY OF ENGINEERING AND MANAGEMENT, KOLKATA

B. TECH – ELECTRONICS & COMMUNICATION ENGINEERING

Second Year Third Semester

A.THEORY							
Sl No.	Subject Code	Theory	Contact Hours/Week				Credit Points
			L	T	P	Total	
1	M(CS)301	Numerical Methods	2	1	0	3	2
2	M302	Mathematics-III	3	1	0	4	4
3	EC301	1. Circuit Theory & Networks	3	0	0	4	4
4	EC302	2. Solid State Device	3	0	0	3	3
5	EC303	1. Signals & Systems	3	0	0	3	3
6	EC304	2. Analog Electronic Circuits	3	1	0	4	4
Total of Theory						21	20
B. PRACTICAL							
7	M(CS)391	Numerical Lab	0	0	2	2	1
8	EC391	Circuit Theory & Network Lab	0	0	3	3	2
9	EC392	Solid State Devices	0	0	3	3	2
10	EC393	1. Signal System Lab	0	0	3	3	2
11	EC394	2. Analog Electronic Circuits Lab	0	0	3	3	2
Total of Practical						14	9
Total of Semester						35	29



Theory

NUMERICAL METHODS

Code : M(CS) 301

Contacts : 2L+1T

Credits :2

Approximation in numerical computation: Truncation and rounding errors, Fixed and floating-point arithmetic, Propagation of errors.

(4)

Interpolation: Newton forward/backward interpolation, Lagrange's and Newton's divided difference Interpolation.

(5)

Numerical integration: Trapezoidal rule, Simpson's 1/3 rule, Expression for corresponding error terms.

(3)

Numerical solution of a system of linear equations:

Gauss elimination method, Matrix inversion, LU Factorization method, Gauss-Seidel iterative method.

(6)

Numerical solution of Algebraic equation:

Bisection method, Regula-Falsi method, Newton-Raphson method. (4)

Numerical solution of ordinary differential equation: Euler's method, Runge-Kutta methods, Predictor-Corrector methods and Finite Difference

method. (6)

Text Books:

1. C.Xavier: C Language and Numerical Methods.
2. Dutta & Jana: Introductory Numerical Analysis.
3. J.B.Scarborough: Numerical Mathematical Analysis.
4. Jain, Iyengar , & Jain: Numerical Methods (Problems and Solution).

References:

1. Balagurusamy: Numerical Methods, Scitech.
2. Baburam: Numerical Methods, Pearson Education.
3. N. Dutta: Computer Programming & Numerical Analysis, Universities Press.
4. Soumen Guha & Rajesh Srivastava: Numerical Methods, OUP.
5. Srimanta Pal: Numerical Methods, OUP.



MATHEMATICS

Code: M 302

Contacts: 3L +1T = 4

Credits: 4

Note 1: The entire syllabus has been divided into four modules.

Module I: Fourier Series & Fourier Transform [8L]

Topic: Fourier Series:

Sub-Topics: Introduction, Periodic functions: Properties, Even & Odd functions: Properties, Special wave forms: Square wave, Half wave Rectifier,

Full wave Rectifier, Saw-toothed wave, Triangular wave. (1)

Euler's Formulae for Fourier Series, Fourier Series for functions of period 2π , Fourier Series for functions of period $2l$, Dirichlet's conditions, Sum of

Fourier series. Examples. (1)

Theorem for the convergence of Fourier Series (statement only). Fourier Series of a function with its periodic

extension. Half Range Fourier Series: Construction of Half range Sine Series, Construction of Half range Cosine Series. Parseval's identity (statement

only). Examples. (2)

Topic: Fourier Transform:

Sub-Topics: Fourier Integral Theorem (statement only), Fourier Transform of a function, Fourier Sine and Cosine Integral Theorem (statement only),

Fourier Cosine & Sine Transforms.

Fourier, Fourier Cosine & Sine Transforms of elementary functions. (1)

Properties of Fourier Transform: Linearity, Shifting, Change of scale, Modulation. Examples.

Fourier Transform of Derivatives. Examples. (1)

Convolution Theorem (statement only), Inverse of Fourier Transform, Examples. (2)

5

Module II : Calculus of Complex Variable [13L]

Topic: Introduction to Functions of a Complex Variable.

Sub-Topics: Complex functions, Concept of Limit, Continuity and Differentiability. (1)

Analytic functions, Cauchy-Riemann Equations (statement only). Sufficient condition for a function to be analytic. Harmonic function and Conjugate

Harmonic function, related problems. (1)

Construction of Analytic functions: Milne Thomson method, related problems. (1)



Topic: Complex Integration.

Sub-Topics: Concept of simple curve, closed curve, smooth curve & contour. Some elementary properties of complex Integrals. Line integrals along a piecewise smooth curve. Examples. (2)

Cauchy's theorem (statement only). Cauchy-Goursat theorem (statement only). Examples. (1)

Cauchy's integral formula, Cauchy's integral formula for the derivative of an analytic function, Cauchy's integral formula for the successive derivatives of an analytic function. Examples. (2)

Taylor's series, Laurent's series. Examples (1)

Topic: Zeros and Singularities of an Analytic Function & Residue Theorem.

Sub-Topics: Zero of an Analytic function, order of zero, Singularities of an analytic function. Isolated and non-isolated singularity, essential singularities. Poles: simple pole, pole of order m.

Examples on determination of singularities and their nature. (1)

Residue, Cauchy's Residue theorem (statement only), problems on finding the residue of a given function, evaluation of definite integrals:

$$\int_0^{\infty} \frac{\sin x}{x} dx, \int_0^{2\pi} \frac{d\theta}{a + b \cos \theta + c \sin \theta}, \oint_C \frac{P(z)}{Q(z)} dz \quad (\text{elementary cases, } P(z) \text{ \& } Q(z) \text{ are polynomials of 2}^{\text{nd}} \text{ order or less}).$$

(2)

Topic: Introduction to Conformal Mapping.

Sub-Topics: Concept of transformation from z-plane to w-plane. Concept of Conformal Mapping. Idea of some standard transformations. Bilinear

Transformation and determination of its fixed point. (1)

Module III: Probability [8L]

Topic: Basic Probability Theory

Sub-Topics: Classical definition and its limitations. Axiomatic definition.

Some elementary deduction: i) $P(O)=0$, ii) $0 \leq P(A) \leq 1$, iii) $P(A')=1-P(A)$ etc. where the symbols have their usual meanings. Frequency interpretation of probability. (1)

Addition rule for 2 events (proof) & its extension to more than 2 events (statement only). Related problems.

Conditional probability & Independent events. Extension to more than 2 events (pairwise & mutual independence). Multiplication Rule. Examples.

Baye's theorem (statement only) and related problems. (3)



Topic: Random Variable & Probability Distributions. Expectation.

Sub-Topics: Definition of random variable. Continuous and discrete random variables. Probability density function & probability mass function for single variable only. Distribution function and its properties (without proof). Examples. Definitions of Expectation & Variance, properties & examples. (2)

Some important discrete distributions: Binomial & Poisson distributions and related problems.

Some important continuous distributions: Uniform, Exponential, Normal distributions and related problems. Determination of Mean & Variance for Binomial, Poisson & Uniform distributions only.

(2)

Module IV: Partial Differential Equation (PDE) and Series solution of Ordinary Differential Equation (ODE) [13L]

Topic: Basic concepts of PDE.

Sub-Topics: Origin of PDE, its order and degree, concept of solution in PDE. Introduction to different methods of solution: Separation of variables, Laplace & Fourier transform methods. (1)

Topic: Solution of Initial Value & Boundary Value PDE's by Separation of variables, Laplace & Fourier transform methods.

Sub-Topics:

PDE I: One dimensional Wave equation. (2)

PDE II: One dimensional Heat equation. (2)

PDE III: Two dimensional Laplace equation. (2)

Topic: Introduction to series solution of ODE.

Sub-Topics: Validity of the series solution of an ordinary differential equation. General method to solve $P_0 y'' + P_1 y' + P_2 y = 0$ and related problems. (2)

Topic: Bessel's equation.

Sub-Topics: Series solution, Bessel function, recurrence relations of Bessel's Function of first kind. (2)



Topic: Legendre's equation.

Sub-Topics: Series solution, Legendre function, recurrence relations and orthogonality relation. (2)

TOTAL LECTURES : 42

Text Books:

1. Brown J.W and Churchill R.V: Complex Variables and Applications, McGraw-Hill.
2. Das N.G.: Statistical Methods, TMH.
3. Grewal B S: Higher Engineering Mathematics, Khanna Publishers.
4. James G.: Advanced Modern Engineering Mathematics, Pearson Education.
5. Lipschutz S., and Lipson M.L.: Probability (Schaum's Outline Series), TMH.

References:

1. Bhamra K. S.: Partial Differential Equations: An introductory treatment with applications, PHI
2. Dutta Debashis: Textbook of Engineering Mathematics, New Age International Publishers.
3. Kreyzig E.: Advanced Engineering Mathematics, John Wiley and Sons.
4. Potter M.C, Goldberg J.L and Aboufadel E.F.: Advanced Engineering Mathematics, OUP.
5. Ramana B.V.: Higher Engineering Mathematics, TMH.
6. Spiegel M.R. , Lipschutz S., John J.S., and Spellman D. , : Complex Variables, TMH.



CIRCUIT THEORY & NETWORKS

Code : EC 301 Contacts : 3L +1T =4hrs Credits :4

1. a) **Resonant Circuits:** Series and Parallel resonance [1L], (*) **Impedance and Admittance Characteristics, Quality Factor, Half Power Points, Bandwidth [2L], Phasor diagrams, Transform diagrams [1L], Practical resonant and series circuits, Solution of Problems [Tutorial - 1L].** (4)

b) **Mesh Current Network Analysis:** Kirchoff's Voltage law, Formulation of mesh equations [1L], Solution of mesh equations by Cramer's rule and matrix method [2L], Driving point impedance, Transfer impedance [1L], Solution of problems with DC and AC sources [1L].(6)

2. a) **Node Voltage Network Analysis:** Kirchoff's Current law, Formulation of Node equations and solutions [2L], driving point admittance, transfer Admittance [1L], Solution of problems with DC and AC sources [1L]. (4)

b) **Network Theorems:** Definition and Implication of Superposition Theorem [1L], Thevenin's theorem, Norton's theorem [1L], Reciprocity theorem, Compensation theorem [1L], maximum Power Transfer theorem [1L], Millman's theorem, Star delta transformations [1L], Solutions and problems with DC and AC sources [1L]. (6)

3. **Graph of Network:** Concept of Tree and Branch [1L], tree link, junctions, (*) **Incident matrix, Tie set matrix [2L], Determination of loop current and node voltages [2L].** (4)

Coupled Circuits: Magnetic coupling, polarity of coils, polarity of induced voltage, concept of Self and mutual inductance, Coefficient of coupling, Solution of Problems. (4)

Circuit transients: DC transients in R-L and R-C Circuits with and without initial charge, (*) **R-L-C Circuits, AC Transients in sinusoidal R-L, R-C and R-L-C Circuits, Solution of Problems [2L].** (2)

4. **Laplace transform:** Concept of Complex frequency [1L], transform of $f(t)$ into $F(s)$ [1L], transform of step,

exponential, over damped surge, critically damped surge, damped and un-damped sine functions [2L], properties of Laplace transform [1L], linearity, real differentiation, real integration, initial value theorem and final value theorem [1L], inverse Laplace transform [1L], application in circuit analysis, Partial fraction expansion, Heaviside's expansion theorem, Solution of problems [1L]. (8)

(*) **Laplace transform and Inverse Laplace transform [2L].**

Two Port Networks: Relationship of Two port network variables, short circuit admittance parameters, open circuit impedance parameters, transmission parameters, relationship between parameter sets, network functions for ladder network and general network. (4)



Text Books:

1. Valkenburg M. E. Van, "Network Analysis", Prentice Hall./Pearson Education
2. Hayt "Engg Circuit Analysis" 6/e Tata McGraw-Hill
3. D.A.Bell- Electrical Circuits- Oxford

Reference Books:

1. A.B.Carlson-Circuits- Cengage Learning
2. John Bird- Electrical Circuit Theory and Technology- 3/e- Elsevier (Indian Reprint)
3. Skilling H.H.: "Electrical Engineering Circuits", John Wiley & Sons.
4. Edminister J.A.: "Theory & Problems of Electric Circuits", McGraw-Hill Co.
5. Kuo F. F., "Network Analysis & Synthesis", John Wiley & Sons.
6. R.A.DeCarlo & P.M.Lin- Linear Circuit Analysis- Oxford
7. P.Ramesh Babu- Electrical Circuit Analysis- Scitech
8. Sudhakar: "Circuits & Networks:Analysis & Synthesis" 2/e TMH
9. M.S.Sukhija & T.K.NagSarkar- Circuits and Networks-Oxford
10. Sivandam- "Electric Circuits and Analysis", Vikas
11. V.K. Chandna, "A Text Book of Network Theory & Circuit Analysis",Cyber Tech
12. Reza F. M. and Seely S., "Modern Network Analysis", Mc.Graw Hill .
13. M. H. Rashid: "Introduction to PSpice using OrCAD for circuits and electronics", Pearson/PHI
14. Roy Choudhury D., "Networks and Systems", New Age International Publishers.
15. D.Chattopadhyay and P.C.Rakshit: "Electrical Circuits" New Age

SOLID STATE DEVICES

Code : EC 302 Contacts : 3L +9T =3hrs Credits :3

Module - 1: Energy Bands and Charge Carriers in Semiconductors- Energy-band (E-k) diagram, effective mass, wave vector, Debye length, Direct & indirect band-gap semiconductors; Carrier distribution, Fermi-level, Intrinsic & Extrinsic semiconductors, Non-equilibrium in carrier distribution; drift, diffusion, scattering; Piezo & Hall effects. [8]

Details: [Recapitulation of Conductor, Insulator & Semiconductor with special emphasis on the concept of energy bands and band-gaps, E-k diagrams for direct and indirect band-gap semiconductors (*1L*);

Concept of the effective mass & crystal momentum, concept of wave-vector 'k'; Intrinsic & extrinsic semiconductors, idea about degeneracy and nondegeneracy.

(*2L*)

Carrier concentration in terms of bulk Density of states and Fermi-Dirac distribution (no derivation, expression and significance only); Concept of



Fermi level, F.L. shift with doping & temperature; (2L)

Non-equilibrium condition: Drift & diffusion of carriers with simple expressions; Hall effect & Piezo-electric effect, Carrier scattering (basic idea only). Generation and re-combination, quasi-Fermi energy level (concept only) (3L)

Module - 2: Rectifier and detector diodes: P-N junction & Schottky junction physics, I-V relation, Junction capacitances, Diode switching, Optical devices & Solar cells, Tunnel diode. [10]

Details: Homo- and Hetero-junctions – examples of semiconductor-semiconductor junction (Homo) & Metal-metal, Metal-S.C. junctions (Hetero-)

(1L);

[Recapitulation of the rectifying properties of these two types of junctions;] Homo-junction – Semiconductor-semiconductor p-n junction & rectification (recapitulation) (1L); Plot of junction voltage, field and depletion charge with distance by solving simple 1D Poisson's Equation (Gradual Channel & Depletion Approximations) (1L); Schottky contact & Schottky diode (1L); Junction capacitances in p-n diodes (recapitulation) and their expressions; Application of Diode capacitance in Varactor Diodes (1L); Derivation for Forward and Reverse current, piece-wise linear diode characteristics, concept of Diode resistance & Differential diode resistance, (1L); Diode switching & diode switch, properties of rectifier and switching diodes (1L); Importance of reverse current in optical detectors, photo-diodes, solar cells (1L); Spontaneous emission & Stimulated emission - optical devices (basic idea only) (1L).], Tunnel diode -(basic principle only - importance of negative resistance) (1L).

Module - 3: Bipolar Junction Transistors: Physical mechanism, current gain, minority current distribution; Punch-through and avalanche effect;

High voltage and high power transistors; Frequency limitations, high frequency transistors, Power transistors. [8]

Details: [Emphasis on BJT as a current controlled device, amplification property of BJT (1L); I-V characteristics (input & output) with derivation,

input & output characteristics for CB, CE & CC mode, current amplification factors α for CB mode and β for CE mode (2L); Eber's Moll model for

Static behaviour & Charge controlled model (without derivation) for dynamic behaviour, equivalent circuits. (2L); Basic idea about Photo-transistors

& Power transistors (only their features Vis-à-vis the ordinary transistors) (1L); PNPN transistors - simple working principle, I-V characteristics, triggering, mention of Triacs, Diacs & Thyristors. (2L)]



Module - 4: Field Effect Transistors: JFETS, IJFETS and MOSFETs; MOS-capacitors, flat band and threshold voltages; P and N-channel MOSFETS, CMOS and VLSI MOSFETS, Semiconductor sensors and detectors. [9]

Details: [Concept of Field effect device (recapitulation), channel modulation & channel isolation (*IL*);] JFET - behaviour, characteristics (*IL*);

MOSFET - channel inversion, Ideal Threshold voltage (*IL*), MOS capacitances, depletion width, surface field and potential (by solving Poisson's equation with gradual channel & depletion approximations) (*2L*); Real MOSFET & Threshold voltage for real MOSFET, (*IL*); I-V characteristics

with expressions for saturation and non-saturation regions (concepts but no detail derivations, empirical relations to be used for solving problems) (*IL*);

Equivalent circuit for MOSFET (*IL*); MOSFET for VLSI - scaling issues (basic concept of Short Channel Effects only) (*IL*);]

Text Books :

Neamen- Semiconductor Physics and Devices TMH

Bhattacharya & Sharma- Solid State Electronic Devices- Oxford

Maini & Agrawal- Electronics Devices and Circuits- Wiley

Reference Books :

Milman, Halkias & Jit- Electronics Devices and Circuits- TMH

Bell-Electronics Devices and Circuits-Oxford

Bhattacharya & Sharma- Solid State Electronic Devices- Oxford

Singh & Singh- Electronics Devices and Integrated Circuits –PHI

Bogart, Bisley & Rice- Electronics Devices and Circuits- Pearson

Kasap-Principles of Electronic Materials and Devices- TMH

Boylestad & Nashelsky- Electronics Devices and Circuit Theory- Pearson

Salivahanan, Kumar & Vallavaraj- Electronics Devices and Circuits- TMH

SIGNALS AND SYSTEMS

Code : EC 303 Contacts : 3L +0T =3hrs Credits :3

Module – 1:Introduction to signal and systems:

Continuous and discrete time signals: Classification of Signals – Periodic aperiodic even – odd – energy and power signals – Deterministic and random signals – complex exponential and sinusoidal signals –periodicity –unit impulse – unit step – Transformation of independent variable of signals: time scaling, time shifting. System properties: Linearity, Causality, time invariance and stability. Dirichlet's conditions, Determination of Fourier series coefficients of signal. (8)



Module-2:Signal Transformation:

Fourier transformation of continuous and discrete time signals and their properties. Laplace transformation- analysis with examples and properties. Parseval's theorem; Convolution in time (both discrete and continuous) and frequency domains with magnitude and phase response of LTI systems.

8

Module-3: Laplace Transform:

Recapitulation, Analysis and characterization of LTI systems using Laplace transform: Computation of impulse response and transfer function using Laplace transform.

2

Module-4:Sampling Theorem:

Representation of continuous time signals by its sample –Types of sampling, Sampling theorem. Reconstruction of a Signal from its samples, aliasing –sampling of band pass signals.

4

Module-5:Z-Transforms:

Basic principles of z-transform - z-transform definition –, Relationship between z-transform and Fourier transform, region of convergence – properties of ROC – Properties of z-transform – Poles and Zeros – inverse z-transform using Contour integration - Residue Theorem, Power Series expansion and Partial fraction expansion

6

Module-6: Random Signals & Systems:

Definitions, distribution & density functions, mean values & moments, function of two random variables, concepts of correlation, random processes, spectral densities, response of LTI systems to random inputs.

4

Total: 32 hrs

Text Books:

3. A.V.Oppenheim, A.S.Willsky and S.H.Nawab -Signals & Systems, Pearson
4. S.Haykin & B.V.Veen, Signals and Systems- John Wiley
5. A.Nagoor Kani- Signals and Systems- McGraw Hill



References:

1. J.G.Proakis & D.G.Manolakis- Digital Signal Processing Principles, Algorithms and Applications, PHI.
2. C-T Chen- Signals and Systems- Oxford
3. E WKamen &BS Heck- Fundamentals of Signals and Systems Using the Web and Matlab- Pearson
4. B.P.Lathi- Signal Processing & Linear Systems- Oxford
5. P.Ramesh Babu & R.Anandanatarajan- Signals and Systems 4/e- Scitech
6. M.J.Roberts, Signals and Systems Analysis using Transform method and MATLAB, TMH
7. S Ghosh- Signals and Systems- Pearson
8. M.H.Hays- Digital Signal Processing “, Schaum’s outlines, TMH
9. Ashok Ambardar, -Analog and Digital Signal Processing- Thomson.
10. Phillip, Parr & Riskin- Signal, Systems and Transforms- Pearson

ANALOG ELECTRONIC CIRCUITS

Code : EC 304 Contacts : 3L +1T =4hrs Credits :4

Module-1: [10]

a) Filters and Regulators: Capacitor filter, π -section filter, ripple factor, series and shunt voltageregulator, percentage regulation, 78xx and 79xx series, concept of SMPS. [4]

b) Transistor Biasing and Stability: Q-point, Self Bias-CE, Compensation techniques, h-model of transistors. Expression for voltage gain, current gain, input and output impedance, trans-resistance & trans-conductance; Emitter follower circuits, High frequency model of transistors.

[6]

Module -2: [10]

1. Transistor Amplifiers: RC coupled amplifier, functions of all components, equivalent circuit, derivation of voltage gain, current gain, input impedance and output impedance, frequency response characteristics, lower and upper half frequencies, bandwidth, and concept of wide band amplifier.

[6]



2. Feedback Amplifiers & Oscillators: Feedback concept, negative & positive feedback, voltage/current, series/shunt feedback, Barkhausen criterion, Colpitts, Hartley's, Phase shift, Wein bridge and crystal oscillators.[4]

Module -3: [10]

1. Operational Amplifier: Ideal OPAMP, Differential Amplifier, Constant current source (current mirror etc.), level shifter, CMRR, Open & Closed loop circuits, importance of feedback loop (positive & negative), inverting & noninverting amplifiers, voltage follower/buffer circuit. [6]

2. Applications of Operational Amplifiers: adder, integrator & differentiator, comparator, Schmitt Trigger. Instrumentation Amplifier, Log & Anti-log amplifiers, Trans-conductance multiplier, Precision Rectifier, voltage to current and current to voltage converter, free running oscillator. [6]

Module -4: [8]

1. Power amplifiers – Class A, B, AB, C, Conversion efficiency, Tuned amplifier [4]

2. Multivibrator – Monostable, Bistable, Astable multivibrators; Monostable and astable operation using 555 timer. [2]

3. Special Functional Circuits: VCO and PLL. [2]

Total: 40 hrs

Text Books:

1. Sedra & Smith-Microelectronic Circuits- Oxford UP
2. Franco—Design with Operational Amplifiers & Analog Integrated Circuits , 3/e, McGraw Hill
3. Boylested & Nashelsky- Electronic Devices and Circuit Theory- Pearson/PHI



Reference Books:

1. Millman & Halkias – Integrated Electronics, McGraw Hill.
2. Rashid-Microelectronic Circuits-Analysis and Design- Thomson (Cengage Learning)
3. Schilling & Belove—Electronic Circuit:Discrete & Integrated , 3/e , McGraw Hill
4. Razavi- Fundamentals of Microelectronics- Wiley
5. Malvino—Electronic Principles , 6/e , McGraw Hill
6. Horowitz & Hill- The Art of Electronics; Cambridge University Press.
7. Bell- Operational Amplifiers and Linear ICs- Oxford UP
8. Tobey & Grame – Operational Amplifier: Design and Applications, McGrawHill.
9. Gayakwad R.A -- OpAmps and Linear IC's, PHI
10. Coughlin and Driscoll – Operational Amplifier and Linear Integrated Circuits – Pearson Education

Practical Details

NUMERICAL METHODS

Code : M(CS) 391

Credits :1

1. Assignments on Newton forward /backward, Lagrange's interpolation.
2. Assignments on numerical integration using Trapezoidal rule, Simpson's 1/3 rule, Weddle's rule.
3. Assignments on numerical solution of a system of linear equations using Gauss elimination and Gauss-Seidel iterations.
4. Assignments on numerical solution of Algebraic Equation by Regular-falsi and Newton Raphson methods.
5. Assignments on ordinary differential equation: Euler's and Runge-Kutta methods.
6. Introduction to Software Packages: Matlab / Scilab / Labview / Mathematica.

Circuits and Networks Laboratory

Code: EC391

Contacts: 3P

Credits: 2

1. Characteristics of Series & Parallel Resonant circuits
2. Verification of Network Theorems
3. Transient Response in R-L & R-C Networks ; simulation / hardware
4. Transient Response in RLC Series & Parallel Circuits & Networks ; simulation / hardware
5. Determination of Impedance (Z), and Admittance (Y) parameters of Two-port networks
6. Generation of periodic, exponential, sinusoidal, damped sinusoidal, step, impulse, and ramp signals using MATLAB



7. Representation of Poles and Zeros in s-plane, determination of partial fraction expansion in s-domain

and cascade connection of second-order systems using MATLAB

8. Determination of Laplace Transform, different time domain functions, and Inverse Laplace

9. Transformation using MATLAB

Note: An Institution / college may opt for some other hardware or software simulation wherever possible in

place of MATLAB

Solid State Devices Laboratory

Code: EC392

Contacts: 3P

Credits: 2

Perform any four experiments:

Ex 1: Study input characteristics of BJT in common-emitter configuration.

Ex 2: Study output characteristics of BJT in common-emitter configuration for different base currents and hence determine hybrid parameters.

Ex 3: Study output characteristics of BJT in common-emitter configuration and find performance parameters (Voltage Gain, Current Gain, Input Impedance, Output Impedance).

Ex 4: Study the variation of small-signal voltage gain with frequency of a common-emitter RC coupled amplifier.

Ex 5: Study of drain characteristics and transfer characteristics of a JFET and hence determine the FET parameters (drain resistance, transconductance & amplification factor).

Ex 6: Study the variation of small-signal voltage gain with frequency of a JFET.

Module 2:

Perform any two experiments

Ex 1: Study of C-V characteristics of a Varactor diode by appropriate software.

Ex 2: Study of C-V characteristics of a MOS structure by appropriate software.

Ex3: Study of drain characteristics and transfer characteristics of a MOSFET and hence determine the FET parameters (drain resistance, transconductance & amplification factor).



Signals and Systems Laboratory

Code: 393

Contacts: 3P

Credits: 2

- To study Z- transform of: a) Sinusoidal signals b) Step functions.
2. To compare Fourier and Laplace transformations of a signal.
 3. To study convolution theorem in time and frequency domain.
 4. To Study Signal Synthesis via sum of harmonics.
 5. To study LPF &HPF, band pass and reject filters using RC circuits.
 6. To demonstrate how analog signals are sampled and how different sampling rates affect the outputs.
 7. To study sampling theorem for low pass signals and band pass signals .
 8. To determine the components of: a) Square wave b) Clipped sine wave.

Analog Electronic Circuits Laboratory

Code:EC394.

Contacts: 3P

Credits: 2

- Any 8 experiments. A College has to design a new design oriented experiment.
1. Study of Diode as clipper & clamper
 2. Study of Zener diode as a voltage regulator
 3. Study of ripple and regulation characteristics of full wave rectifier without and with capacitor filter
 4. Study of characteristics curves of B.J.T & F.E.T .
 5. Design a two-stage R-C coupled amplifier & study of it's gain & Bandwidth.
 6. Study of class A & class B power amplifiers.
 7. Study of class C & Push-Pull amplifiers.
 8. Realization of current mirror & level shifter circuit using Operational Amplifiers.
 9. Study of timer circuit using NE555 & configuration for monostable & astable multivibrator.
 10. Design a Bistable multivibrator using NE 555.
 11. Study of Switched Mode Power Supply & construction of a linear voltage regulator using regulator IC chip.
 12. Design a simple function generator using IC.
 13. Realization of a V-to-I & I-to-V converter using Op-Amps.
 14. Realization of a Phase Locked Loop using Voltage Controlled Oscillator (VCO).
 15. Study of D.A.C & A.D.C.



Second Year Fourth Semester

A.THEORY							
Sl No.	Subject Code	Theory	Contact Hours/Week				Credit Points
			L	T	P	Total	
1	HU401	Values & Ethics in Profession	3	0	0	3	3
2	CH401	Basic Environmental Engineering & Elementary Biology	3	0	0	3	3
3	EC401	1. EM Theory & Transmission Lines	3	1	0	4	4
4	EC402	2. Digital Electronic & Integrated Circuits	3	1	0	4	4
5	EC403	Computer Organisation and Architecture	3	1	0	4	4
Total of Theory						18	18
B. PRACTICAL							
6	HU481	Technical Report Writing & Language Lab Practice	0	0	3	3	2
7	EC491	1. EM Theory & Tx Lines Lab	0	0	3	3	2
8	EC492	2. Digital Electronic & Integrated Circuits Lab	0	0	3	3	2
9	EC493	Computer Organisation and Architecture Lab	0	0	3	3	2
Total of Practical						12	8
Total of Semester						30	26



SEMESTER - IV
Theory

VALUES & ETHICS IN PROFESSION

HU-401

Contracts:3L

Credits- 3

Science, Technology and Engineering as knowledge and as Social and Professional Activities

Effects of Technological Growth:

Rapid Technological growth and depletion of resources, Reports of the Club of Rome. Limits of growth: sustainable development

Energy Crisis: Renewable Energy Resources

Environmental degradation and pollution. Eco-friendly Technologies. Environmental Regulations, Environmental Ethics

Appropriate Technology Movement of Schumacher; later developments

Technology and developing notions. Problems of Technology transfer, Technology assessment impact analysis.

Human Operator in Engineering projects and industries. Problems of man, machine, interaction, Impact of assembly line and automation. Human centered Technology.

Ethics of Profession:

Engineering profession: Ethical issues in Engineering practice, Conflicts between business demands and professional ideals. Social and ethical

responsibilities of Technologists. Codes of professional ethics. Whistle blowing and beyond, Case studies.

Profession and Human Values:

Values Crisis in contemporary society

Nature of values: Value Spectrum of a good life

Psychological values: Integrated personality; mental health

Societal values: The modern search for a good society, justice, democracy, secularism, rule of law, values in Indian Constitution.

Aesthetic values: Perception and enjoyment of beauty, simplicity, clarity

Moral and ethical values: Nature of moral judgements; canons of ethics; ethics of virtue; ethics of duty; ethics of responsibility.

**Books:**

1. Stephen H Unger, Controlling Technology: Ethics and the Responsible Engineers, John Wiley & Sons, New York 1994 (2nd Ed)
2. Deborah Johnson, Ethical Issues in Engineering, Prentice Hall, Englewood Cliffs, New Jersey 1991.
3. A N Tripathi, Human values in the Engineering Profession, Monograph published by IIM, Calcutta 1996.

CH401: Basic Environmental Engineering & Elementary Biology**Contacts : 3L****Credits : 3****General**

Basic ideas of environment, basic concepts, man, society & environment, their interrelationship.

1L

Mathematics of population growth and associated problems, Importance of population study in environmental engineering, definition of resource, types of resource, renewable, non-renewable, potentially renewable, effect of excessive use vis-à-vis population growth, Sustainable Development.

2L

Materials balance: Steady state conservation system, steady state system with non conservative pollutants, step function.

1L

Environmental degradation: Natural environmental Hazards like Flood, earthquake, Landslide-causes, effects and control/management;

Anthropogenic degradation like Acid rain-cause, effects and control. Nature and scope of Environmental Science and Engineering.

2L

Ecology

Elements of ecology: System, open system, closed system, definition of ecology, species, population, community, definition of ecosystem components types and function. 1L

Structure and function of the following ecosystem: Forest ecosystem, Grassland ecosystem, Desert ecosystem, Aquatic ecosystems, Mangrove ecosystem (special reference to Sundar ban); Food chain [definition and one example of each food chain], Food web. 2L



Biogeochemical Cycle- definition, significance, flow chart of different cycles with only elementary reaction [Oxygen, carbon, Nitrogen, Phosphate, Sulphur]. 1L

Biodiversity- types, importance, Endemic species, Biodiversity Hot-spot, Threats to biodiversity, Conservation of biodiversity. 2L

Air pollution and control

Atmospheric Composition: Troposphere, Stratosphere, Mesosphere, Thermosphere, Tropopause and Mesopause.

1L

Energy balance: Conductive and Convective heat transfer, radiation heat transfer, simple global temperature model [Earth as a black body, earth as albedo], Problems. 1L

Green house effects: Definition, impact of greenhouse gases on the global climate and consequently on sea water level, agriculture and marine food. Global warming and its consequence, Control of Global warming. Earth's heat budget. 1L

Lapse rate: Ambient lapse rate Adiabatic lapse rate, atmospheric stability, temperature inversion (radiation inversion).

2L

Atmospheric dispersion: Maximum mixing depth, ventilation coefficient, effective stack height, smokestack plumes and Gaussian plume model.

2L

Definition of pollutants and contaminants, Primary and secondary pollutants: emission standard, criteria pollutant.

Sources and effect of different air pollutants- Suspended particulate matter, oxides of carbon, oxides of nitrogen, oxides of sulphur, particulate, PAN.

2L

Smog, Photochemical smog and London smog.

Depletion Ozone layer: CFC, destruction of ozone layer by CFC, impact of other green house gases, effect of ozone modification.

1L

Standards and control measures: Industrial, commercial and residential air quality standard, control measure (ESP. cyclone separator, bag house, catalytic converter, scrubber (ventury), Statement with brief reference).

1L

Water Pollution and Control

Hydrosphere, Hydrological cycle and Natural water.

20

Pollutants of water, their origin and effects: Oxygen demanding wastes, pathogens, nutrients, Salts, thermal application, heavy metals, pesticides,



volatile organic compounds. 2L

River/Lake/ground water pollution: River: DO, 5 day BOD test, Seeded BOD test, BOD reaction rate constants, Effect of oxygen demanding wastes

on river[deoxygenation, reaeration], COD, Oil, Greases, pH. 2L

Lake: Eutrophication [Definition, source and effect]. 1L

Ground water: Aquifers, hydraulic gradient, ground water flow (Definition only) 1L

Standard and control: Waste water standard [BOD, COD, Oil, Grease],

Water Treatment system [coagulation and flocculation, sedimentation and filtration, disinfection, hardness and alkalinity, softening]

Waste water treatment system, primary and secondary treatments [Trickling filters, rotating biological contractor, Activated sludge, sludge treatment, oxidation ponds] tertiary treatment definition.

2L

Water pollution due to the toxic elements and their biochemical effects: Lead, Mercury, Cadmium, and Arsenic

1L

Land Pollution

Lithosphere; Internal structure of earth, rock and soil 1L

Solid Waste: Municipal, industrial, commercial, agricultural, domestic, pathological and hazardous solid wastes; Recovery and disposal method-

Open dumping, Land filling, incineration, composting, recycling.

Solid waste management and control (hazardous and biomedical waste). 2L

Noise Pollution

Definition of noise, effect of noise pollution, noise classification [Transport noise, occupational noise, neighbourhood noise]

1L

Definition of noise frequency, noise pressure, noise intensity, noise threshold limit value, equivalent noise level, L_{10} (18hr Index) , $n L_d$.

Noise pollution control. 1L

Environmental Management:

Environmental impact assessment, Environmental Audit, Environmental laws and protection act of India, Different international environmental treat

References/Books

1. Masters, G. M., "Introduction to Environmental Engineering and Science", Prentice-Hall of India Pvt. Ltd., 1991.

2. De, A. K., "Environmental Chemistry", New Age International.



ELECTROMAGNETIC THEORY & TRANSMISSION LINES

Code : EC 401 Contacts : 3L +1T =4hrs Credits :4

Electromagnetic Theory

1. Vector calculus - orthogonal Coordinate System, Transformations of coordinate systems; Del operator; Gradient, Divergence, Curl - their physical interpretations; Laplacian operator. [3]
2. Coulomb's law, electric field intensity, charge distribution; Gauss' law, flux density and electric field intensity. Divergence theorem. Current Densities, Conductors, Poisson's & Laplace's equations. Uniqueness theorem, Biot-Savart law, Ampere's law, Relation between J & H, Vector magnetic Potential, Stokes' theorem. [5]
3. Faraday's law & Lenz's law. Displacement Current, J_c - J_D Relation, Maxwell's equations, Time-harmonic fields, Wave Equation, Boundary Conditions between media interface; Uniform Plane wave; Plane Wave Propagation in Lossy Dielectric, Loss-less Dielectric, Good Conductor, Free space; Poynting Theorem, Power flow, Poynting vector, Skin Depth, Surface Resistance; Reflection and Transmission for normal incidence.[10]

Transmission Lines

4. Transmission Lines; Concept of Lumped parameters and Distributed parameters. Line Parameters, Transmission line equations and solutions, Physical significance of the solutions, Propagation constant, Characteristic Impedance; Wavelength; Velocity of Propagation; Distortion-less Line, Reflection and Transmission coefficients; Standing Waves, VSWR, Input Impedance, Smith Chart -Applications; Load Matching Techniques / Quarter wave Matching, Bandwidth problem; Low loss RF transmission lines, line as circuit elements. [10]
5. Types of transmission line (open 2-wire, coaxial line, micro strip coplanar waveguide), applications and limitations: Design principle, Power handling capacity. Power Dissipation, Breakdown with coaxial line and micro strip line as examples. [4]

Radiation of E M Waves

6. Antenna Concepts, Antenna Characteristic; Hertzian dipole (Radiation Fields, Radiation Resistance, Radiation patterns, Directive Gain); Properties and typical applications of Half-wave dipole, Loop antenna, Yagi-Uda array, Array Antennas. [6]



Text Books

1. Principles of Electromagnetics, 4th Edition, Matthew O H Sadiku, Oxford University Press.
2. Electromagnetic Field Theory & Transmission Lines, G.S.N. Raju, Pearson Education
3. Electromagnetic Waves Shevgaonkar, Tata-McGraw-Hill –R K

Reference Books

1. Engineering Electromagnetics, 2ed Edition - Nathan Ida, Springer India
2. Fields & Waves in Communication Electronics, S. Ramo, J. R. Whinnery & T. Van Duzer, John Wiley
3. Electromagnetic Theory & Applications, A. K. Saxena, Narosa Publishing House Pvt. Ltd.
4. Electromagnetics, 2ed Edition – J A Edminister, Tata-McGraw-Hill.
5. Engineering Electromagnetics, 7th Edition - W.H. Hayt & J.A. Buck, Tata-McGraw-Hill
6. Electromagnetic Waves and Transmission Lines- by G.Prasad, J.Prasad and J.Reddy- Scitech

DIGITAL ELECTRONICS & INTEGRATED CIRCUITS

Code : EC 402 Contacts : 3L +1T =4hrs Credits :4

Module1.

a) Data and number systems; Binary, Octal and Hexadecimal representation and their conversions; BCD, ASCII, EBCDIC, Gray codes and their conversions; Signed binary number representation with 1's and 2's complement methods, Binary arithmetic.

[5]

b) Venn diagram, Boolean algebra; Various Logic gates- their truth tables and circuits; Representation in SOP and POS forms; Minimization of logic expressions by algebraic method, K-map method [6]

Module-2:

a) Combinational circuits- Adder and Subtractor circuits; Applications and circuits of Encoder, Decoder, Comparator, Multiplexer, De-Multiplexer and Parity Generator.[5]

b) Memory Systems: RAM, ROM, EPROM, EEROM [4]

c) Design of combinational circuits-using ROM, Programming logic devices and gate arrays. (PLAs and PLDs) [4]

Module-3:

Sequential Circuits- Basic memory element-S-R, J-K, D and T Flip Flops, various types of Registers and counters and their design, Irregular counter, State table and state transition diagram, sequential circuits design methodology.[6]



Module-4:

- a) Different types of A/D and D/A conversion techniques. [4]
- b) Logic families- TTL, ECL, MOS and CMOS, their operation and specifications. [6]

Total: 40 hours

22

Textbooks:

1. A.Anand Kumar, Fundamentals of Digital Circuits- PHI
2. A.K.Maini- Digital Electronics- Wiley-India
3. Kharate- Digital Electronics- Oxford

Reference:

1. Morris Mano- Digital Logic Design- PHI
2. R.P.Jain—Modern Digital Electronics, 2/e , Mc Graw Hill
3. H.Taub & D.Shilling, Digital Integrated Electronics- Mc Graw Hill.
4. D.Ray Chaudhuri- Digital Circuits-Vol-I & II, 2/e- Platinum Publishers
5. Givone—Digital Principles & Design, Mc Graw Hill
6. Tocci, Widmer, Moss- Digital Systems,9/e- Pearson
7. S.K.Mandal, Digital Electronics Principles and Applications- Mc Graw Hill.
8. J.Bignell & R.Donovan-Digital Electronics-5/e- Cengage Learning.
9. Leach & Malvino—Digital Principles & Application, 5/e, Mc Graw Hill
10. Floyd & Jain- Digital Fundamentals-Pearson.
11. P.Raja- Digital Electronics- Scitech Publications
12. S.Aligahanan, S.Aribazhagan, Digital Circuit & Design- Bikas Publishing

Computer Organisation and Architecture

EC403

Contact: 3L + 1T

Credits: 4

Module 1: Computer Organization & Architecture, Basic functional Unit, Computer component structure [Eg. Structure of IAS Computer, IBM Machine configuration], Harvard & Von Neumann architecture, BUS architecture, ALU designs [combinational ALU & sequential ALU], Instruction set: Instruction format & types. [8L]

Module 2: Memory Organization: Memory system overview, Cache memory organizations, Techniques for reducing cache misses; Hierarchical memory technology: Inclusion, Coherence and locality properties; Virtual memory organization, mapping and management techniques, memory replacement policies [10L]



Module 3: CPU Organization: Fundamentals, Processor-memory communication [Clock cycles and Timing Diagram], Instruction cycle, RISC & CISC based architecture. [4L]

Module 4: Pipelining: Basic concepts, instruction and arithmetic pipeline, data hazards, control hazards and structural hazards, techniques for handling hazards, Flynn's classification –SISD, SIMD, MISD, MIMD architectures, Pipeline optimization techniques. [7L]

Module 5: Instruction-level parallelism: basic concepts, techniques for increasing ILP, superscalar, super pipelined and VLIW processor architectures, Array and Vector processors. [6L]

Module 6: Overview of HDL: VHDL basics programming concept, Structural, dataflow, behavioural & mixed style modeling techniques. [3L]

Text & Reference books:

1. William Stallings —“ Computer Organization & Architecture Designing for performance” , 8/e , Pearson
2. Carl Hamacher, Zvonko Vranesic, Safwat Zaky —“Computer Organization”, 5/e, MGH
3. Mano M.M—“Computer System Architecture”, 3/e, Pearson
4. Kai Hwang & Naresh Jotwani-- “ Advanced Computer Architecture Parallelism, Scalability, Programmability”, 2/e, MGH
5. Pedroni---“Circuit Design And Simulation With VHDL”, 2/e, PHI

Practical

TECHNICAL REPORT WRITING & LANGUAGE LABORATORY PRACTICE

Code: HU481

Cr-2

Detailed Course Outlines:

A. **Technical Report Writing** : 2L+6P

1. Report Types (Organizational / Commercial / Business / Project)
2. Report Format & Organization of Writing Materials
3. Report Writing (Practice Sessions & Workshops)

B. **Language Laboratory Practice**

I. Introductory Lecture to help the students get a clear idea of Technical Communication & the need of Language Laboratory

Practice Sessions 2L



2. Conversation Practice Sessions: (To be done as real life interactions) 2L+4P

- a) Training the students by using Language Lab Device/Recommended Texts/cassettes /cd's to get their Listening Skill & Speaking Skill honed
- b) Introducing Role Play & honing over all Communicative Competence

3. Group Discussion Sessions: 2L+6P

- a) Teaching Strategies of Group Discussion
- b) Introducing Different Models & Topics of Group Discussion
- c) Exploring Live /Recorded GD Sessions for mending students' attitude/approach & for taking remedial measure

Interview Sessions; 2L+6P

- a) Training students to face Job Interviews confidently and successfully
- b) Arranging Mock Interviews and Practice Sessions for integrating Listening Skill with Speaking Skill in a formal situation for effective communication

4. Presentation: 2L+6P

- a) Teaching Presentation as a skill
- b) Strategies and Standard Practices of Individual /Group Presentation
- c) Media & Means of Presentation: OHP/POWER POINT/ Other Audio-Visual Aids

5. Competitive Examination: 2L+2P

- a) Making the students aware of Provincial /National/International Competitive Examinations
- b) Strategies/Tactics for success in Competitive Examinations
- c) SWOT Analysis and its Application in fixing Target

Books – Recommended:

**Nira Konar: English Language Laboratory: A Comprehensive Manual
PHI Learning, 2011**

**D. Sudharani: Advanced Manual for Communication Laboratories &
Technical Report Writing Pearson Education (W.B. edition), 2011**

References:

Adrian Duff et. al. (ed.): Cambridge Skills for Fluency

A) Speaking (Levels 1-4 Audio Cassettes/Handbooks)

B) Listening (Levels 1-4 Audio Cassettes/Handbooks)

Cambridge University Press 1998

Mark Hancock: English Pronunciation in Use

4 Audio Cassettes/CD'S OUP 2004



Electromagnetic Wave and Transmission Lines

Code: EC491

Contacts: 3P

Credits: 2

Module I:

1. Plotting of Standing Wave Pattern along a transmission line when the line is open-circuited, short-circuited and terminated by a resistive load at the loadend.

25

2. Input Impedance of a terminated coaxial line using shift in minima technique.

3. Study of Smith chart on Matlab platform.

4. Simulation study of Smith chart - Single and double stub matching.

Module II:

5. Radiation Pattern of dipole antenna.

6. Radiation Pattern of a folded-dipole antenna.

7. Radiation pattern of a 3-element Yagi-Uda Antenna.

8. Beam width, gain and radiation pattern of a 3-element, 5-element and 7-element. Yagi-Uda antenna - Comparative study.

9. Radiation pattern, Gain, Directivity of a Pyramidal Horn Antenna.

10. Study of Spectrum Analyzer.

Digital Electronic & Integrated Circuits Laboratory

Code: EC492

Contacts: 3P

Credits: 2

1. Realization of basic gates using Universal logic gates.

2. Code conversion circuits- BCD to Excess-3 and vice-versa.

3 Four-bit parity generator and comparator circuits.

4. Construction of simple Decoder and Multiplexer circuits using logic gates.

5. Design of combinational circuit for BCD to decimal conversion to drive 7-segment display using multiplexer.

6. Construction of simple arithmetic circuits-Adder, Subtractor.

7. Realization of RS-JK and D flip-flops using Universal logic gates.

8. Realization of Universal Register using JK flip-flops and logic gates.

Realization of Universal Register using multiplexer and flip-flops.

9.

10. Construction of Adder circuit using Shift Register and full Adder.

11. Realization of Asynchronous Up/Down counter.

12. Realization of Synchronous Up/Down counter.

13. Design of Sequential Counter with irregular sequences.



14. Realization of Ring counter and Johnson's counter.
15. Construction of adder circuit using Shift Register and full Adder.

Computer Organisation and Architecture Lab

Code: EC493

Contact: 3P

Credits: 2

All laboratory assignments are based on Hardware Description Language (VHDL or Verilog) Simulation.

HDL introduction

Basic digital logic base programming with HDL

8-bit Addition, Multiplication, Division

8-bit Register design

Memory unit design and perform memory operations.

2-bit, 4-bit, 8-bit simple ALU design

8-bit simple CPU design

Interfacing of CPU and Memory



Third Year – Fifth Semester

A.THEORY							
Sl No.	Subject Code	Theory	Contact Hours/Week				Credit Points
			L	T	P	Total	
1	HU501	Economics for Engineers	3	0	0	3	3
2	EC-501	Analog Communication	3	1	0	4	4
3	EC-502	Microprocessors & Microcontrollers	3	1	0	4	4
4	EC-503	Control System	3	0	0	3	3
5	F. E.- EC 504A EC-504B	Design and Analysis of Algorithm Object Oriented Programming using Java	3	1	0	4	3/4
Total of Theory						18	18
B. PRACTICAL							
6	EC-591	Analog Communication	0	0	3	3	2
7	EC-592	Microprocessors & Microcontrollers	0	0	3	3	2
8	EC -593	Control System	0	0	3	3	2
9	F.E. EC-594A EC-594B	Design and Analysis of Algorithm Object Oriented Programming using Java	0	0	3	3	2
Total of Practical						12	8
Total of Semester						30	26

Economics for Engineers

HU-501

Contracts: 3L

Credits- 3

Module-I

1. Economic Decisions Making – Overview, Problems, Role, Decision making process.
2. Engineering Costs & Estimation – Fixed, Variable, Marginal & Average Costs, Sunk Costs, Opportunity Costs, Recurring And Nonrecurring Costs, Incremental Costs, Cash Costs vs Book Costs, Life-Cycle Costs; Types Of Estimate, Estimating Models - Per-Unit Model, Segmenting Model, Cost Indexes, Power-Sizing Model, Improvement & Learning Curve, Benefits.



Module-II

3. Cash Flow, Interest and Equivalence: Cash Flow – Diagrams, Categories & Computation, Time Value of Money, Debt repayment, Nominal & Effective Interest.
4. Cash Flow & Rate Of Return Analysis – Calculations, Treatment of Salvage Value, Annual Cash Flow Analysis, Analysis Periods; Internal Rate Of Return, Calculating Rate of Return, Incremental Analysis; Best Alternative Choosing An Analysis Method, Future Worth Analysis, Benefit-Cost Ratio Analysis, Sensitivity And Breakeven Analysis. Economic Analysis In The Public Sector - Quantifying And Valuing Benefits & drawbacks.

Module-III

5. Inflation And Price Change – Definition, Effects, Causes, Price Change with Indexes, Types of Index, Composite vs Commodity Indexes, Use of Price Indexes In Engineering Economic Analysis, Cash Flows that inflate at different Rates.
6. Present Worth Analysis: End-Of-Year Convention, Viewpoint Of Economic Analysis Studies, Borrowed Money Viewpoint, Effect Of Inflation & Deflation, Taxes, Economic Criteria, Applying Present Worth Techniques, Multiple Alternatives.
7. Uncertainty In Future Events - Estimates and Their Use in Economic Analysis, Range Of Estimates, Probability, Joint Probability Distributions, Expected Value, Economic Decision Trees, Risk, Risk vs Return, Simulation, Real Options.

Module-IV

8. Depreciation - Basic Aspects, Deterioration & Obsolescence, Depreciation And Expenses, Types Of Property, Depreciation Calculation Fundamentals, Depreciation And Capital Allowance Methods, Straight-Line Depreciation Declining Balance Depreciation, Common Elements Of Tax Regulations For Depreciation And Capital Allowances.
9. Replacement Analysis - Replacement Analysis Decision Map, Minimum Cost Life of a New Asset, Marginal Cost, Minimum Cost Life Problems.
10. Accounting – Function, Balance Sheet, Income Statement, Financial Ratios Capital Transactions, Cost Accounting, Direct and Indirect Costs, Indirect Cost Allocation.

Text book:

1. James L.Riggs, David D. Bedworth, Sabah U. Randhawa : Economics for Engineers 4e , Tata McGraw-Hill
2. Donald Newnan, Ted Eschembach, Jerome Lavelle : Engineering Economics Analysis, OUP
3. John A. White, Kenneth E. Case, David B. Pratt : Principle of Engineering Economic Analysis, John Wiley
4. Sullivan and Wicks: Engineering Economy, Pearson
5. R. Paneer Seelvan: Engineering Economics, PHI



6. Michael R Lindeburg : Engineering Economics Analysis, Professional Pub

EC501 - Analog Communication

EC 501 Contacts: 3-1-0 Credits: 4

Module-1

Introduction to Analog Communication:

Elements of communication system - Transmitters, Transmission channels & receivers (1),
Concept of modulation,
its needs (1). 9hrs

Continuous Wave Linear Modulation:

a) Amplitude modulation(AM-DSB/TC): Time domain representation of AM signal (expression derived using a single tone message), modulation index [1], frequency domain (spectral) representations, illustration of the carrier and side band components; transmission bandwidth for AM; Phasor diagram of an AM signal; [2]

Calculation of Transmitted power & sideband power & Efficiency ; concept of under, over and critical modulation of AM-DSB-TC.[2]

b) Other Amplitude Modulations: Double side band suppressed carrier (DSBSC) modulation: time and frequency

domain expressions, bandwidth and transmission power for DSB.[1] Single side band modulation (SSB) both

TC & SC and only the basic concept of VSB, Spectra and band-width. [2]

Module-2

Generation & Detection of Amplitude Modulation:

a) Generation of AM: Concept of i) Gated and ii) Square law modulators, Balanced Modulator. [2]

b) Generation of SSB: Filter method, Phase shift method and the Third method [2]
9hrs

Demodulation for Linear Modulation:

Demodulation of AM signals: Detection of AM by envelope detector [1], Synchronous detection for AM-SC, Effects of Frequency & Phase mismatch, Corrections. [2]

Principle of Super heterodyne receivers: Super heterodyning principle, intermediate frequency, Local oscillator

frequency, image frequency. [2] 9hrs

Module-3

Angle Modulation:

a) Frequency Modulation (FM) and Phase Modulation (PM): Time and Frequency domain representations, Spectral

representation of FM and PM for a single tone message, Bessel's functions and Fourier series. (2); Phasor diagram(1);



- b) **Generation of FM & PM:** Narrow and Wide-band angle modulation, Basic block diagram representation of generation of FM & PM, Concept of VCO & Reactance modulator (2)
- c) **Demodulation of FM and PM:** Concept of frequency discriminators (1), Phase Locked Loop (2) 8hrs

Module - 4 Multiplexing

- a) Frequency Division Multiplexing, Time Division Multiplexing, (FDM) (1)
- b) Stereo – AM and FM: Basic concepts with block diagrams (2)
- c) **Random Signals and Noise in Communication System:**
- i) Noise in Communication systems – Internal & External noise, Noise Temperature, Signal-to-Noise ratio, White noise, thermal noise, Figure of Merit. (2)
- iii) Noise performance in Analog Communication systems: SNR calculation for DSB/TC, DSB-SC, SSB-TC, SSBSC & FM. (5) 10hrs

Total 36 Hours

Text Books:

7. Taub and Schilling , “Principles of Communication Systems”, 2nd ed., Mc-Graw Hill
8. B.P.Lathi -Communication Systems- BS Publications
2. V Chandra Sekar – Analog Communication- Oxford University Press

References:

9. Carlson—Communication System,4/e , Mc-Graw Hill
10. Proakis & Salehi Fundamentals of Communication Systems- Pearson
11. Singh & Sapre—Communication Systems: 2/e, TMH
12. P K Ghosh- Principles of Electrical Communications- University Press
13. L.W.Couch II, “Digital and Analog Communication Systems”, 2/e, Macmillan Publishing
14. Blake, Electronic Communication Systems- Cengage Learning
15. S Sharma, Analog Communication Systems- Katson Books

Microprocessor & Microcontroller

Code: EC502

Contact: 3L + 1T

Credits: 4

Module-1

Introduction to Microcomputer based system. History Evolution of Microprocessor and microcontrollers and their advantages and Disadvantages (1)



Architecture of 8085 Microprocessor. Address / Data Bus multiplexing and demultiplexing. Status and Control signal generation. Instruction set of 8085 Microprocessor. Classification of instructions, addressing modes, timing diagram of the instructions.

Assembly language programming:

Addition, Multiplication, Block Transfer, Ascending order, Descending order, Finding largest & smallest number, Look-up table etc.

Interrupts of 8085 processor: classification of interrupts, Programming using interrupts (programming using INTR is not required)

(8)

Serial and parallel data transfer – Basic concept of serial I/O, DMA, Asynchronous and synchronous serial transmission using SID and SOD pins of 8085 Microprocessor.

(2)

Module-2

8051 architecture:

8051 micro controller hardware, input/output pins, ports, external memory, counters and timers, instruction set, addressing modes, serial data i/o, interrupts.

Assembly language Programming using 8051

Moving data:

External data moves, code memory read only data moves, PUSH and POP opcodes, data exchanges.

Logical operations:

Byte-level, bit-level, rotate and swap operations.

Arithmetic operations:

Flags, incrementing and decrementing, addition, subtraction, multiplication and division, decimal arithmetic. Jump and call instructions:

Jump and call program range, jumps, calls and subroutines, interrupts and returns.

(7)

Module-3

The 8086 microprocessor: Architecture, Pin details, memory segmentation, addressing modes, Familiarization of basic Instructions, Interrupts.

Assembly language programming: Addition, Multiplication, Block Transfer, Ascending order, Descending order, Finding largest & smallest number etc.

(7)



Module-4 Support IC chips: 8255, 8253 and 8251: Block Diagram, Pin Details, Modes of operation, control word(s) format.

Interfacing of support IC chips with 8085, 8086 and 8051.

(6)

Memory interfacing with 8085, 8086 & 8051.

ADC / DAC interfacing with 8085, 8086 & 8051.

(4)

Brief introduction to PIC microcontroller (16F877): Architecture, PIN details, memory layout etc. (1)

28

TEXT BOOKS:

13. Microprocessor architecture, programming and application with 8085 – R. Gaonkar (Penram International) (strongly recommended)

14. The 8051 microcontroller - K. Ayala (Thomson)

15. Microprocessors & interfacing – D. V. Hall (Tata McGraw-hill)

16. Ray & Bhurchandi, Advanced Microprocessors & Peripherals, TMH

17. The 8051 microcontroller and Embedded systems - Mazidi, Mazidi and McKinley (PEARSON)

18. An Introduction to Microprocessor and Applications –Krishna Kant (Macmillan)

References:

Microprocessors and microcontrollers - N. Senthil Kumar, M. Saravanan and Jeevanant (Oxford university press).

8086 Microprocessor –K Ayala (Cengage learning)

Microprocessors – The 8086/8088, 80186/80386/80486 and the Pentium family – N. B. Bahadure (PHI).

The 8051 microcontrollers – Uma Rao and Andhe Pallavi (PEARSON).

CONTROL SYSTEMS

Code: EC503

Contact: 3L

Credits: 3

Module – I:

a) INTRODUCTION

Concepts of Control Systems- Open Loop and closed loop control systems and their differences-

Different examples of control systems- Classification

of control systems, Feed-Back Characteristics, Effects of feedback.

Mathematical models – Differential equations, Impulse Response and transfer functions -

Translational and Rotational mechanical systems

[4L]



b) TRANSFER FUNCTION REPRESENTATION

Transfer Function of linear systems, Block diagram representation of systems considering electrical systems as examples -Block diagram algebra – Representation by Signal flow graph - Reduction using mason's gain formula. [5L]

Module – II:

a) TIME RESPONSE ANALYSIS

Standard test signals - Time response of first order systems – Characteristic Equation of Feedback control systems, Transient response of second order systems - Time domain specifications – Steady state response - Steady state errors and error constants.

[5L]

b) STABILITY ANALYSIS IN S-DOMAIN

The concept of stability – Routh's stability criterion – limitations of Routh's stability. Root Locus Technique: The root locus concept - construction of root loci-effects of adding poles and zeros to $G(s)H(s)$ on the root loci.[5L]

Module – III:

a) FREQUENCY RESPONSE ANALYSIS

Introduction, Frequency domain specifications-Bode diagrams-Determination of Frequency domain specifications and transfer function from the Bode Diagram-Phase margin and Gain margin-Stability Analysis from Bode Plots. [6L]

b) STABILITY ANALYSIS IN FREQUENCY DOMAIN

Polar Plots, Nyquist Plots Stability Analysis. [4L]

Module - IV :

a) CLASSICAL CONTROL DESIGN TECHNIQUES

Compensation techniques – Lag, Lead, Lead-Lag Controllers design in frequency Domain, PID Controllers. [5L]

b) STATE SPACE ANALYSIS OF CONTINUOUS SYSTEMS

Concepts of state, state variables and state model, derivation of state models from block diagrams, Diagonalization- Solving the Time invariant state Equations- State Transition Matrix and it's Properties – Concepts of Controllability and Observability

[6L]

TEXT BOOKS:

1. Automatic Control Systems 8th edition– by B. C. Kuo 2003– John Wiley and son's.,
2. Control Systems Engineering – by I. J. Nagrath and M. Gopal, New Age International (P) Limited, Publishers, 2nd edition.



REFERENCE BOOKS:

1. Modern Control Engineering – by Katsuhiko Ogata – Prentice Hall of India Pvt. Ltd., 3rd edition, 1998.
2. Control Systems Engg. by NISE 3rd Edition – John Wiley

Design & Analysis of Algorithm

Code: EC504A

Contact: 3L + 1T

Credits: 4

Complexity Analysis:[2L]

Time and Space Complexity, Different Asymptotic notations – their mathematical significance

Algorithm Design Techniques:

Divide and Conquer: [3L]

Basic method, use, Examples – Binary Search, Merge Sort, Quick Sort and their complexity.

Heap Sort and its complexity [1L]

Dynamic Programming: [3L]

Basic method, use, Examples – Matrix Chain Manipulation, All pair shortest paths, single source shortest path. Backtracking: [2L]

Basic method, use, Examples – 8 queens problem, Graph coloring problem. Greedy Method: [3L]

Basic method, use, Examples – Knapsack problem, Job sequencing with deadlines, Minimum cost spanning tree by Prim's and Kruskal's algorithm.

Lower Bound Theory: [1L]

$O(n \lg n)$ bound for comparison sort

Disjoint set manipulation: [2L]

Set manipulation algorithm like UNION-FIND, union by rank.

Graph traversal algorithm: Recapitulation [1L]

Breadth First Search(BFS) and Depth First Search(DFS) – Classification of edges - tree, forward, back and

cross edges – complexity and comparison

String matching problem: [3L]

Different techniques – Naive algorithm, string matching using finite automata, and Knuth, Morris, Pratt (KMP) algorithm with their complexities.

Amortized Analysis: [3L]

Aggregate, Accounting, and Potential Method.



Network Flow: [3L]

Ford Fulkerson algorithm, Max-Flow Min-Cut theorem (Statement and Illustration)

Matrix Manipulation Algorithm: [3L]

Strassen's matrix manipulation algorithm; application of matrix multiplication to solution of simultaneous linear equations using LUP decomposition, Inversion of matrix and Boolean matrix multiplication

Notion of NP-completeness: [3L]

P class, NP class, NP hard class, NP complete class – their interrelationship, Satisfiability problem, Cook's theorem (Statement only), Clique decision problem

Approximation Algorithms: [3L]

Necessity of approximation scheme, performance guarantee, polynomial time approximation schemes, vertex cover problem, travelling salesman problem.

Text Book:

1. T. H. Cormen, C. E. Leiserson, R. L. Rivest and C. Stein, "Introduction to Algorithms"
2. A. Aho, J. Hopcroft and J. Ullman "The Design and Analysis of Algorithms"
- D.E. Knuth "The Art of Computer Programming", Vol. 3
- Jon Kleinberg and Eva Tardos, "Algorithm Design"

Reference:

- 2.5 K. Mehlhorn, "Data Structures and Algorithms" - Vol. I & Vol. 2.
- 2.6 S. Baase "Computer Algorithms"
- 2.7 E. Horowitz and Shani "Fundamentals of Computer Algorithms"
- 2.8 E.M. Reingold, J. Nievergelt and N. Deo- "Combinational Algorithms- Theory and Practice", Prentice Hall, 1997

Object Oriented Programming

Code: EC504B

Contact: 3L

Credits: 3

Object oriented design [10 L]

Concepts of object oriented programming language, Major and minor elements, Object, Class, relationships among objects, aggregation, links, relationships among classes-association, aggregation, using, instantiation, meta-class, grouping constructs.



Object oriented concepts [4 L]

Difference between OOP and other conventional programming – advantages and disadvantages.
Class, object, message passing, inheritance, encapsulation, polymorphism

Basic concepts of object oriented programming using Java [22 L]

Implementation of Object oriented concepts using Java.

Language features to be covered:

Class & Object properties [6L]

Basic concepts of java programming – advantages of java, byte-code & JVM, data types, access specifiers, operators, control statements & loops, array, creation of class, object, constructor, finalize and garbage collection, use of method overloading, this keyword, use of objects as parameter & methods returning objects, call by value & call by reference, static variables & methods, garbage collection, nested & inner classes, basic string handling concepts- String (discuss charAt() , compareTo(), equals(), equalsIgnoreCase(), indexOf(), length() , substring(), toCharArray() ,toLowerCase(), toString(), toUpperCase() , trim() , valueOf() methods) & StringBuffer classes (discuss append(), capacity(), charAt(), delete(),deleteCharAt(), ensureCapacity(), getChars(), indexOf(), insert(), length(), setCharAt(), setLength(), substring(), toString() methods), concept of mutable and immutable string, command line arguments, basics of I/O operations – keyboard input using BufferedReader & Scanner classes.

Reusability properties[6L] – Super class & subclasses including multilevel hierarchy, process of constructor calling in inheritance, use of super and final keywords with super() method, dynamic method dispatch, use of abstract classes & methods, interfaces. Creation of packages, importing packages, member access for packages.

Exception handling & Multithreading [6L] – Exception handling basics, different types of exception classes, use of try & catch with throw, throws & finally, creation of user defined exception classes.
Basics of multithreading, main thread, thread life cycle, creation of multiple threads, thread priorities, thread synchronization, inter-thread communication, deadlocks for threads, suspending & resuming threads.

Applet Programming (using swing) [4L] – Basics of applet programming, applet life cycle, difference between application & applet programming, parameter passing in applets, concept of delegation event model and listener, I/O in applets, use of repaint(), getDocumentBase(), getCodeBase() methods, layout manager (basic concept), creation of buttons (JButton class only) & text fields.

Textbooks/References:

1. Rambaugh, James Michael, Blaha – "Object Oriented Modelling and Design" – Prentice Hall, India
2. Ali Bahrami – "Object Oriented System Development" – Mc Graw Hill
3. Patrick Naughton, Herbert Schildt – "The complete reference-Java2" – TMH
4. R.K Das – "Core Java For Beginners" – VIKAS PUBLISHING
5. Deitel and Deitel – "Java How to Program" – 6th Ed. – Pearson
6. Ivor Horton's Beginning Java 2 SDK – Wrox
7. E. Balagurusamy – " Programming With Java: A Primer" – 3rd Ed. – TMH

Practical**Analog Communication Lab****Code: EC591****Contact: 3P****Credits: 2**

1. Measurement of modulation index of an AM signal.
2. measurement of output power with varying modulation index an AM signal(for both DSB- & SSB).
3. Measurement of distortion of the demodulated output with varying modulation index of an AM signal (for both DSB-SC & SSB).
4. Measurement of power of different frequency components of a frequency modulated signal & the measurement of the bandwidth.
5. Design a PLL using VCO & to measure the lock frequency.
6. Design a FM demodulator using PLL.
7. Measurement of SNR of a RF amplifier.
8. Measurement of selectivity ,sensitivity,fidelity of a superhetrodyne receiver.
9. Study of waveforms of various functional points (output of RF,IF & video) of a B/W TV receiver.
10. Study of the vertical & horizontal sweep of the time base unit of a B/W TV.
11. One innovative experiment.

Microprocessors & Microcontrollers Lab**Code:EC-592****Contact: 3P****Credits: 2**

1.Study of prewritten programs on trainer kit using the basic instruction set (data transfer, Load/Store, Arithmetic,Logical) Assignments based on above.

3hrs

2. a) Familiarization with 8085 & 8051 simulator on PC.

Study of prewritten programs using basic instruction set (data transfer, Load/Store, Arithmetic, Logical) on the simulator. Assignments based on above

3hrs



3. Programming using kit and simulator for:

- i) Table look up
 - ii) Copying a block of memory
 - iii) Shifting a block of memory
 - iv) Packing and unpacking of BCD numbers
 - v) Addition of BCD numbers
 - vi) Binary to ASCII conversion
 - vii) String Matching, Multiplication using shift and add method and Booth's Algorithm
- 6hrs

4. Program using subroutine calls and IN/OUT instructions using 8255 PPI on the trainer kit e.g. subroutine for delay, reading switch state and glowing LEDs accordingly.

3hrs

5. Study of timing diagram of an instruction on oscilloscope. 3hrs

6. Interfacing of 8255: Keyboard and Multi-digit Display with multiplexing using 8255 6hrs

7. Study of 8051 Micro controller kit and writing programs as mentioned in S/L3. Write programs to interface of Keyboard, DAC and ADC using the kit. 3hrs

8. Serial communication between two trainer kits 3hrs

Total 30 hours (10 classes each of 3 periods)

Control System Lab

Code: EC583

Contact: 3P

Credits: 2

1. Familiarization with MATLAB Control System tool Box, MATLAB- SIMULINK tool box & pSPICE.

3

2. Determination of step response for 1st order & 2nd order system with unity feedback on CRO & calculation of control system specifications for variations of system design.

3

3. Simulation of step response & impulse response for Type-I & Type-II system with unity feedback using MATLAB & pSPICE.

3



4. Determination of root locus, Bode-plot, Nyquist Plot, using MATLAB control system toolbox for a given 2nd order transfer function & determination of different control system specifications.

6

5. Determination of PI, PD, and PID controller action on 1st order simulated process. 3

6. Determination of approximate transfer function experimentally using Bode Plot. 3

7. Evaluation of steady-state error, setting time, percentage peak overshoots, gain margin, phase margin with addition of lead compensator in forward path transfer functions using MATLAB & pSPICE.

3

8. Study of position control system using servomotor. 3

9. Design and hardware implementation of a temperature controller using microprocessor/microcontroller. 6

Total 33 hours (11 classes each of 3 periods)

Design & Analysis Algorithm Lab

Code: EC594A

Contact: 3P

Credits: 2

Programming Language used :C

Lab :1 : Divide and Conquer :

- > Implement Binary Search using Divide and Conquer approach
- > Implement Merge Sort using Divide and Conquer approach

Lab :2 : Divide and Conquer :

- > Implement Quick Sort using Divide and Conquer approach
- > Find Maximum and Minimum element from a array of integer using Divide and Conquer approach

Lab :3 : Dynamic Programming :

- > Find the minimum number of scalar multiplication needed for chain of matrix

Lab :4 : Dynamic Programming :

- >Implement all pair of Shortest path for a graph (Floyd- Warshall Algorithm)
- >Implement Traveling Salesman Problem

Lab :5 : Dynamic Programming :

- >Implement Single Source shortest Path for a graph (Dijkstra , Bellman Ford Algorithm)

Lab :6 : Brunch and Bound :

- >Implement 15 Puzzle Problem

Lab :7 : Backtracking :



>Implement 8 Queen problem

Lab :8 : Backtracking (implement any one of the following problem):

>Graph Coloring Problem

>Hamiltonian Problem

Lab :9 : Greedy method(implement any one of the following problem) :

>Knapsack Problem

>Job sequencing with deadlines

Lab :10 : Greedy method (implement any one of the following problem) :

>Minimum Cost Spanning Tree by Prim's Algorithm

>Minimum Cost Spanning Tree by Kruskal's Algorithm

Lab :11 : Graph Traversal Algorithm :

>Implement Breadth First Search (BFS)

>Implement Depth First Search (DFS)

Object Oriented Programming Laboratory

EC594B

L-0, T-0, P-3;

Cr 2

1. Assignments on class, constructor, overloading, inheritance, overriding
2. Assignments on wrapper class, arrays
3. Assignments on developing interfaces- multiple inheritance, extending interfaces
4. Assignments on creating and accessing packages
5. Assignments on multithreaded programming
6. Assignments on applet programming

Note: Use Java for programming

Preferably download "[java_ee_sdk-6u4-jdk7-windows.exe](#)" from

<http://www.oracle.com/technetwork/java/javasee/downloads/java-ee-sdk-6u3-jdk-7u1-downloads-523391.html>



Third Year – Sixth Semester

A.THEORY							
Sl No.	Subject Code	Theory	Contact Hours/Week				Credit Points
			L	T	P	Total	
1	HU601	Principles of Management	2	0	0	2	2
2	EC601	Digital Communications	3	0	0	3	3
3	EC602	Digital Signal Processing	3	0	0	3	3
4	EC 603	Telecommunication System	3	0	0	3	3
5	(No Lab) EC-604A EC-604B	Antenna Theory & Propagation Information Theory & Coding	3	0	0	3	3
6	(With Lab) EC-605A EC-605B EC-605C	Operating System Data Base Management Systems Electronic Measurement & Instrumentation	3	0	0	3	3
Total of Theory						17	17
B. PRACTICAL							
7	EC691	Digital Communications	0	0	3	3	2
8	EC 692	Digital Signal Processing	0	0	3	3	2
9	F.E. EC-695A EC-695B EC-695C	Operating System Data Base Management Systems Electronic Measurement & Instrumentation	0	0	3	3	2
10	EC-681	Seminar	0	0	3	3	2
Total of Practical						12	8
Total of Semester						29	25

SEMESTER - VI

Theory

Principles of Management

HU-601

Contracts: 2L

Credits- 2

Module-I

1. Basic concepts of management: Definition – Essence, Functions, Roles, Level.
2. Functions of Management: Planning – Concept, Nature, Types, Analysis, Management by objectives; Organisation Structure – Concept,



Structure, Principles, Centralization, Decentralization, Span of Management; Organisational Effectiveness.

Module-II

3. Management and Society – Concept, External Environment, CSR, Corporate Governance, Ethical Standards.
4. People Management – Overview, Job design, Recruitment & Selection, Training & Development, Stress Management.
5. Managerial Competencies – Communication, Motivation, Team Effectiveness, Conflict Management, Creativity, Entrepreneurship.

Module-III

6. Leadership: Concept, Nature, Styles.
7. Decision making: Concept, Nature, Process, Tools & techniques.
8. Economic, Financial & Quantitative Analysis – Production, Markets, National Income Accounting, Financial Function & Goals, Financial Statement & Ratio Analysis, Quantitative Methods – Statistical Interference, Forecasting, Regression Analysis, Statistical Quality Control.

Module-IV

9. Customer Management – Market Planning & Research, Marketing Mix, Advertising & Brand Management.
10. Operations & Technology Management – Production & Operations Management, Logistics & Supply Chain Management, TQM, Kaizen & Six Sigma, MIS.

TEXT BOOK:

1. Management: Principles, Processes & Practices – Bhat, A & Kumar, A (OUP).
2. Essentials for Management – Koontz, Revised edition, Tata McGraw Hill (TMH)
3. Management – Stoner, James A. F. (Pearson)
4. Management - Ghuman, Tata McGraw Hill(TMh)

Digital Communication

EC-601

Contracts: 3L

Credits- 3

MODULE – I:

Probability Theory and Random Processes:

Conditional probability, communication example, joint probability, statistical independence, random variable-continuous and discrete, cumulative distribution function, probability density function – Gaussian, Rayleigh and Rician, mean, variance, random process, stationary and ergodic



processes, correlation coefficient, covariance, auto correlation function and its properties, random binary wave, power spectral density.

6L

MODULE – II:

Signal Vector Representation:

Analogy between signal and vector, distinguishability of signal, orthogonality and orthonormality, basis function, orthogonal signal space, message point, signal constellation, geometric interpretation of signals, likelihood functions, Schwartz inequality, Gram-Schmidt orthogonalization procedure, response of the noisy signal at the receiver, maximum likelihood decision rule, decision boundary, optimum correlation receiver; probability of error, error function, complementary error function, Type-I and Type-II errors. 6L

MODULE – III:

Digital Data Transmission:

Concept of sampling, Pulse Amplitude Modulation (PAM), interlacing and multiplexing of samples, Pulse Code Modulation (PCM), quantization, uniform and non-uniform quantization, quantization noise, binary encoding, A-Law and μ -law companding, differential PCM, delta modulation and adaptive delta modulation.

Digital transmission components, source, multiplexer, line coder, regenerative repeater, concept of line coding – polar/unipolar/bipolar NRZ and RZ, Manchester, differential encoding and their PSDs, pulse shaping, Inter Symbol Interference (ISI), Eye pattern, Nyquist criterion for zero ISI, equalizer, zero forcing equalizer, timing extraction. 10L

MODULE –IV:

Digital Modulation Techniques:

Types of Digital Modulation, coherent and non-coherent Binary Modulation Techniques, basic digital carrier modulation techniques: ASK, FSK and PSK,

Coherent Binary Phase Shift Keying (BPSK), geometrical representation of BPSK signal; error probability of BPSK, generation and detection of BPSK Signal, power spectrum of BPSK.

Concept of M-ary Communication, M-ary phase shift keying, the average probability of symbol error for coherent M-ary PSK, power spectra of MPSK,

Quadrature Phase Shift Keying (QPSK), error probability of QPSK signal, generation and detection of QPSK signals, power spectra of QPSK signals,

Offset Quadrature Phase shift Queuing (OQPSK),

Coherent Frequency Shift Keying (FSK), Binary FSK, error probability of BFSK signals, generation and detection of Coherent Binary FSK signals, power spectra of BFSK signal,



Minimum Shift Keying (MSK), signal constellation of MSK waveforms, error probability of MSK signal, Gaussian Minimum Shift Keying: GMSK, basic concept of OFDM, constellation diagram, Some performance issues for different digital modulation techniques - Error Vector Magnitude (EVM), Eye Pattern and Relative Constellation Error (RCE), Conceptual idea for Vector Signal Analyzer (VSA) 14L

TEXT BOOKS:

- a) Digital Communications, S. Haykin, Wiley India.
- b) Principles of Communication Systems, H. Taub and D.L.Schilling, TMH Publishing Co.
- c) Wireless Communication and Networks : 3G and Beyond, I. Saha Misra, TMH Education.
- d) Digital Communications, J.G.Proakis, TMH Publishing Co.

REFERENCE BOOKS:

- a) Digital Communications Fundamentals and
- b) Applications, B. Sklar and P.K.Ray, Pearson.
- c) Modern Digital and Analog Communication Systems, B.P.Lathi and Z.Ding, Oxford University Press.
- f) Digital Communication, A. Bhattacharya, TMH Publishing Co.

Digital Signal Processing

EC- 602

Contracts: 3L

Credits- 3

MODULE – I:

Discrete-time signals:

Concept of discrete-time signal, basic idea of sampling and reconstruction of signal, sampling theorem, sequences – periodic, energy, power, unit-sample, unit-step, unit-ramp, real & complex exponentials, arithmetic operations on sequences. 3L

LTI Systems:

Definition, representation, impulse response, derivation for the output sequence, concept of convolution, graphical, analytical and overlap-add methods to compute convolution supported with examples and exercises, properties of convolution, interconnections of LTI systems with physical interpretations, stability and causality conditions, recursive and non-recursive systems. 6L

MODULE –II:

Z-Transform:

Definition, mapping between s-plane and z-plane, unit circle, convergence and ROC, properties of Z-transform, Z-transform on sequences with



examples and exercises, characteristic families of signals along with ROCs, convolution, correlation and multiplication using Z-transform, initial value theorem, Parseval's relation, inverse Z-transform by contour integration, power series & partial-fraction expansions with examples and exercises. 6L

Discrete Fourier Transform:

Concept and relations for DFT/IDFT, Twiddle factors and their properties, computational burden on direct DFT, DFT/IDFT as linear transformations, DFT/IDFT matrices, computation of DFT/IDFT by matrix method, multiplication of DFTs, circular convolution, computation of circular convolution by graphical, DFT/IDFT and matrix methods, linear filtering using DFT, aliasing error, filtering of long data sequences – Overlap-Save and Overlap-Add methods with examples and exercises. 5L

Fast Fourier Transform:

Radix-2 algorithm, decimation-in-time, decimation-in-frequency algorithms, signal flow graphs, Butterflies, computations in one place, bit reversal, examples for DIT & DIF FFT Butterfly computations and exercises. 4L

MODULE – III:

Filter Design:

Basic concepts of IIR and FIR filters, difference equations, design of Butterworth IIR analog filter using impulse invariant and bilinear transforms, design of linear phase FIR filters, no. of taps, rectangular, Hamming and Blackman windows. 5L

MODULE – IV:

Digital Signal Processor:

Elementary idea about the architecture and important instruction sets of TMS320C 5416/6713 processor, writing of small programs in Assembly Language. 4L

FPGA:

Architecture, different sub-systems, design flow for DSP system design, mapping of DSP algorithms onto FPGA. 3L

TEXT BOOKS:

1. Digital Signal Processing – Principles, Algorithms and Applications, J.G.Proakis & D.G.Manolakis, Pearson Ed.
2. Digital Signal processing – A Computer Based Approach, S.K.Mitra, TMH Publishing Co.
3. Digital Signal Processing Signals, Systems and Filters, A. Antoniou, TMH Publishing Co.
4. VLSI Digital Signal Processing Systems Design and Implementation, Wiley International Publication.



5. Digital Signal Processing with Field Programmable Gate Arrays, U.Meyer-Baese, Springer.

REFERENCE BOOKS:

13. Digital Signal Processing, P. Rameshbabu, Scitech Publications (India).
14. Digital Signal Processing, S.Salivahanan, A.Vallabraj & C. Gnanapriya, TMH Publishing Co.
15. Digital Signal Processing; A Hands on Approach, C. Schuler & M.Chugani, TMH Publishing Co.
16. Digital Signal Processing, A. Nagoor Kani, TMH Education
17. Digital Signal Processing S. Poornachandra & B. Sasikala, MH Education
18. Digital Signal Processing; Spectral Computation and Filter Design Chi-Tsong Chen, Oxford University Press
19. Texas Instruments DSP Processor user manuals and application notes.
20. Xilinx FPGA user manuals and application notes.

Telecommunication System

EC-603

Contracts: 3L

Credits- 3

Module-1

Introduction to Telephone Systems: Evolution of Telecommunication; Components and Examples of

Telecommunication systems; Pulse dialing & Tone dialing; Telephone Instruments -rotary dial and push button types. 3

Module-2.

Telecommunication Transmission Lines:- Copper, Co-axial, and Fiber optic cables; Transmission Bridge -

Hybrid circuit for 2-wire to 4-wire conversion and vice versa. PCM Carriers; American and European standards of carrier channels.

6

Module-3.

Subscriber Loop Systems: BORSCHT Functions; Switching hierarchy & routing, signaling techniques-in

channel & common channel signaling, SS7.

4



Module-4.

Switching System: Electro-mechanical switching-Strowger & Crossbar; Circuit Switching & Packet Switching,
Digital Switching systems - Time division Time switch, Time multiplexed Space switch, Time multiplexed Time switch, Hybrid switching, ; TS, ST, STS, TST systems; Architecture of 5ESS systems; 6

Module-5.

Stored Program Control: Software architecture, Application software;. Electronic Exchanges, Introduction to cordless telephones and Digital PABX
4

Module-6.

Traffic Engineering: Blocking network, blocking probability, grade of service, traffic load, Erlang-B and C congestion formulas-case studies
4

Module-7.

Modems and Their Standards: RS 232C; DTE and DCE, Facsimile Transmission, Broad band transmission- ISDN, DSL and ADSL, ISDN and B-ISDN
4

Module-8.

IP Telephony: Voice over IP, Session initiation protocol, H.323 signaling, IP multimedia service
4

TOTAL LECTURE HOURS: 35

Text Books:

- b) T. Viswanathan, “ Telecommunications Switching Systems & Networks”, PHI
- c) J.C.Bellamy “Digital Telephony”- Wiley-India

Reference Books:

1. O Hersent, D Gurle, J P Petit “IP Telephony” Pearson
2. J.E.Flood “Telecommunications Switching, Traffic and Networks” Pearson
3. R L Freeman “Telecommunication System Engineering”- Wiley-India
4. A Gokhale “Introduction to Telecommunication”- Cengage Learning



Antenna Theory & Propagation

EC-604A

Contracts: 3L

Credits- 3

Module-I

A. Review of Maxwell's Equation; Radiation of e.m waves and introducing Antenna; Vector Potential and Retarded Vector

Potential; Radiation fields of a Hertzian dipole(electric); Duality Principle, Radiation fields due to short magnetic dipole.

B. Antenna Characteristics: Radiation Pattern, Beam Width; Radiation Resistance and efficiency; Directivity and Gain;

Impedance, VSWR, Polarization; Effective height and Receive Aperture; Noise Temperature of Antenna.

7

Module-II

A. Radiation fields and Characteristics of $\lambda/2$ dipole; discussion on $\lambda/4$ monopole antenna; Current distribution and

Radiation patterns of center-fed dipoles of length λ , $3\lambda/2$ and 2λ . Horizontal and Vertical antennas over a plane ground.

B. Antenna Arrays: electric Field due to 2 element arrays, 3 element Arrays; Pattern Multiplication; Uniform Linear Array:

End fire and Broad side; Phased array.

9

Module-III

A. Characteristics and properties of :Travelling Wave Antenna, Helical Antenna, Folded Dipole, Yagi-Uda Array, Loop

Antenna, Electrically Short Antennas, Broad Band Antenna (Log periodic Antenna), Microstrip Patch Antenna.

B. Radiation from an aperture: Sectoral and Pyramidal Horn Antennas, Design of Optimum Horn Antenna; Parabolic and

Corner Reflectors and feed systems.

[Major stress on Characteristics features, applications (including frequency at which used), advantages and disadvantages, major design principles and equations (without long and detailed derivations)] **10**



Module-IV

A. Methods of Propagation: Ground Wave Propagation, Components of ground wave, Field strength dependence on physical factors. Sky wave Propagation; Ionospheric Layers; Virtual Height, Critical Frequency, MUF, Skip distance, Sporadic Reflections. Space wave propagation: Tropospheric Scatter, Ducting Super refraction, Sub refraction.

B. Friss Transmission Formula, SNR of a Radio Link. Physical (Medium) effects on Radio wave Propagation: Absorption, Refraction and Radio Horizon, Diffraction, Multipath Propagation and fading, Noise, Doppler effect. **10**

Recommended (Text Books)

1. Antenna (for all application), John D. Kraus and Ronald J. Marhcfska; Tata- MacGraw Hill, 3rd Edition
2. Antenna & Wave Propagation, K.D Prasad; Satya Prakashan, New Delhi, 3rd Edition
3. Antenna Theory: Analysis & Design, Constantine A. Balanis; Willey, 3rd Edition

Reference Book

1. Elements of Electromagnetics; Mathew N.O. Sadiku, Oxford University Press, 5th Edition(2010)
2. Electromagnetic Waves & Radiating Systems, EC Jordan & K.G. Balmain; Pearson Education, 2nd Edition (2009)
3. Microstrip Antenna Design Handbook- Ramesh Garg; Artech House (2001)

Information Theory & Coding

EC604B

Contracts: 3L

Credits- 3

Source Coding [7L]

Uncertainty and information, average mutual information and entropy, information measures for continuous random variables, source coding theorem, Huffman codes.

Channel Capacity And Coding [7L]

Channel models, channel capacity, channel coding, information capacity theorem, The Shannon limit.

Linear And Block Codes For Error Correction [8L]

Matrix description of linear block codes, equivalent codes, parity check matrix, decoding of a linear block code, perfect codes, Hamming codes.

Cyclic Codes [7L]

Polynomials, division algorithm for polynomials, a method for generating cyclic codes, matrix description of cyclic codes, Golay codes.



BCH Codes [8L]

Primitive elements, minimal polynomials, generator polynomials in terms of minimal polynomials, examples of BCH codes.

Convolutional Codes [8L]

Tree codes, trellis codes, polynomial description of convolutional codes, distance notions for convolutional codes, the generating function, matrix representation of convolutional codes, decoding of convolutional codes, distance and performance bounds for convolutional codes, examples of convolutional codes, Turbo codes, Turbo decoding.

Books

4. Information theory, coding and cryptography - Ranjan Bose; TMH.
5. Information and Coding - N Abramson; McGraw Hill.
6. Introduction to Information Theory - M Mansurpur; McGraw Hill.
7. Information Theory - R B Ash; Prentice Hall.
8. Error Control Coding - Shu Lin and D J Costello Jr; Prentice Hall.

Operating System

CE605A

Contact: 3L

Credits: 3

Introduction [4L]

Introduction to OS. Operating system functions, evaluation of O.S., Different types of O.S.: batch, multi-programmed, time-sharing, real-time, distributed, parallel.

System Structure[3L]

Computer system operation, I/O structure, storage structure, storage hierarchy, different types of protections, operating system structure (simple, layered, virtual machine), O/S services, system calls.

Process Management [17L]

Processes [3L]: Concept of processes, process scheduling, operations on processes, co-operating processes, inter-process communication.

Threads [2L]: overview, benefits of threads, user and kernel threads.

CPU scheduling [3L]: scheduling criteria, preemptive & non-preemptive scheduling, scheduling algorithms (FCFS, SJF, RR, priority), algorithm evaluation, multi-processor scheduling.

Process Synchronization [5L]: background, critical section problem, critical region, synchronization hardware, classical problems of synchronization, semaphores.

Deadlocks [4L]: system model, deadlock characterization, methods for handling deadlocks, deadlock prevention, deadlock avoidance, deadlock detection, recovery from deadlock.



Storage Management [19L]

Memory Management [5L]: background, logical vs. physical address space, swapping, contiguous memory allocation, paging, segmentation, segmentation with paging.

Virtual Memory [3L]: background, demand paging, performance, page replacement, page replacement algorithms (FCFS, LRU), allocation of frames, thrashing.

File Systems [4L]: file concept, access methods, directory structure, file system structure, allocation methods (contiguous, linked, indexed), free-space management (bit vector, linked list, grouping), directory implementation (linear list, hash table), efficiency & performance.

I/O Management [4L]: I/O hardware, polling, interrupts, DMA, application I/O interface (block and character devices, network devices, clocks and timers, blocking and nonblocking I/O), kernel I/O subsystem (scheduling, buffering, caching, spooling and device reservation, error handling), performance.

Disk Management [3L]: disk structure, disk scheduling (FCFS, SSTF, SCAN, C-SCAN), disk reliability, disk formatting, boot block, bad blocks.

Protection & Security [4L]

Goals of protection, domain of protection, security problem, authentication, one time password, program threats, system threats, threat monitoring, encryption.

Text Books / References :

1. Milenkovic M., "Operating System : Concept & Design", McGraw Hill.
2. Tanenbaum A.S., "Operating System Design & Implementation", Practice Hall NJ.
3. Silbersehatz A. and Peterson J. L., "Operating System Concepts", Wiley.
4. Dhamdhare: Operating System TMH
5. Stalling, William, "Operating Systems", Maxwell McMillan International Editions, 1992.
6. Dietel H. N., "An Introduction to Operating Systems", Addison Wesley.

Database Management System

EC605B

Contacts: 3L

Credits: 3

Introduction [4L]

Concept & Overview of DBMS, Data Models, Database Languages, Database Administrator, Database Users, Three Schema architecture of DBMS.



Entity-Relationship Model [6L]

Basic concepts, Design Issues, Mapping Constraints, Keys, Entity-Relationship Diagram, Weak Entity Sets, Extended E-R features.

Relational Model [5L]

Structure of relational Databases, Relational Algebra, Relational Calculus, Extended Relational Algebra Operations, Views, Modifications Of the Database.

SQL and Integrity Constraints [8L]

Concept of DDL, DML, DCL. Basic Structure, Set operations, Aggregate Functions, Null Values, Domain Constraints, Referential Integrity Constraints, assertions, views, Nested Subqueries, Database security application development using SQL, Stored procedures and triggers.

Relational Database Design [9L]

Functional Dependency, Different anomalies in designing a Database., Normalization using functional dependencies, Decomposition, Boyce-Codd Normal Form, 3NF, Normalization using multi-valued dependencies, 4NF, 5NF

Internals of RDBMS [7L]

Physical data structures, Query optimization : join algorithm, statistics and cost based optimization. Transaction processing, Concurrency control and Recovery Management : transaction model properties, state serializability, lock based protocols, two phase locking.

File Organization & Index Structures [6L]

File & Record Concept, Placing file records on Disk, Fixed and Variable sized Records, Types of Single-Level Index (primary, secondary, clustering), Multilevel Indexes, Dynamic Multilevel Indexes using B tree and B+ tree

Text Books:

8. Henry F. Korth and Silberschatz Abraham, "Database System Concepts", Mc.Graw Hill.
9. Elmasri Ramez and Novathe Shamkant, "Fundamentals of Database Systems", Benjamin Cummings Publishing Company.
10. Ramakrishnan: Database Management System , McGraw-Hill
11. Gray Jim and Reuter Address, "Transaction Processing : Concepts and Techniques", Morgan Kauffman Publishers.
12. Jain: Advanced Database Management System CyberTech



13. Date C. J., "Introduction to Database Management", Vol. I, II, III, Addison Wesley.
14. Ullman JD., "Principles of Database Systems", Galgottia Publication.

Reference:

10. James Martin, "Principles of Database Management Systems", 1985, Prentice Hall of India, New Delhi
11. "Fundamentals of Database Systems", Ramez Elmasri, Shamkant B.Navathe, Addison Wesley Publishing Edition
12. "Database Management Systems", Arun K.Majumdar, Pritimay Bhattacharya, Tata McGraw Hill

ELECTRONIC MEASUREMENT AND INSTRUMENTATION

Code: EC605C

Contact: 3L

Credits: 3

Module I- Basic Measurement Concepts:

Measurement systems – Static and Dynamic Characteristics – Units and Standards of measurements, –errors analysis, –

moving iron meters, dynamometer, wattmeter– multimeter, – True rms meters– Bridge measurements, Wheatstone

Bridge, Kelvin, Wein, Maxwell, Hay, Schering and Anderson Bridges.

6hrs

Module -II Basic Measurement Concepts:

Electronic Multimeter

Current measurement with analog electronic instruments. Chopper stabilized amplifier for measurement of very low voltage and currents.

Cathode Ray Oscilloscopes- Block Schematic, Principles and applications. Dual Trace and Dual Beam Oscilloscopes,

Digital Storage Oscilloscopes

7hrs

Module- III Signal Generator and Analysis

Function Generators- RF Signal Generators- Sweep Generators – Frequency Synthesizer-Wave Analyzer- Harmonic

Distortion Analyzer – Spectrum Analyzer

7hrs

Module- IV Digital Instruments

Comparison of analog & digital techniques- digital voltmeter- mutlimeter – frequency counters- measurement of

frequency and time interval – extension of frequency range- measurement errors.

7hrs



Module -V Data Acquisition Systems

Elements of digital data acquisition system- interfacing of transducers –multiplexing – computer controlled

instrumentation : IEEE 488 Bos. Optical Power Measurement, Optical Time Domain Reflectometer.

7hrs

Total Lecture Hours 34

Text Books:

1. Modern Electronic Instrumentation & Measurement Techniques – Albert D. Helfrick & William D. Copper, Prentice Hall of India, 2003
2. Elements of Electronics Instrumentation & Measurement, Pearson Education 2003
3. Measurement System- Application & Design – Ernest O.Doeblin, Tata McGraw Hill 2004

Practical

Digital Communication Lab

Code: EC691

Contact: 3P

Credits: 2

- a) Design, implementation and study of all the properties of 7-length and 15-length pn sequences using shift register.
- b) Study of PAM and demodulation.
- c) Study of PCM and demodulation.
- d) Study of line coders: polar/unipolar/bipolar NRZ ,RZ and Manchester.
- e) Study of delta modulator and demodulator.
- f) Study of adaptive delta modulator and demodulator.
- g) Study of BPSK modulator and demodulator.
- h) Study of BFSK modulator and demodulator.
- i) Study of ASK modulator and demodulator.
- j) Study of QPSK modulator and demodulator.
- k) Simulation study of probability of symbol error for BPSK modulation.
- l) Simulation study of probability of symbol error for BFSK modulation.

Digital Signal Processing Lab

Code: EC692

Contact: 3P

Credits: 2

Simulation Laboratory using standard Simulator:

1. Sampled sinusoidal signal, various sequences and different arithmetic operations.
2. Convolution of two sequences using graphical methods and using commands- verification of the properties of convolution.
3. Z-transform of various sequences – verification of the properties of Z-transform.
4. Twiddle factors – verification of the properties.



5. DFTs / IDFTs using matrix multiplication and also using commands.
6. Circular convolution of two sequences using graphical methods and using commands, differentiation between linear and circular convolutions.
7. Verifications of the different algorithms associated with filtering of long data sequences and Overlap –add and Overlap-save methods.
8. Butterworth filter design with different set of parameters.
9. FIR filter design using rectangular, Hamming and Blackman windows.

Hardware Laboratory using either 5416 or 6713 Processor and Xilinx FPGA:

1. Writing & execution of small programs related to arithmetic operations and convolution using Assembly Language of TMS320C5416/6713 Processor, study of MAC instruction.
2. Writing of small programs in VHDL and downloading onto Xilinx FPGA.
3. Mapping of some DSP algorithms onto FPGA.

Operating System Lab

Code: EC695A

Contact: 3P

Credits: 2

1. **Shell programming [6P]:** creating a script, making a script executable, shell syntax (variables, conditions, control structures, functions, commands).
2. **Process [6P]:** starting new process, replacing a process image, duplicating a process image, waiting for a process, zombie process.
3. **Signal [9P]:** signal handling, sending signals, signal interface, signal sets.
4. **Semaphore [6P]:** programming with semaphores (use functions semctl, semget, semop, set_semvalue, del_semvalue, semaphore_p, semaphore_v).
5. **POSIX Threads [9P]:** programming with pthread functions(viz. pthread_create, pthread_join, pthread_exit, pthread_attr_init, pthread_cancel)
6. **Inter-process communication [9P]:** pipes(use functions pipe, popen, pclose), named pipes(FIFOs, accessing FIFO)



Database Management System Lab

EC695B

Contact: 3P

Credits: 2

Structured Query Language

1. Creating Database

- Creating a Database
- Creating a Table
- Specifying Relational Data Types
- Specifying Constraints
- Creating Indexes

2. Table and Record Handling

- INSERT statement
- Using SELECT and INSERT together
- DELETE, UPDATE, TRUNCATE statements
- DROP, ALTER statements

3. Retrieving Data from a Database

- The SELECT statement
- Using the WHERE clause
- Using Logical Operators in the WHERE clause
- Using IN, BETWEEN, LIKE, ORDER BY, GROUP BY and HAVING

4. Clause

- Using Aggregate Functions
- Combining Tables Using JOINS
- Subqueries

5. Database Management

- Creating Views
- Creating Column Aliases
- Creating Database Users
- Using GRANT and REVOKE

Cursors in Oracle PL / SQL

Writing Oracle PL / SQL Stored Procedures

ELECTRONIC MEASUREMENT AND INSTRUMENTATION

Code: EC695C

Contact: 3P

Credits: 2

1. Study of Static Characteristics of a Measuring Instrument
2. Study of Dynamic Characteristics of a Measuring Instrument
3. Acquaintance with basic structure of DMM and measurement of different electrical parameters
4. Realization of Data Acquisition system



5. Wave and spectrum analysis using Q meter
6. Realization of a V-to-I & I-to-V converter.
7. Statistical analysis of errors in measurement .
8. Study of VCO (Voltage controlled oscillator) & PLL (Phase Locked Loop).

Fourth Year – Seventh Semester

A.THEORY								
Sl No.	Subject Code	Theory	Contact Hours/Week				Credit Points	
			L	T	P	Total		
1	EC701	Wireless Communication & N/W	3	0	0	3	3	
2	EC702	Microelectronics & VLSI Designs	3	0	0	3	3	
3	EC703 (With Lab)	A. RF & Microwave Engineering. B. Optical Communication & N/W C. Computer Networks D. FPGA & Reconfigurable Computing	3	0	0	3	3	
4	EC704 (No Lab)	A. Radar Engg B. Embedded Systems C. Biomedical Instrumentation	3	0	0	3	3	
5	F. E. EC705	A. Artificial Intelligence B. Robotics C. Software Engineering D. Power Electronics	3	0	0	3	3	
Total of Theory						15	15	
B. PRACTICAL								
6	HU78 1	Group Discussion	0	0	3	3	2	
7	EC79 2	VLSI Design Lab	0	0	3	3	2	
8	EC79 3	A. RF & Microwave Engg. Lab B. Optical Communication & N/W Lab C. Computer Networks Lab D. FPGA & Reconfigurable Computing lab	0	0	3	3	2	
9	F.E EC79 5	A.Artificial Intelligence Lab B.Robotics lab C.Software Engineering D.Power Electronics Lab	0	0	3	3	2	
10	EC78 1	Industrial training	4 weeks during 6th -7thSem-break					2
11	EC78 2	Project- 1				3	2	
Total of Practical						15	12	
Total of Semester						30	27	



**VII Semester
Theory**

WIRELESS COMMUNICATION AND NETWORKS

EC701

Contacts: 3L

Credits: 3

MODULE – I:

Cellular Mobile Wireless Networks: Systems and Design Fundamentals:

Brief introduction to mobile wireless communication and systems, Description of cellular system, Cellular Structure, Frequency Reuse, Cell clustering, Capacity enhancement techniques for cellular networks, cell splitting, antenna sectoring, Co-channel and Adjacent channel interferences, Channel assignment schemes – Fixed channel, Dynamic channel and Hybrid channel, mobility management – location management and handoff management, handoff process, different types of handoff.

6L

Characteristics of wireless channel and propagation path loss models:

Different Multi-path propagation mechanisms, Multi-path effects on mobile communication, Fading, different types of fading, small and large scale fading, slow and fast fading, narrowband and wideband fading, Inter symbol interference, fast fading model, Doppler effect due to velocity of mobiles, Rayleigh envelop, free space propagation model, two ray ground reflection model, log distance path loss model, log normal shadowing model, macro and micro cell propagation models, types of base stations and mobile station antennas. 6L

MODULE – II:

Modern Mobile Wireless Communication Systems

Evolution strategies – First Generation (1G) to Fourth Generation (4G), Personal Area Networks :PAN, Low Tier Wireless System: Cordless Telephone, Second Generation (2G), Digital European Cordless Telecommunications (DECT), Public wide-area Wireless Networks: 1 G to 3G cellular networks

2L

Multiple Access Technologies in cellular communication

Time division multiple access (TDMA), narrowband and wideband TDMA, synchronous and asynchronous TDMA, Frequency division multiple access (FDMA), Code Division Multiple Access (CDMA), Direct-sequence CDMA, spread spectrum technique, spectral efficiency of different wireless access technologies:

Spectral Efficiency in FDMA system, Spectral Efficiency in TDMA system, Spectral Efficiency for DS-SS-CDMA system 3L

Cellular Communication Networks and Systems

Second generation (2G) Network: Global system for mobile communication (GSM): Architecture and Protocols Air Interface, GSM spectrum, GSM Multiple Access Scheme, GSM Channel Organization, Traffic Channel multi-frame, Control (Signaling) Channel Multi-frame, Frames, Multi-frames, Superframes and Hyper-frames, GSM Call Set up Procedure, Location Update Procedure, Routing of a call to a Mobile Subscriber 3L

The concept of packet data services The 2.5 G General Packet Radio Services: GPRS Networks



Architecture, GPRS Interfaces and Reference Points, GPRS Mobility Management Procedures, GPRS Attachment and Detachment Procedures, Session Management and PDP Context, Data Transfer through GPRS Network and Routing, The IP Internetworking Model 3L

Overview of CDMA systems: IS-95 Networks and 3G – The Universal Mobile Telecommunication System (UMTS)

CDMA based IS-95 Systems, forward link and reverse link for IS-95, handoff process in CDMA based IS-95 network. UMTS Network Architecture –Release 99, UMTS Interfaces, UMTS Network Evolution UMTS Release 4 and 5, UMTS FDD and TDD, UMTS Channels, Logical Channels, UMTS

Time Slots 3L

MODULE – III:

Wireless Local Area Networks (WLAN): IEEE 802.11 Standards and Protocols

IEEE 802.11 standards, WLAN family, WLAN transmission technology, WLAN system architecture, Collision Sense Multiple Access with Collision Detection (CSMA/CD) and CSMA collision avoidance (CSMA/CA), Frequency Hopping Spread Spectra, 802.11 PHY and MAC layers, IEEE 802.11 Distributed Coordination function (DCF) and Point coordination function (PCF), Back off algorithm, Virtual carrier sense, MAC frame format. Security and QoS issues, WLAN applications 4L

Wireless Broadband Networks and Access

Evolution of broadband wireless, IEEE 802.16 standards : **WiMAX** , Spectrum Allocation, IEEE 802.16 Standard Architecture, Overview of WiMAX PHY, IEEE 802.16 MAC Layer, IEEE 802.16 Scheduling Services, Unsolicited Grant Service (UGS), Real-time Polling Service (rtPS), Non-realtime Polling Service (nrtPS), Best Effort (BE) Overview of 3G Long Term Evolution (3G LTE) for broadband wireless communication, Orthogonal Frequency Division Multiple Access (OFDMA)

3L

MODULE – IV:

Mobile Internet Protocol

Basic Mobile IP, Mobile IP Type-MIPv4 and MIPv6, Mobile IP: Concept, Four basic entities for MIPv4, Mobile IPv4 Operations, Registration, Tunneling, MIPv4 Reverse Tunneling, MIPv4 Triangular Routing, Configuring PDP Addresses on Mobile Station, Mobility Classification, Seamless Terminal Mobility Management, Limitations of current TCP/IP networks for mobility support, Mobility solution, Accessing External PDN through

GPRS/UMTS PS Domain, Transparent Access, Use of Mobile IP for Non-transparent access, Dynamically accesses IP address from External Network. 3L

TEXT BOOKS:

1. Wireless Networks: Applications and Protocols,
T. S. Rappaport, Pearson Education



2. Wireless Communication and Networks : 3G and Beyond, I. Saha Misra, TMH Education.
3. Wireless Communications : Principles and Practice, T.S.Rappaport, PHI Learning.
4. Wireless Communications, A. Goldsmith, Cambridge University Press.

REFERENCE BOOKS:

1. Lee's Essentials of Wireless Communications, MH Prof. Med/Tech
2. Wireless Digital Communications: Modulations and Spread Spectrum Applications, K. Feher, Prentice Hall.
3. Wireless Communications and Networking, J.W.Mark and W. Zhuang, PHI.

Microelectronics & VLSI Designs

EC702

Contacts: 3L

Credits: 3

Module 1: Introduction to VLSI Design: [6L]

VLSI Design Concepts, Moor's Law, Scale of Integration

(SSI, MSI, LSI, VLSI, ULSI – basic idea only), Types of VLSI Chips (Analog & Digital VLSI chips, General purpose, ASIC, PLA, FPGA)(2L), Design principles (Digital VLSI – Concept of Regularity, Granularity etc), Design Domains (Behavioral, Structural)(2L);

Module 2: Micro-electronic Processes for VLSI Fabrication: [10]

Silicon Semiconductor Technology- An

Overview, Wafer processing (1L), Oxidation, Epitaxial deposition, Ion-implantation & Diffusion (1L),

Cleaning, Etching (1L), Photo-lithography – Positive & Negative photo-resist

(1L); Basic CMOS Technology – (Steps in fabricating CMOS (1L)), Basic n-well CMOS process, p-well CMOS process, Twin tub

process (1L), Silicon on insulator

(1L); Layout Design Rule: Stick diagram with examples (2L), Layout rules (1L).

Module – 3: CMOS for Digital VLSI Circuits: [10]

Recapitulation of MOS (2L); CMOS, CMOS inverter characteristics (1L); CMOS logic circuits, NAND & NOR Gates (1L),

Complex logic circuits (1L), CMOS Full Adder (1L), CMOS Transmission GATE (1L), Advanced CMOS Logic circuits; Sequential

CMOS logic circuits (1L); SR Latch circuit, clocked JK Latch/ Master-Slave JK (1L), CMOS D-latch & Edge triggered flip-flop

(1L);

Module – 4: Analog VLSI Circuits: [8L]

Analog VLSI design steps (1L); Basic building blocks of Analog VLSI chips (1L); MOS switch (1L); Active load / resistors; Voltage



dividers (1L); CMOS Current source & sink; CMOS Voltage references/voltage dividers [Basic circuits only] (1L); CMOS Differential amplifier; Output amplifiers [Basic circuits only] (1L); CMOS OPAMP (1L); Switched capacitor filter (1L)

Text Books:

1. Digital Integrated Circuit, J.M.Rabaey, Chandrasan, Nicolic, Pearson Education.
2. CMOS Digital Integrated Circuit, S.M.Kang & Y.Leblebici, TMH.
3. Modern VLSI Design, Wayne Wolf, Pearson Education.
4. VHDL, Bhaskar, PHI.
5. Advance Digital Design Using Verilog , Michel D. Celliti, PHI

References:

1. Digital Integrated Circuits, Demassa & Ciccone, John Willey & Sons .
2. Modern VLSI Design: system on silicon, Wayne Wolf; Addison Wesley Longman Publisher
3. Basic VLSI Design, Douglas A. Pucknell & Kamran Eshranghian, PHI
4. CMOS Circuit Design, Layout & Simulation, R.J.Baker, H.W.Lee, D.E. Boyee, PHI
5. CMOS Analog Circuit Design by P.E. Allen & D.R. Holberg; OUP

RF & Microwave Engg

EC703A

Contacts: 3L

Credits: 3

Total Lectures: 39 periods (minimum) :

Module-1

Introduction

RF & Microwave Spectrum, Typical applications of RF and Microwave, Safety considerations. **1**

Microwave Waveguide and Waveguide Resonator

Rectangular Waveguide- Design consideration, TE & TM modes, TE₁₀ mode analysis, cut-off frequency,

propagation constant, intrinsic wave impedance, phase and group velocity, power transmission, attenuation, waveguide excitation, wall current; Introduction of circular waveguide; Rectangular waveguide resonator- Design consideration, resonant frequency, Q-factor, excitation.

6

Planar Transmission line

Micro-strip lines, Coplanar waveguide, Slot line-design consideration, field patterns, propagation characteristics, Comparison for different characteristics of the above mentioned lines.

3

Module-2

High frequency Circuit Elements:

Difference in High frequency and relatively low frequency behavior of Lumped circuit components.



Miniaturization and Design of Lumped components at High RF. Realization of reactive elements as Waveguide and Planar Circuit components.

4

Waveguide Passive Components and their S-matrix Representation

N-port networks-Properties of S matrix, Transmission matrix & their relationships; Microwave passive

components and their S matrix representation: Attenuators, Phase shifter, Directional coupler, Bethe-hole

coupler, Magic tee, hybrid ring, Circulators, Isolators; Design procedure of filter (maximally flat and

equal ripple) using insertion loss method-specification, low-pass prototype design, scaling and conversion, implementation.

8

Module-3

Microwave Tubes

Electron beam & Field interaction for energy exchange in resonant (two cavity klystron, Reflex Klystron,

Magnetron) and non-resonant (TWT & BWO) microwave active devices: Typical characteristics &

applications (only physical explanation is required, no mathematical derivation required).

4

Semiconductor Microwave devices

TED (Gunn diode) & Avalanche Transit Time (IMPATT) device, Schottky diode, PIN diode characteristics

& applications; Microwave bipolar transistor, Microwave field effect transistor (MESFET).

5

Microwave Amplifier Design

Basic consideration in the design of RF amplifier- Transistor S-parameter, Stability, matching network,

noise figure; Matching network design using lumped elements and L-Section.

Brief introduction to NBA, LNA.

4

Module-4

Typical Microwave Test Bench & measurement

VSWR meter, Tunable detector, Slotted line and Probe detector, Frequency meter, Network analyzer,

Measurement of VSWR – low, medium and high, Measurement of power: low, medium and high,

Frequency measurement.

4

**Text Books:**

1. Microwave Engineering, 3Rd Ed David M. Pozar, Willey & Sons Inc.
2. Microwaves, K C Gupta, New Age Publishers.
3. Microwave Engineering, A Das & S Das, TMH.
4. Microwave Devices & Circuits, SY Liao , Pearson Education /PHI

References Books:

- (5) Microwave Engineering-Passive Circuits, PA Rizzi , Pearson Education.
- (6) Foundation of Microwave Engineering, 2ed edition, Robert E Collin, McGraw Hill, Inc.
- (7) Microwave Devices & Circuit Design , GP Srivastava & VL Gupta, PHI

Optical Communication & N/W**EC703B****Contacts: 3L****Credits: 3**

Introduction to communication systems: [2]

Principles, components; Different forms of communications in brief, advantages of optical fibre communication, spectral characteristics.

Optical Fibre wave guide: [2]

Structure, Single and Multimode operation; Attenuation, Material and wave guide dispersion.

Optical Sources: [5]

Light Emitting Diode; principle, structures, power and efficiency, coupling to fibres.

Laser diodes; principle, double heterostructure, gain and index guiding, distributed lasers.

Quantum Well Lasers; Modes and narrow linewidth lasers.

Modulation; Bandwidth for modulation, Optical transmitters: components.

Optical Detectors: [2]

Device types, optical detection principles, efficiency, responsivity, bandwidth. Preamplifiers; noise sources, signal to noise ratio.

Point-to-point link and Wavelength Division Multiplexing: [11]

Building blocks; Multiplexing; Intensity Modulation/Direct Detection system; Principle of Regeneration; WDM link, Optical amplifiers; EDFA, SOA, Raman amplifier, Fabry-Perot filters.

Dispersion compensation and

management, Link analysis and Bit-Error-Rate calculation.

Optical Network: [4]

LAN, MAN, WAN; Topologies: bus, star, ring; Ethernet; FDDI; Telecom networking:SDH/SONET.



Different forms of access networks: [4]

Telephony; ISDN; Cable TV; Broadcast and Switched Networks; HFC networks; FTTC and FTTH networks; All optical networks.

Books:

1. Optical Networks – A practical perspective : Rajiv Ramaswami, K. N. Sivarajan, Galen H. Sasaki (Morgan-Kaufman)
2. Optical Fibre Communication : John M. Senior (Pearson)
3. Optical Fibre Communication : Gerd Kaiser (TMH)
4. Optical Communication Systems : John Gawar (PHI)

Computer Networks

EC703C

Contacts: 3L

Credits: 3

Module I

Overview of Data Communication and Networking: [4L]

Introduction; Data communications: components, data representation (ASCII, ISO etc.), direction of data flow (simplex, half duplex, full duplex); network criteria, physical structure (type of connection, topology), categories of network (LAN, MAN, WAN); Internet: brief history, Protocols and standards; Reference models: OSI reference model, TCP/IP reference model, their comparative study.

Physical Level: [6L]

Overview of data (analog & digital), signal (analog & digital), transmission (analog & digital) & transmission media (guided & unguided); Circuit switching: time division & space division switch, TDM bus; Telephone Network;

Module II

Data link Layer: [5L]

Types of errors, framing (character and bit stuffing), error detection & correction methods; Flow control; Protocols: Stop & wait ARQ, Go-Back- N ARQ, Selective repeat ARQ, HDLC;

Medium Access sub layer: [5L]

Point to Point Protocol, LCP, NCP, Token Ring; Reservation, Polling, Multiple access protocols: Pure ALOHA, Slotted ALOHA, CSMA, CSMA/CD, CSMA/CA Traditional Ethernet, fast Ethernet (in brief);



Module III

Network layer: [8L]

Internetworking & devices: Repeaters, Hubs, Bridges, Switches, Router, Gateway; Addressing : IP addressing, subnetting; Routing : techniques, static vs. dynamic routing , Unicast Routing Protocols: RIP, OSPF, BGP; Other Procols: ARP, IP, ICMP, IPV6;.

Transport layer: [4L]

Process to Process delivery; UDP; TCP; Congestion Control: Open Loop, Closed Loop choke packets; Quality of service: techniques to improve QoS: Leaky bucket algorithm, Token bucket algorithm,

Module IV

Application Layer [5L]

Introduction to DNS, SMTP, SNMP, FTP, HTTP & WWW; Security: Cryptography (Public, Private Key based), Digital Signature, Firewalls.

Modern topics: [5L]

ISDN services & ATM, DSL technology, Cable Modem: Architecture & Operation in brief
Wireless LAN: IEEE 802.11, Introduction to blue-tooth.

Text Books:

1. B. A. Forouzan – “Data Communications and Networking (3rd Ed.) “ – TMH
2. A. S. Tanenbaum – “Computer Networks (4th Ed.)” – Pearson Education/PHI
3. W. Stallings – “Data and Computer Communications (5th Ed.)” – PHI/ Pearson Education
4. Zheng & Akhtar, Network for Computer Scientists & Engineers, OUP
5. Black, Data & Computer Communication, PHI
6. Miller, data Communication & Network, Vikas
7. Miller, Digital & Data Communication, Jaico
8. Shay, Understanding Data Communication & Network, Vikas

Reference Books:

1. Kurose and Rose – “ Computer Networking -A top down approach featuring the internet” – Pearson Education
2. Leon, Garica, Widjaja – “Communication Networks” – TMH
3. Walrand – “Communication Networks” – TMH.
4. Comer – “Internetworking with TCP/IP, vol. 1, 2, 3(4th Ed.)” – Pearson Education/PHI



FPGA & Reconfigurable Computing

EC703D

Contacts: 3L

Credits: 3

Module –I: Introduction to Reconfigurable Computing (RC)

History, State-of-the-Art and Future Trends, Computing requirements as Power, Area and VLSI scaling, Mapping of Algorithm analysis and speed-up, RC architectures- Fine Grain and Coarse Grain, Hybrid and Embedded Architectures, Supercomputers.

5L

Module-II: Reconfigurable Logic Devices:

FPGA and its internal architecture, computing elements, LUT, BRAM, interconnects, I/O Blocks, programming of FPGA and interfacing case study, ALU design, designing with embedded processors, introduction to Power PC and ARM processors.

6L

Module III: Hardware Description Language for RC:

Design cycle, algorithms, Hardware Description Language, VHDL, different design styles: data flow, structural and behavioral and practical logic circuit implementation example on FPGA, debugging, writing test bench, High level synthesis and Low level synthesis.

6L

Module IV: RC Configuration:

Application segmentation and Resource partitioning, spatial and temporal configuration, systolic architectures and algorithms, Bit serial, on the fly, multiplexing vs. run-time reconfiguration 4L

Module V: RC Implementation:

Virtual Hardware Components (VHC) design process, high level synthesis of VHC and optimization, VHC data-path and control unit design, simulation and verification of VHC, determination of reconfigurable scheme and associated loading mechanisms (temporal and spatial partitioning) for RC. 6L

Module VI: RC applications:

RC for DSP, DSP application building blocks, RC for Image processing, Bioinformatics and Network Security

5L

**Text Books:**

1. M. Gokhale and P. Graham; Reconfigurable Computing: Accelerating Computation with FPGAs, Springer, 2005
2. C. Maxfield ; The design Warrior's Guide to FPGAs: Devices, Tools and Flows, Newnes, 2004
3. C. Bobda, Introduction to Reconfigurable Computing : Architectures, Algorithm and Applications, Springer, 2005

Reference Books:

1. W. Wolf , FPGA Based Systems Design, PHI, 2004
2. P. Lysagt and W. Rosenstiel, New Algorithms, Architectures and Applications for Reconfigurable Computing, Springer, 2005

Radar Engineering**EC704A****Contacts: 3L****Credits: 3****Module –I: Introduction to Radar**

Historical background, radar terminology, radar band designations, Radar block diagram, radar equation: detection of signals in noise and signal-to-noise ratio, Probabilities of detection & False alarm, integration of radar pulses, radar cross section, distributed targets, Transmitted power, pulse-repetition frequency, antenna parameters & system losses, introduction to radar clutter.

6L

Module – II: Radar Types

Pulse radars and CW radars, Advantages of coherent radar, Doppler radar and MTI: Doppler effect, delay-line cancellers, blind speeds, staggered PRFs, Digital filter bank, Moving Target Detector, limitations of MTI, tracking with radar, monopulse tracking, conical scan, limitation to tracking accuracy,

8L

Module –III: Radar signals & clutter

Basic radar measurement, theoretical accuracy of radar measurements, Range and velocity ambiguities, the ambiguity diagram, pulse compression-principles, the matched filter, chirp waveforms, Waveform design: nonlinear FM, phase codes, waveform generation and compression



Descriptions of land & sea clutter, statistical models for surface clutter, detection of targets in clutter.

10L

Module –IV: Devices and Radar Systems

Radar transmitter: Solid-state RF power source, Magnetron, other RF power sources, Radar receiver: Super heterodyne receiver, receiver noise figure, duplexers & diplexers, Receiver protectors, Applications: Electronic Warfare: ESM, ECM, ECCM; super resolution, IFM, types of jammers, Stealth and counter-stealth: stealth techniques for aircraft and other target types, low frequency and UWB radar ,System design examples 8L

Text Books :

1. Introduction to Radar Systems-3/E , M. I. Skolnik, Tata McGrawhill
2. Principles of Modern radar system , M. H. Carpentier, Artech House

Reference Books:

1. Fundamentals of radar signal processing, M. I. Richards, McGraw-Hill
2. Handbook of radar measurement , Barton, David & Ward, H. R, Artech House
3. Radar Technology , Brookner, Eli, Artech House
4. Radar Handbook , ed. M. I. Skolnik, Mc-Graw Hill, 1990
5. Skolnik, M. I, “Fifty years of Radar”, Proc. IEEE, vol. 73 (Feb. 1985), pp. 182-197

Embedded Systems

EC704B

Contacts: 3L

Credits: 3

Introduction to Embedded System : Embedded system Vs General computing systems, History of Embedded systems, Purpose of Embedded systems, Microprocessor and Microcontroller, Hardware architecture of the real time systems.

[5]

Devices and Communication Buses: I/o types, serial and parallel communication devices, wireless communication devices, timer and counting devices, watchdog timer, real time clock, serial bus communication protocols, parallel communication network using ISA, PCI, PCT-X, Intrnet embedded system network protocols, USB, Bluetooth.

[10]

Program Modelling Concepts ; Fundamental issues in Hardware software co-design, Unified Modelling Language(UML), Hardware Software trade-offs DFG model, state machine programming model, model for multiprocessor system.

[5]



Real Time Operating Systems : Operating system basics, Tasks, Process and Threads, Multiprocessing and multitasking, task communication, task synchronization, qualities of good RTOS. [8]

Examples of Embedded System : Mobile phones, RFID, WISENET, Robotics, Biomedical Applications, Brain machine interface etc.

Popular microcontrollers used in embedded systems, sensors, actuators. [6]

Programming concepts and embedded programming in C, C++, JAVA. [4]

Books:

1. Introduction to Embedded Systems : Shibu K. V. (TMH)
2. Embedded System Design – A unified hardware and software introduction: F. Vahid (John Wiley)
3. Embedded Systems : Rajkamal (TMH)
4. Embedded Systems : L. B. Das (Pearson)
5. Embedded System design : S. Heath (Elsevier)
6. Embedded microcontroller and processor design: G. Osborn (Pearson)

Biomedical Instrumentation

EC704C

Contacts: 3L

Credits: 3

Module -1 (Fundamentals)

1.1 Introduction to Physiological Systems –Organism, Cardiovascular, Respiratory, Renal, Hepatic, Gastrointestinal, Endocrinal, Nervous, Muscular, Cellular [2]

1.2 Biological Signals – Bioelectric events, Biomechanical Systems, Cellular & Membrane phenomenon. The Action Potential and Propagation through Nervous System. The Peripheral Nervous Systems and sensory mechanisms. Biomaterials. [2]

1.3 Fundamentals of Electrophysiology –EKG, EEG, EMG, Evoked potentials. Quantification of Biological Signals[2]

Module 2 (Measurement & Analysis)

2.1 Biological Sensors- Bio-electrodes, Biosensors and Transducers for Cardiology, Neurology, Pulmonary, Oxygen saturation & gaseous exchange, flow measurement, goniometry, Endoscopy, Impedance Plethysmography. [3]

2.2 Biological Amplifiers –Instrumentation Amplifiers for Electrophysiology (ECG, EMG, EEG, EOG), Filters, Power Supplies.[3]

2.3 Recording and Display systems, Digital Conversion for storage, Electrical Hazards in measurements, Isolation Circuits, calibration, alarms & Multi-channel re-constitution [2]



2.4 Hospital requirements – Multi-parameter bed-side monitors, Central Nursing Stations, Defibrillators, Ventilators, Catheters, Incubators. [2]

Module - 3 (Life-Support & Treatment)

3.1 Cardiac Support: Implantable & programmable Pacemakers, External & Internal Defibrillators, Coronary Angiography.

[2]

3.2 Electro-physiotherapy : Shortwave & ultrasonic diathermy, Transcutaneous Nerve Stimulators in pain relief, Traction Systems,

Ultrasound in bone fracture regeneration, hypothermia & hyperthermia systems. [3]

3.3 Lasers in treatment and surgery : Ophthalmic, Ablators, Endoscopic [2]

3.4 Assists and Artificial limbs- Orthoses , passive and powered Prostheses [2]

Module-4 (Imaging)

4.1 Fundamentals of X-Rays, Radiological Imaging, Digital Radiology, DSA. [3]

4.2 Computer Tomography, Image Processing, solid state sensors, whole-body scans. [3]

4.3 Gamma camera & radio- isotope imaging. [1]

4.5 Ultrasonography- Transducers, Signal Conditioners, 2D & 3D scans, Doppler & Colour Doppler [3]

4.6 Fundamentals of Magnetic Resonance Imaging and PET - scans [2]

Text Books:-

2) R S Khandpur:- Handbook of Biomedical Instrumentation (Tata –Mcgraw Hill Education) [Partly Downloadable]

3) M E Valentiniuzzi:- Understanding the Human Machine- A Primer for Bioengineering [Freely Downloadable in PDF]

(World Scientific Publishing Co. Pte. Ltd, Singapore)

4) L Cornwell, F.J. Weibell & E.A. Pfeiffer:- Biomedical Instrumentation and Measurements(Prentice Hall/ Medical)

5) J G Webster & J W. Clark:- Medical Instrumentation – Application & Design (Houghton Mifflin Pub)

6) J J Carr & JM Brown:- Introduction to Bio-medical Equipment Technology(Regents / Prentice Hall)

7) J Tompkins & J G Webster :-Design of Micro- controller based Medical Instrumentation (Prentice Hall Inc)

Reference Books:

1. W.B. Blesser :- A systems approach to Biomedicine (McGraw Hill.,NY)

2. J H U Brown, J E Jacobs & L Stark:- Biomedical Engineering (Davis Co, Philadelphia, USA)

3. L A Geddes & L E Baker :- Principles of Applied Biomedical Instrumentation (John Wiley & sons, NY)

4. J H Milsum:- Biological Control Systems(Mc Graw Hill, NY)

5. R Plonsey:- Bioelectric Phenomena (McGraw-Hill Co, NY)



Artificial Intelligence

EC705A

Contacts: 3L

Credits: 3

Introduction [2]

Overview of Artificial intelligence- Problems of AI, AI technique, Tic - Tac - Toe problem.

Intelligent Agents [2]

Agents & environment, nature of environment, structure of agents, goal based agents, utility based agents, learning agents.

Problem Solving [2]

Problems, Problem Space & search: Defining the problem as state space search, production system, problem characteristics, issues in the design of search programs.

Search techniques [5]

Solving problems by searching :problem solving agents, searching for solutions; uniform search strategies: breadth first search, depth first search, depth limited search, bidirectional search, comparing uniform search strategies.

Heuristic search strategies [5]

Greedy best-first search, A* search, memory bounded heuristic search: local search algorithms & optimization problems: Hill climbing search, simulated annealing search, local beam search, genetic algorithms; constraint satisfaction problems, local search for constraint satisfaction problems.

Adversarial search [3]

Games, optimal decisions & strategies in games, the minimax search procedure, alpha-beta pruning, additional refinements, iterative deepening.

Knowledge & reasoning [3]

Knowledge representation issues, representation & mapping, approaches to knowledge representation, issues in knowledge representation.

Using predicate logic [2]

Representing simple fact in logic, representing instant & ISA relationship, computable functions & predicates, resolution, natural deduction.



Representing knowledge using rules [3]

Procedural versus declarative knowledge, logic programming, forward versus backward reasoning, matching, control knowledge.

Probabilistic reasoning [4]

Representing knowledge in an uncertain domain, the semantics of Bayesian networks, Dempster-Shafer theory, Fuzzy sets & fuzzy logics.

Planning [2]

Overview, components of a planning system, Goal stack planning, Hierarchical planning, other planning techniques.

Natural Language processing [2]

Introduction, Syntactic processing, semantic analysis, discourse & pragmatic processing.

Learning [2]

Forms of learning, inductive learning, learning decision trees, explanation based learning, learning using relevance information, neural net learning & genetic learning.

Expert Systems [2]

Representing and using domain knowledge, expert system shells, knowledge acquisition.

Basic knowledge of programming language like Prolog & Lisp. [6]

Books:

1. Artificial Intelligence, Ritch & Knight, TMH
2. Artificial Intelligence A Modern Approach, Stuart Russel Peter Norvig Pearson
3. Introduction to Artificial Intelligence & Expert Systems, Patterson, PHI
4. Poole, Computational Intelligence, OUP
5. Logic & Prolog Programming, Saroj Kaushik, New Age International
6. Expert Systems, Giarranto, VIKAS
7. Artificial Intelligence, Russel, Pearson

Robotics

EC705B

Contacts: 3L

Credits: 3

Robot Anatomy Arm Geometry-Direct & Inverse Kinematics Problem.Arm Dynamics,D Alembert Equations of Motion, Synthesis of



elements with mobility constraints, manipulations-trajectory planning, joint interpolated trajectories. [15L]

Control of Robot Manipulation-computed torque technique sequencing & adaptive control, resolved motion control Mobile Robots. [6L]

Robot sensing-Range & Proximity & Higher-Level vision, illumination techniques, Imaging Geometry, Segmentation Recognition & Interpretation. [8L]

Robot Programming Language Characteristics of Robot Level & Task Level languages. Robot intelligence-State Space search, Robot learning, Robot Task Planning, Knowledge Engineering. [10L]

References:

1. K.S Fu R.C . CSG Lee-Robotics Control, Sensing, Vision & Intelligence, McGraw-Hill.
2. M.P. Groover, M. Weins, R.N. Nagel, N.C. Odrey –Industrial Robotics, McGraw Hill
3. Andrew C. Straugard-Robotics & AI, PHI
4. S. Sitharama Iyengar, Alberto Elfes-Autonomous Mobile Robots Control, Planning & Architecture, IEEE Computer Society Press

Software Engineering

EC705C

Credits: 3L

Credits- 3

Module I

Software Engineering –Objectives, Definitions, Software Process models - Waterfall Model, Prototype model, RAD, Evolutionary

Models, Incremental, Spiral (4L)

Software Project Planning- Feasibility Analysis, Technical Feasibility, Cost- Benefit Analysis, COCOMO model. [4L]

Module II

Structured Analysis, Context diagram and DFD, Physical and Logical DFDs, Data Modelling, ER diagrams, Software Requirements Specification (5L)

Module III

Design Aspects: Top-Down And Bottom-Up design; Decision tree, decision table and structured English, Structure chart, Transform analysis Functional vs. Object- Oriented approach. [3L]



Unified Modelling Language

Class diagram, interaction diagram: collaboration diagram, sequence diagram, state chart diagram, activity diagram, implementation diagram. **(4L)**

Module V

Coding & Documentation – Structured Programming, Modular Programming, Module Relationship- Coupling, Cohesion, OO

Programming, Information Hiding, Reuse, System Documentation. **[5L]**

Testing – Levels of Testing, Integration Testing, System Testing. **(5L)**

Software Quality, Quality Assurance, Software Maintenance, Software Configuration Management, Software Architecture. **[6L]**

Reference Books:

1. Software Engineering : A practitioner's approach– Pressman(TM)
2. Software Engineering- Pankaj Jalote (Wiley-India)
3. Software Engineering- Rajib Mall (PHI)
4. Software Engineering –Agarwal and Agarwal (PHI)

Power Electronics

EC705D

Contacts: 3L

Credits: 3

Module I Advances in Power Electronics

Power Semiconductor Switches: Rectifier diodes, fast recovery diodes, Schottky barrier diode, Power

BJT, Power MOSFET, SCR, TRIAC, IGBT and GTO.

Ratings, Static and Dynamic Characteristics, Trigger, driver and switching-aid circuits and cooling.

SCR turn –on and turn - off methods, Triggering circuits, SCR Commutation circuits, SCR Series and

Parallel operation, Snubber Circuit.

6hrs

Module II

Rectifiers Single phase and three phase controlled Rectifiers with inductive loads, RL load Effect of

source inductance- performance parameters .Dual Converters.

6hrs



Module III

Step up and Step down choppers Time ratio control and current limit control, Buck, Boost, Buck Boost and Cuk Converters, Concept of Resonant Switching.

4hrs

Module IV

Single phase and three phase inverters – PWM techniques, Sinusoidal PWM, modified Sinusoidal PWM- multiple PWM Voltage and harmonic Control – Series resonant inverter- Current Sources Inverter.

6hrs

Module V

AC Voltage Controllers, Single phase and three phase Cycloconverters – Power factor control and Matrix Converters.

4hrs

Module VI

DC and AC Drives

DC Motor Speed control

Induction Motor Speed Control

Synchronous Motor Speed Control

8hrs

Total Lecture Hours 34

Books:

b) P.C. Sen, Power Electronics

c) M.H. Rashid, Power Electronics, PHI/ Pearson Education

d) C.W. Lander, Power Electronics, McGraw Hill

e) B.K. Bose, Modern Power Electronics, JAICO

f) Mohan, N Undeland, TM & Robbins, WP- Power Electronics, John Wiley & Sons.

Practical

VLSI Design Lab

EC792

Contacts: 3

Credits: 2

Laboratory 1. Familiarity with Spice simulation tool (3 Hrs.)

Laboratory 2. Spice Simulation of Inverter , NAND , NOR Gates. (3 Hrs.)

Laboratory 3 Familiarity with EDA tools for VLSI design /FPGA based system design (6 Hrs.)



Laboratory 4. Layouts ,Transistors and tools,. (3 Hrs.)

Laboratory 5. Standars cell Design (3 Hrs.)

Laboratory 6. Design of CMOS XOR/XNOR Gates. (3 Hrs.)

Laboratory 7. Design of CMOS Full adder (3 Hrs.)

Laboratory 8. Design of CMOS Flip flops (R-S ,D , J-K) (3 Hr.s)

Laboratory 10. Design of 8 bit synchronous Counter (3 Hrs.)

Laboratory 11. Design of 8 bit bi-directional register with tri-stated input/output bus (3 Hrs.)

Laboratory 12 Design of a 12 bit CPU with few instructions and implementation and validation on FPGA (15 Hrs.)

Books:

1. M.J.S Smith , Application Specific Integrated circuits ,Pearson.
2. P.J Anderson ,The designer's guide to VHDL, Morgan Kaufman , 2nd edition ,2002.
3. W.Wolf , Modern VLSI Design: Systems on silicon , Pearson
4. G.Hatchel and F.Somenzi , logic Synthesis and verification Algorithms,Kluwer,1998

References:

1. <http://www-ee.eng.hawaii.edu/~msmith/ASIC/HTML/ASIC.htm#anchor935203>
2. J.Bhasker ,A VHDL Primer , BS Publications/Pearson Education.

RF & Microwave Engg Lab

EC793A

Contacts: 3

Credits: 2

Experiments

1. Determination of phase and group velocities in a waveguide carrying TE₁₀ Wave from Dispersion diagram [$\omega - \beta$ Plot].
2. Measurement of unknown impedance using shift in minima technique using a waveguide test bench/ Measurement of the susceptance of an inductive and or a capacitive window using shift in minima technique using a waveguide test bench
3. Study of the characteristics of a Reflex Klystron oscillator
4. Study of Gunn-oscillator Characteristics using X-band waveguide test bench.
5. Measurement of coupling factor, Directivity, Insertion loss and Isolation of a Directional coupler using X-band waveguide test bench set up.



6. Scattering matrix of a magic tee / E-plane tee / H-plane tee using waveguide test bench at X-band.
7. Experimental/Simulation Study of filter (LPF, HPF,BPF) response.
8. Measuring of dielectric constant of a material using waveguide test bench at X-band.

Reference Books

1. ML Sisodia & GS Raghuvanshi Basic Microwave Techniques and Laboratory Manual; Wiley Eastern Limited 1987
2. EL Gintzton Microwave Measurements, McGraw-Hill Book Co.
3. M Sucher and J Fox, Handbook of Microwave Measurements, Vol I, Wiley-Interscience Inc.

Optical Communication & N/W Lab

EC793B

Contacts: 3

Credits: 2

Experiment with Optical fibre :

To calculate attenuation constant, bending loss and numerical aperture of optical fibre.

Experiments using LED module : Study of DC characteristics.

I-V characteristics of LED (i) using optical fibre between LED and power meter and (ii) without using optical fibre.

P-I characteristics of LED (i) using optical fibre between LED and power meter and (ii) without using optical fibre.

Experiment with fibre Optic analog link :

Input-output characteristics using long optical fibre. Calculation of attenuation per unit length of optical fibre

Computer Networks lab

EC793C

Contacts: 3

Credits: 2

- 1) IPC (Message queue)
- 2) NIC Installation & Configuration (Windows/Linux)
- 3) Familiarization with
- 4) Networking cables (CAT5, UTP)
- 5) Connectors (RJ45, T-connector)
- 6) Hubs, Switches
- 7) TCP/UDP Socket Programming
- 8) Multicast & Broadcast Sockets
- 9) Implementation of a Prototype Multithreaded Server
- 10) Implementation of
 - a) Data Link Layer Flow Control Mechanism (Stop & Wait, Sliding Window)



- b) Data Link Layer Error Detection Mechanism (Cyclic Redundancy Check)
- c) Data Link Layer Error Control Mechanism (Selective Repeat, Go Back N)

FPGA & Reconfigurable Computing

EC793D

Contacts: 3

Credits: 2

1. Implementation of basic logic gates with VHDL on FPGA using different design styles.
2. Implementation of Multiplexers, Priority Encoder, decoder, counters etc. with VHDL on FPGA using different design styles.
3. Design and implementation of 16-bit ALU with VHDL on FPGA and verification by writing a test bench.
4.
 - a) Generation of Filter co-efficient of a LPF using Simulink FDA tool.
 - b) Generation of VHDL codes for the LPF by coupling the co-efficient in “a” with Xilinx.
 - c) Implementation of the LPF in FPGA using the code in “b”.
 - d) Testing of the LPF by using the hardware-in-the loop configuration.
5. Design and implementation of a real time user defined Traffic Light Controller using FSM method on an FPGA.
6. Interfacing of LCD display with FPGA and configuration for the scrolling display.

Artificial Intelligence Lab

EC795A

Contacts: 3

Credits: 2

Programming Languages such as PROLOG & LISP

Robotics Lab

EC795B

Contacts: 3

Credits: 2

1. Determination of link parameters of a multi-link robot using Denavit-Hartenberg scheme.
2. Inverse kinematic approach to determine required angular displacements for translation of link-end-points
3. Adaptive position control of a single/two-link robotic manipulator
4. Characterization of an ultrasonic transducer for range measurement applications
5. Segmentation of an image by histogram thresholding
6. Task-planning using pick-up and placement operations
7. Developing motion plan of a robot-cart using real-time A* algorithm



Software Engineering Lab

CS791

Contracts: 3L

Credits- 2

Assignments to be given from the following

1.Preparation of requirement document for standard application problems in standard format.(e.g Library Management System, Railway Reservation system, Hospital management System, University Admission system)

2.Project Schedule preparation .

3. Use Case diagram,Class diagram,Sequence diagram and prepare Software Design Document using tools like Rational Rose.(For standard application problems)

4.Estimation of project size using Function Point(FP) for calculation.

5.Design Test Script/Test Plan(both Black box and White Box approach)

6.Compute Process and Product Metrics (e.g Defect Density,Defect Age,Productivity,Cost etc.)>Also by Cost Estimation models.

Power Electronics Lb

EC795D

Contacts: 3

Credits: 2

List of Experiments:

1. Study of the characteristics of an SCR.

2. Study of the characteristics of a Triac

3. Study of different triggering circuits of an SCR

4. Study of firing circuits suitable for triggering SCR in a single phase full controlled bridge.

5. Study of the operation of a single phase full controlled bridge converter with R and R-L load.

6. Study of performance of single phase half controlled symmetrical and asymmetrical bridge converters.



7. Study of performance of step down chopper with R and R-L load.
8. Study of performance of single phase controlled converter with and without source inductance (simulation)
9. Study of performance of step up and step down chopper with MOSFET, IGBT and GTO as switch (simulation).
10. Study of performance of single phase half controlled symmetrical and asymmetrical bridge converter.(simulation)
11. Study of performance of three phase controlled converter with R & R-L load. (simulation)
12. Study of performance of PWM bridge inverter using MOSFET as switch with R and R-L load.
13. Study of performance of three phase AC controller with R and R-L load (simulation)
14. Study of performance of a Dual converter. (simulation)
15. Study of performance of a Cycloconverter (simulation)

Reference books:

1. Fundamental of Power Electronics with MATLAB, Randall Shaffer, Cengage Learning.
2. SPICE for Power electronics and electric power, M.H. Rashid & H.M. Rashid, Taylor & Francis.
3. Power Electronics: Principles and application, Jacob, Cengage Learning
4. Power Electronics, Daniel W. Hart, Tata McGraw Hill Edition.
5. Modeling & Simulation using MATLAB-SIMILINK , S. Jain, Wiley India
6. MATLAB & SIMULINK for Engineers, A.K. Tyagi, Oxford University Press.



Fourth Year – Eighth Semester

A.THEORY							
Sl No.	Subject Code	Theory	Contact Hours/Week				Credit Points
			L	T	P	Total	
1	HU801A	A. Organisational Behaviour B. Project Management	2	0	0	2	2
2	EC801 (No Lab)	A. Smart Antenna B. Digital Image Processing C. Satellite Communication & Remote Sensing	3	0	0	3	3
3	EC802 (No Lab)	A. Neural Network & Applications B. Material Science & Engineering C. Renewable Energy D. Audio & Speech Processing E. Mobile Computing	3	0	0	3	3
Total of Theory						8	8
B. PRACTICAL							
4	EC881	Design Lab / Industrial problem related practical training	0	0	6	6	4
5	EC882	Project-2	0	0	12	12	6
6	EC893	Grand Viva					3
Total of Practical						18	13
Total of Semester						26	21

VIII Semester Theory

Organisational Behaviour

HU801A

Contacts: 2L

Credits: 2

1. Organizational Behaviour: Definition, Importance, Historical Background, Fundamental Concepts of OB, Challenges and Opportunities for OB. [2]



2. Personality and Attitudes: Meaning of personality, Personality Determinants and Traits, Development of Personality, Types of Attitudes, Job Satisfaction. [2]
3. Perception: Definition, Nature and Importance, Factors influencing Perception, Perceptual Selectivity, Link between Perception and Decision Making. [2]
4. Motivation: Definition, Theories of Motivation - Maslow's Hierarchy of Needs Theory, McGregor's Theory X & Y, Herzberg's Motivation-Hygiene Theory, Alderfer's ERG Theory, McClelland's Theory of Needs, Vroom's Expectancy Theory. [4]
5. Group Behaviour: Characteristics of Group, Types of Groups, Stages of Group Development, Group Decision Making. [2]
6. Communication: Communication Process, Direction of Communication, Barriers to Effective Communication. [2]
7. Leadership: Definition, Importance, Theories of Leadership Styles. [2]
8. Organizational Politics: Definition, Factors contributing to Political Behaviour. [2]
9. Conflict Management: Traditional vis-a-vis Modern View of Conflict, Functional and Dysfunctional Conflict, Conflict Process, Negotiation – Bargaining Strategies, Negotiation Process. [2]
10. Organizational Design: Various Organizational Structures and their Effects on Human Behaviour, Concepts of Organizational Climate and Organizational Culture. [4]

References:

1. Robbins, S. P. & Judge, T.A.: Organizational Behavior, Pearson Education, 15th Edn.
2. Luthans, Fred: Organizational Behavior, McGraw Hill, 12th Edn.
3. Shukla, Madhukar: Understanding Organizations – Organizational Theory & Practice in India, PHI
4. Fincham, R. & Rhodes, P.: Principles of Organizational Behaviour, OUP, 4th Edn.
5. Hersey, P., Blanchard, K.H., Johnson, D.E.- Management of Organizational Behavior Leading Human Resources, PHI, 10th Edn.



Project Management

HU801B

Contracts: 2L

Credits- 2

1. Project Management Concepts: Concept and Characteristics of a Project, Importance of Project Management.[1]

2. Project Planning: Project Evaluation, Financial Sources, Feasibility Studies. [4]

3. Project Scheduling: Importance of Project Scheduling, Work Breakdown Structure and Organization Breakdown Structure, Scheduling Techniques – Gantt Chart and LOB, Network Analysis – CPM/PERT. [6]

4. Time Cost Trade-off Analysis – Optimum Project Duration. [2]

5. Resource Allocation and Leveling. [2]

6. Project Life Cycle. [2]

7. Project Cost – Capital & Operating Costs, Project Life Cycle Costing, Project Cost Reduction Methods. [2]

8. Project Quality Management: Concept of Project Quality, TQM in Projects, Project Audit. [1]

9. Software Project Characteristics and Management [2]

10. IT in Projects: Overview of types of Softwares for Projects, Major Features of Project Management Softwares like MS Project, Criterion for Software Selection. [2]

References

1. Gopalkrishnan P. and Rama Mmoorthy: Text Book of Project Management, Macmillan
2. Nicholas John M.: Project Management for Business and Technology – Principles and Practice, Prentice Hall India, 2ndEdn.
3. Levy Ferdinand K., Wiest Jerome D.: A Management Guide to PERT/CPM with GERT/PDM/DCPM and other networks, Prentice Hall India, 2nd Edn.
4. Mantel Jr., Meredith J. R., Shafer S. M., Sutton M. M., Gopalan M. R.: Project Management: Core Text Book, Wiley India, 1st Indian Edn.
5. Maylor H.: Project Management, Pearson, 3rd Edn.
6. Nagarajan K.: Project Management, New Age International Publishers, 5th Edn.
7. Kelkar. S.A, Software Project Management: A concise Study, 2nd Ed., PHI



Smart Antenna

EC801C

Contacts: 3L

Credits: 3

MODULE –I:

INTRODUCTION:

Antenna Basics, Phased array antenna, power pattern, beam steering, degree of freedom, adaptive antennas, smart antennas – key benefits of smart antenna technology, wide band smart antennas, Propagation Channels 4L

MODULE –II:

SMART ANTENNAS FOR WIRELESS COMMUNICATIONS:

Spatial Processing for Wireless Systems, Key Benefits of Smart Antenna Technology, The Vector Channel Impulse Response and the Spatial Signature, Spatial Processing Receivers, Fixed Beam forming Networks, Switched Beam Systems, Adaptive Antenna Systems, Wideband Smart Antennas, Diversity Techniques, Multiple Input - Multiple Output (MIMO) Communications Systems, MIMO for frequency selective scenarios.

10L

MODULE –III:

ADAPTIVE PROCESSING:

Sample matrix inversion algorithm, unconstrained LMS algorithm, normalized LMS algorithm, Constrained LMS algorithm, Perturbation algorithms, Neural network approach, Adaptive beam space processing, Implementation issues.

8L

MODULE –IV:

DIRECTION OF ARRIVAL ESTIMATION (DOA) METHODS:

Spectral estimation methods, linear prediction method, Maximum entropy method, Maximum likelihood method, Eigen structure methods, MUSIC algorithm – root music and cyclic music algorithm, the ESPRIT algorithm.

8L

MODULE –V:

IMPLEMENTATION OF SMART ANTENNA SYSTEM:

DOA based beam former design using simulation and hardware. Adaptive beam forming implementation using Altera Stratix® series FPGA, QRD RLS Algorithm. CORDIC algorithm.

6L

TEXT BOOKS:

1. Smart Antenna for Wireless Communication ,



T.S.Rappaport and J.C.Liberti, Prentice Hall, 1999

2. Smart Antennas,

L.C.Godra, CRC Press, 2004

3. Adaptive Filter Theory,

S. Haykin. Prentice Hall, 1985

4. Introduction to Smart Antennas, C.A.Balanis, Morgan and Claypool, 2007

Digital Image Processing

EC801C

Contacts: 3L

Credits: 3.

Module 1

Digital Image Processing Systems:

Introduction to structure of human eye, Image formation in the human eye, Brightness adaptation and discrimination,

Image sensing and acquisition, storage, Processing, Communication, Display Image Sampling and quantization, Basic

relationships between pixels. [4]

Module 2

Image Transforms (implementation):

Introduction to Fourier transform, DFT and 2-D DFT, Properties of 2-D DFT, FFT, IFFT, Walsh transform,

Hadamard transform, Discrete cosine transform, Slant transform, Optimum transform: Karhunen - Loeve (Hotelling)

transform. [7].

Module 3

Image Enhancement in the Spatial and Frequency Domain:

Gray level transformations, Histogram processing, Arithmetic and logic operations, Spatial filtering: Introduction,

Smoothing and sharpening filters. Frequency domain filters: Homomorphic filtering. [6]

Module 4

Image Data Compression:

Fundamentals, Redundancies: Coding, Interpixel Psycho-visual, fidelity criteria, Image compression models,

Error free compression, Lossy compression, Image compression standards: Binary image and Continuous tone Still Image

compression standards, Video compression standards. [6]

Module 5

Morphological Image Processing:



Introduction, Dilation, Erosion, Opening, closing, Hit -or-miss transformation, Morphological algorithm operations on binary Images, Morphological algorithm operations on gray-scale Images. [6]

Module 6

Image Segmentation, Representation and Description: Detection of discontinuities, Edge linking and Boundary detection, Thresholding Region based segmentation, Image Representation schemes, Boundary descriptors, and Regional descriptors. [7]

Text Books:

1. R.C Gonzalez and R. Woods :-Digital Image Processing, (Indian reprint: Pearson publication, 2001)
2. Anil K. Jain :- Digital Image Processing (Prentice-Hall, India)

Reference Books:

1. W. K. Pratt :- Digital Image Processing, - 2nd Edition, (John Wiley & Sons).
2. B. Chanda & D. Dutta Majumder, Digital Image Processing and Analysis, (Prentice-Hall, India)
3. M. A. Sid-Ahmed :- Image Processing- Theory, Algorithms & Architecture, (McGraw-Hill).

Satellite Communication & Remote Sensing

EC801D

Contacts: 3L

Credits: 3

Historical background, Basic concepts, Frequency allocation for satellite services, orbital & spacecraft problems, comparison of networks and services, modulation techniques used for satellite communication. (2)

Orbits- Two body problem, orbital mechanics, geostationary orbit, change in longitude, orbital maneuvers, orbital transfer, orbital perturbations. (2)

Launch Vehicles- principles of Rocket propulsion, powered flight, Launch vehicles for communication satellite (1)

RF link- noise, the basic RF link, satellite links (up and down) , optimization RF link, intersatellite link, noise temperature, Antenna temperature, overall system temperature, propagation factors, rain attenuation model. Tropospheric and Ionospheric EFFECT. (5)

Multiple access- FDMA, TDMA, CDMA techniques, comparison of multiple access techniques, error correcting codes. (5)

Satellite subsystems and satellite link design- AOCS, TT&C , power system, spacecraft antenna, transponder, Friis transmission equation, G/T ratio of earth station. (6)

Remote Sensing:

1. Basic of remote sensing, Electromagnetic Radiation principles, Atmospheric window, Indian satellite sensing satellite system,

Active, Passive, ground based and space based remote sensing. (3)



2. Spatial, spectral, Radiometric and temporal resolution, satellite sensors, detectors and scanning technique, FOV and error sources, Image analysis and Interpretation weather RADAR, LIDAR, acoustic sounding systems, TRMM, AURA-MLS, Megha Tropiques Altimeter , Scatterometer, Radiometer.(9)
3. Ground based and radio oclusion techniques, spectral response of water, Sea surface temperature, wind speed, colour monitor, clouds and aerosol, water vapor, convective system, Trace gases.(7)

References:

- Ref.: 1. Remote Sensing and GIS - B. Bhatta (Oxford University Press)
Remote sensing of the Environment – J.R. Jensen (Pearson)
Global Navigation satellite systems - B. S. Rao (TMH)
Satellite communication – D. Roddy (TMH)
Remote Sensing - R.A. Schowengerdt (Academic Press)

Neural Network & Applications

EC802A

Contacts: 3L

Credits: 3

Module-1

Introduction to neural networks: Human brain and models of a neuron, artificial neurons and activation functions; Learning processes: Introduction to Supervised, Unsupervised and Reinforcement Learning, Memory-based learning, Hebbian learning, competitive learning, Boltzmann learning, Adaptive Linear Neuron (Adaline); [8L]

Module-2

Single-layer perceptrons: Unconstrained optimization, LMS algorithm, learning curves, perceptrons, convergence theorem, limitations of single-layer perceptrons; Multi-layer perceptrons: Back-propagation algorithm, XOR problem, feature detection, accelerated convergence of back-propagation algorithm, limitations; [8L]

Module-3

Radial Basis function networks: Theorems on separability of patterns, interpolation problem, regularization theory and regularization networks, generalized RBF, approximation properties of RBF, Wavelet Neural Network, comparison of RBF and back-propagation; [6L]



Module-4

Associative Memory Networks: Training Algorithm for Pattern Association-Hebb Rule, Bidirectional Associative Memory, Hopfield Networks- Continuous and Discrete, Hamming Network;
Self- Organizing maps: Feature mapping models, SOM algorithm, learning vector quantization, adaptive vector quantization;
Stochastic machines: Statistical mechanics, Markov chains, Simulated annealing, Gibbs sampling, Boltzman machine, Sigmoid belief networks; [10L]

Module-5

Applications: Applications on Digital Image Processing and other related areas, Image Restoration based on Associative Memory,
Data Visualization with self organizing feature MAP, Support Vector machines (SVM), SVM based learning. Introduction to MATLAB Programming. [4L]

Text Books:

- 1) S. N. Sivanandam, S.N. Deepa: Principles of Soft Computing (Wiley India)
- 2) Satish Kumar: Neural Networks – A Classroom Approach (Mc Graw Hill Ed.)
- 3) Mohamad H. Hassoun: Fundamentals of Artificial Neural Networks (PHI)
- 4) James A. Freeman, David M. Skapura: Neural Networks (Pearson)
- 5) Simon Heykin : Neural Networks – A Comprehensive Foundation (PHI)
- 6) M. Ananda Rao, J. Srinibas: Neural Networks Algorithms and Applications (Narosa Publ. House)
- 7) S. Rajsekaran, G.A. Vijaylakshmi Pai: Neural Networks, Fuzzy Logic and Genetic Algorithm

Reference Books:

- 1) Amit Konar: Artificial Intelligence and Soft Computing (CRC Press, Indian Edition Available)
- 2) Cloete, Zarunda: Knowledge based Neurocomputing (University Press)
- 3) Duda, Hart, Stork: Pattern Classification (Wiley)
- 4) J.S. Jang, C.T. Sun, E. Mizutani: Neuro-Fuzzy and Soft Computing (PHI)
- 5) Bart Kosko: Neural Network and Fuzzy Systems (PHI)
- 6) N. K. Bose, P. Liang : Neural Network Fundamentals with Graphs, Algorithms and Applications (TMG)
- 7) Dan W Patterson, PHI : Introduction to Artificial Intelligence and Expert Systems (PHI)



**Material Science & Engineering
EC802B**

Contacts: 3L

Credits: 3

Structure of Solids : Atoms and their binding, Bonds, Crystal Systems, Bravais Lattice Miller Indices, Crystalline, Polycrystalline and Amorphous Materials; Metals, Semiconductors and Insulators, Lattice defects-Qualitative ideas of point, line, surface and volume defects. [5]

Dielectric Propertise : Dielectric Polarization and Mechanism- Internal or local field, Dielectric Loss, Temperature and Frequency dependence of dielectric constant, Elementary ideas of Piezoelectrics, Ferroelectrics and Pyroelectric Materials and its Applications. [4]

Magnetic Properties : Elementary ideas of classification of magnetic materials – Diamagnetism, Paramagnetism, Ferromagnetism, Ferrimagnetism, Magnetic Domains. [2]
Superconductors : Basic concepts of superconductivity, Transition temperature, Meissner effect High-T superconductors, Hard and Soft Materials, SQUID. [3]

Optical properties : Absorption, Emission, Luminescence, Electro-optic and Acousto-optic effects, Photorefractive effects. [3]

Materials for Optical Communication : LED and Laser Materials, Optical Fibre. [3]

Materials for Data Storage : Magnetic Cores, Tapes, Disks, Hard disk, Floppy disk, Magneto-optic devices, Bubble memories, Magneto-electronic Materials, CD, DVD, CCD. [5]

Materials for Display Devices : CRT, LED, LCD, TFT, Plasma Display. [3]

Advanced Materials : Metallic Glasses, Nanomaterials, etc. [2]

Books:

1. Electrical Engineering Materials – A. J. Dekker (PHI)
2. Material Science and Engineering–A First Course – V. Raghavan (PHI Learning Pvt. Ltd)
3. Principles of Electronic Materials and Devices – S. Kasap (McGraw-Hill)
4. An Introduction to Solid State Physics - Charles Kittel (John Wiley & sons)
5. An Introduction to Electronic Materials for Engineers – W. Kao, Z. Lee and N. Sannes (World Scientific)



Renewable Energy

EC802C

Contacts: 3L

Credits: 3

Classification of Energy Sources (2)

Advantages of Non Conventional Energy Sources over Conventional Sources Economics, Impact on Environment

Electricity Generation from Non Conventional Energy Sources:

Solar Energy: (12)

Solar radiation and its Characteristics, Solar Collector: flat Plate, focusing, Solar Energy use for water heating, Solar thermal power generation, Hybrid solar power

Principle of energy conversion in solar cells, Photovoltaics, Different types of PV Cells, Monopoly crystalline and amorphous

Silicon solar cells. Design of PV array. Efficiency and cost of PV systems.

Wind Energy: (7)

Wind as energy source, Design of Wind turbine, Selection of site of Wind farm, characteristics of different types of wind generators used with wind turbines

Hydel Energy: (2)

Electricity generation from micro hydel plants, location, auxiliaries and associated problems.

Bio Energy: (4)

Resources and conversion process: bio gas conversion, bio gas plant, bio mass gasifier. cogeneration Bio diesel; (2)

Sources, usability and advantages over mineral product,

Tidal Energy: Principle, selection of site, Economics and future prospect (2)

Wave Energy: Principle , selection of site and future prospect (2)

Geo thermal Energy: Principle , location , economics and prospect (2)

Fuel Cells: (5)

Principle of fuel cells, Different types of fuel cells, advantages and limitations

Magneto hydrodynamics energy conversion: (2)

Principle, Economics and environmental aspect of MHD generation



Audio & Speech Processing

EC802D

Contacts: 3L

Credits: 3

Module -1

Introduction : Production and transmission of acoustic signals : articulation of human speech. Acoustic-phonetic structure of Speech and Music : music synthesis and speech synthesis. A history of Voders & Vocoders and early speech recognition methods.

[4]

Module -2

Acoustic-Phonetic classification : Phonemes, Auto-spectra. Review of Digital Signal Processing and FFT. Short-term Spectral Analysis and STFT, the ARPA and DARPA projects, Pattern matching, introduction to Hidden Markov (HMM)

Models. Adaptive segmentation of speech. [6]

Module -3

The stochastic parameters of human speech, Gaussian densities and statistical model training, voiced and unvoiced speech, voice-box modeling, resonance. Acoustic travelling waves. Psycho-acoustics, Physiological exploration of periodicity, audio-spectrograms and sonograms, pitch-perception models. [7]

Module -4

Physiology of the ear and hearing mechanism, the Auditory System modeled as a Filter-bank, Gamma-tone and Roex filters,

Spectrum and Complex Cepstrum analysis of speech as perceived by detectors, Automatic Speech Recognition (ASR), Linear Prediction analysis [7]

Module -5

Phonetic and phonemic alphabets, phonological models of ASR, Linear and Dynamic Time-warping, connected word recognition,

Statistical sequence recognition and model training in speech pattern recognition, HMM training, Viterbi training, MLP architecture and training, [8]

Module -6

Speech Synthesis and coding, Formant synthesizers, Vocoders, Speech transformation, Speaker verification, Music synthesizers, speech-assisted applications in industry, defence and medicine. [5]

Text Books :

14. B.Gold & N.Morgan :- Speech & Audio Signal Processing -*Processing and Perception of Speech & Music* (Wiley Student edition)

15. L.R. Rabiner & B.H.Juang :- Fundamentals of Speech Recognition (Prentice-Hall Signal Processing series)



16. B.Plannerer : An Introduction to Speech Recognition [Freely downloadable e-Book]
17. F.Mihelic & J.Zibert : Speech Recognition (InTech) [Freely downloadable e-Book]
18. I. Mcloughlin :Applied Speech and Audio Processing with MATLAB examples (Cambridge University Press)

Reference Books :

- viii) G. Young :-The Application of Hidden Markov Models in Speech Recognition [freely downloadable e-Book]
- ix) M.Grimm & K.Kroschel :-Robust Speech Recognition & Understanding (Intech)[Freely downloadable]
- x) L. R.Rabiner & R.W.Schafer : Theory and Applications of Digital Speech Processing (Hewlett-Packard Labs/Pearson Pub)
- xi) C. Schmandt :- Voice Communication with Computers-Conversational Systems (Van Norstrand Reinhold Computers Series)
- xii) SOUND FORGE software package (SONY) for practice sessions

Mobile Computing

EC802E

Contact: 3L + 1T

Credit: 4

1. Introduction:

Wireless Communication Fundamentals: Wireless transmission, Frequencies for radio transmission, Signal Propagation, Modulations- Spread spectrum – MCA, SDMA, FDMA, TDMA, CDMA, Cellular wireless Networks.

2. Wireless access protocols:

IEEE 802.11 standard, WLAN Family, WLAN transmission technology, WLAN system architecture, Collision Sense Multiple Access with Collision Detection(CSMA/CD) and CSMA Collision avoidance (CSMA/CA), 802.11 PHY and MAC layers, IEEE 802.11 Distributed Co-ordinate System (DCF) and Point Co-ordination Function (PCF), WLAN family, HyperLAN, Bluetooth, Brief overview of WiMAX for wireless broadband communication.

3. Basic mobility management in Wireless Networks:

Handoff and location management, Basic Mobile IP operations, types, concepts, Four basic entities for MIPv4, Mobile IPv4 Registration, Tunneling, MIPv4 Reverse Tunneling, MIPv4 Triangular Routing.

4. Mobile Network Layer Considerations:

Limitations of MIPv4, MIPv6 and HMIPv6, Dynamic Host Configuration protocol, Micromobility solutions to the host mobility problem, Routing in Mobile ad-hoc network, DSDV,



DSR, AODV, Alternative metrics.

5. Transport Layer Considerations:

Traditional TCP, Classical TCP improvements- WAP, WAP 2.0.

6. Mobile Operating Systems:

PalmOS, Pocket PC and Windows CE, Embedded Linux and other Mobile Operating Systems.

7. Application Layer Considerations:

Adaptation, Disconnected operations, Mobile Agents, Business implications and mobile commerce. Emerging Technologies such as Wearable Computing- challenges and concerns.

Books:

1. Mobile Computing by Raj Kamal, Oxford Higher Education University Press, New Delhi.
2. 802.11 Wireless LAN Fundamentals by Pejman Roshan & Jonathan Leay, Pearson Education, New Delhi.
- GPRS Networks by Geoff Sanders, John Wiley and sons, England

Practical

Design Lab EC881

Contacts: 6L

Credits: 4

A. DISCRETE ANALOG CIRCUITS.

1. Rectifiers.

(To design a rectifier for a given average output dc voltage and a given load resistance, compare between the theoretical values of V_{dc} , V_{rms} , RF , HD , output regulation, transformer utility factor etc. with the measured values, and thus comprehend the relevance/effect of these various parameters.)

2. DC power supplies regulation and protection circuits.

(To learn designing a series transistor based output regulation circuit, an output current limiting circuit, fold back circuit needed for a given output parameters.)

3. Single stage audio frequency voltage amplifier with BJT for a given A_v , Z_{in} and Z_{out} and maximum symmetrical out put swing.

(To learn basic design principles, different methods of biasing, bias stability, selection of transistor from data manuals and effect of ac coupling on bandwidth.)

4. Single stage audio frequency emitter follower with JFET for a given A_v , Z_{in} and Z_{out} and maximum symmetrical out put swing.



(To learn the design principles and applications of an emitter follower.)

5. Complimentary symmetry power amplifier with pre amplifier, if necessary, for a given out put power to a given load with single ended power supply.

(To learn the distinction of a power amplifier over and above a voltage or current amplifier, its design principles, issues like, efficiency, cross over distortion etc.)

6. RC phase shift Oscillator , Wien Bridge oscillator, Hartley and Colpitt oscillator

(To learn the design of oscillators and measuring the frequency and amplitude of oscillations)

B. OPAMP BASED ANALOG CIRCUITS

1. Inverting and non-inverting amplifier of given dc gain, input impedance and output impedance.

(To learn the basic design, inter relation between the dc gain and input/output impedances, offset balance and the relation between feedback and GBW.)

2. Adder and subtractor.

(To learn the basic design and function of a multi input adder/subtractor (with ac and dc inputs present simultaneously).

3. Comparator/voltage level detector for a given upper threshold level and a given lower threshold level with facility of independent adjustment of hysteresis and center point.

(To learn the design and the technique of independent adjustment of both hysteresis and center point.)

4. Active filters: LP, BP, HP, 1st order, 2nd order.

(To learn the design of a filter and it's inherent phase shifting characteristics.)

5. 555 based monostable and astable of duty cycle below and above 50%.

(To learn designing 555 based timer circuits.)

DIGITAL LOGIC CIRCUITS

1. Design and implement a BCD to 7-segment decoder with basic and universal gates.

(To understand clearly the method of writing a truth table, use of K-map, simplifying a logic function and optimum design with minimum number of ICs and inputs.)

2. Design and implement a 4-digit frequency counter with a clock generator.

(To learn designing a digital circuit using available standard gate, FF, counter and display Ics.)



3. Designing logic circuits using multiplexers, demultiplexers and gates to implement logic functions.

(To learn the use multiplexers and demultiplexers)

4. Design and implement a sequence detector.

(To learn designing a sequential circuit, whose output is 1 or 0 when any input bit is preceded or succeeded by a predefined

binary sequence. To define the input & output sequence from a given physical problem, to prepare a state diagram, derive a

minimal state table, to find the simplified state equation, to implement the same & verify the result)

5. To design and implement a combination of a logic circuit and a RAM in order to generate a 4-bit data after simplifying a logic expression, to store the output data at a predefined location in the RAM, to retrieve the same and verify.

(To comprehend the structure and operating principle of memory devices.)

D. Power Electronics

1. Design a Single-phase full & shaft controlled converter.

2. Design of Microprocessor based Triggering socket.