Syllabus for B.Tech(Electronics & Communication Engineering) Second Year & 3rd Year (Proposed)

Revised Syllabus of B.Tech ECE (for the students who were admitted in Academic Session 2010-2011)

ECE SECOND YEAR: THIRD SEMESTER

Sl.No.	Field	Theory	Contact Hours/Week				Cr. Points
			L	T	P	Total	
A. THEORY							
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	1	0	4	4
4	**EC302**	2. Solid State Device	3	0	0	3	3
5	**EC303**	1. Signals & Systems	3	0	0	3	3
	EC304	2. Analog Electronic Circuits	3	1	0	4	4
6							
Total of Theory						**21**	**20**
B. PRACTICAL							
7	**M(CS)391**	Nunerical 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**

ECE SECOND YEAR: FOURTH SEMESTER

Sl.No.	Field	Theory	Contact Hours/Week				Cr. Points
			L	T	P	Total	
A. THEORY							
1	**HU401**	Values & Ethics in Profession	3	0	0	3	3
2	**PH401**	Physics-II	3	1	0	4	4
3	**CH401**	Basic Environmental Engineering & Elementary Biology	2+1	0	0	3	3
4	**EC401**	1. EM Theory & Transmission Lines	3	1	0	4	4
5	**EC402**	2. Digital Electronic & Intrgrated Circuits	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	**PH491**	Physics-II Lab	0	0	3	3	2
8	**EC491**	1. EM Theory & Tx Lines Lab	0	0	3	3	2
9	**EC492**	2. Digital Electronic & Integrated Circuits Lab	0	0	3	3	2
Total of Practical						**12**	**8**
Total of Semester						**30**	**26**

Syllabus for B.Tech(Electronics & Communication Engineering) Second Year & 3rd Year (Proposed)

Revised Syllabus of B.Tech ECE (for the students who were admitted in Academic Session 2010-2011)

SEMESTER - III

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.
Note 2: Structure of Question Paper
There will be two groups in the paper:

Group A: Ten questions, each of 2 marks, are to be answered out of a total of 15 questions, covering the entire syllabus.

Group B: Five questions, each carrying 10 marks, are to be answered out of (at least) 8 questions.
Students should answer at least one question from each module.
[At least 2 questions should be set from each of Modules II & IV.
At least 1 question should be set from each of Modules I & III. Sufficient questions should be set covering the whole syllabus for alternatives.]

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)

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: $\int_0^{\infty} \frac{\sin x}{x} dx$, $\int_0^{2\pi} \frac{d\theta}{a + b\cos\theta + c\sin\theta}$, $\oint_C \frac{P(z)}{Q(z)} dz$ (elementary cases, P(z) & Q(z) are polynomials of 2nd 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) $0 \le P(A) \le 1$, 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 $P_o y''+P_1 y'+P_2 y=0$ 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**

Module	Content	Hrs
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]***. **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].	4 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]. **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].	4 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]***. **Coupled Circuits**: Magnetic coupling, polarity of coils, polarity of induced voltage, concept of Self and mutual inductance, Coefficient of coupling, Solution of Problems. **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].***	4 4 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]. ***(*) 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.	8 4

Old module 9 viz. SPICE deleted for consideration in Sessional Subject.

Problems for Module 1a:

Ex. 1. A parallel RLC Circuit has R= 100 K Ohms, L= 10 mH, C= 10 nF. Find resonant frequency, bandwidth and Quality factor.

Ex. 2. Two coils one of R= 0.51 Ohms,L= 32 mH, other of R= 1.3 Ohms, L= 15 mH, and two capacitors of 25 micro F and 62 micro F are in series with a resistance of 0.24 Ohms. Determine resonance frequency and Q of each coil.

Ex. 3. In a series circuit with R= 50 Ohms, l= 0.05 Ohms and C= 20 micro F, frequency of the source is varied till the voltage across the capacitor is maximum. If the applied voltage is 100 V, find the maximum voltage across the capacitor and the frequency at which this occurs. Repeat the problem with R= 10 Ohms.

Problems for Module 1b and 2:

Examples for mesh current in networks like T, π, bridged T and combination of T and π.

See Annexure-1 for the figures

Problems for Module- 2a:

Ex.1. The network of Fig.1 – Mod.4 is in the zero state until t= 0when switch is closed. Find the current i1(t) in the resistor R3.

Hints: the Fig.1 – Mod.4 shows the same network in terms of transform impedance with the Thevenin equivalent network.

Ex.2. Find the Norton's equivalent circuit for the circuit Fig.2 – Mod.4.
Hints: As a 1st. step, short the terminals ab. This results in the Circuit of Fig.2.(a). By applying KCL at node a, we have, (0-24)/4+ isc = 0; i.e isc= 9 A. To find out the equivalent Norton's impedance RN, deactivate all the independent sources, resulting in a circuit of Fig.2.(b), RN= (4x12)/(4+12) = 3 Ohms. Thus we obtain Norton equivalent circuit of Fig.2 (c).

Problems for Module – 2b:
Ex.1. Draw the graph, one tree and its co tree for the circuit shown in Fig.1 – mod.5.
Hints: In the circuit there are four nodes (N= 4) and seven branches (B= 7). The graph is so drawn and appears as in Fig. 1 (a). Fig.1(b) shows one tree of graph shown in Fig. 1(a). The tree is made up of branches 2, 5 and 6. The co tree for the tree of Fig.1 (b) is shown in Fig. 1(c). The co tree has L= B-N+1 = 7-4+1 = 4 Links.
Ex.2. (a). For the circuit shown in Fig.2- Mod.5, construct a tree so that i1 is a link current. Assign a complete set of link currents and find i1 (t).
(b). Construct another tree in which v1 is a tree branch voltage. Assign a complete set of tree branch voltages and v1 (t).
Take i(t) = 25 sin 1000t A, v(t)= 15 cos 1000t.

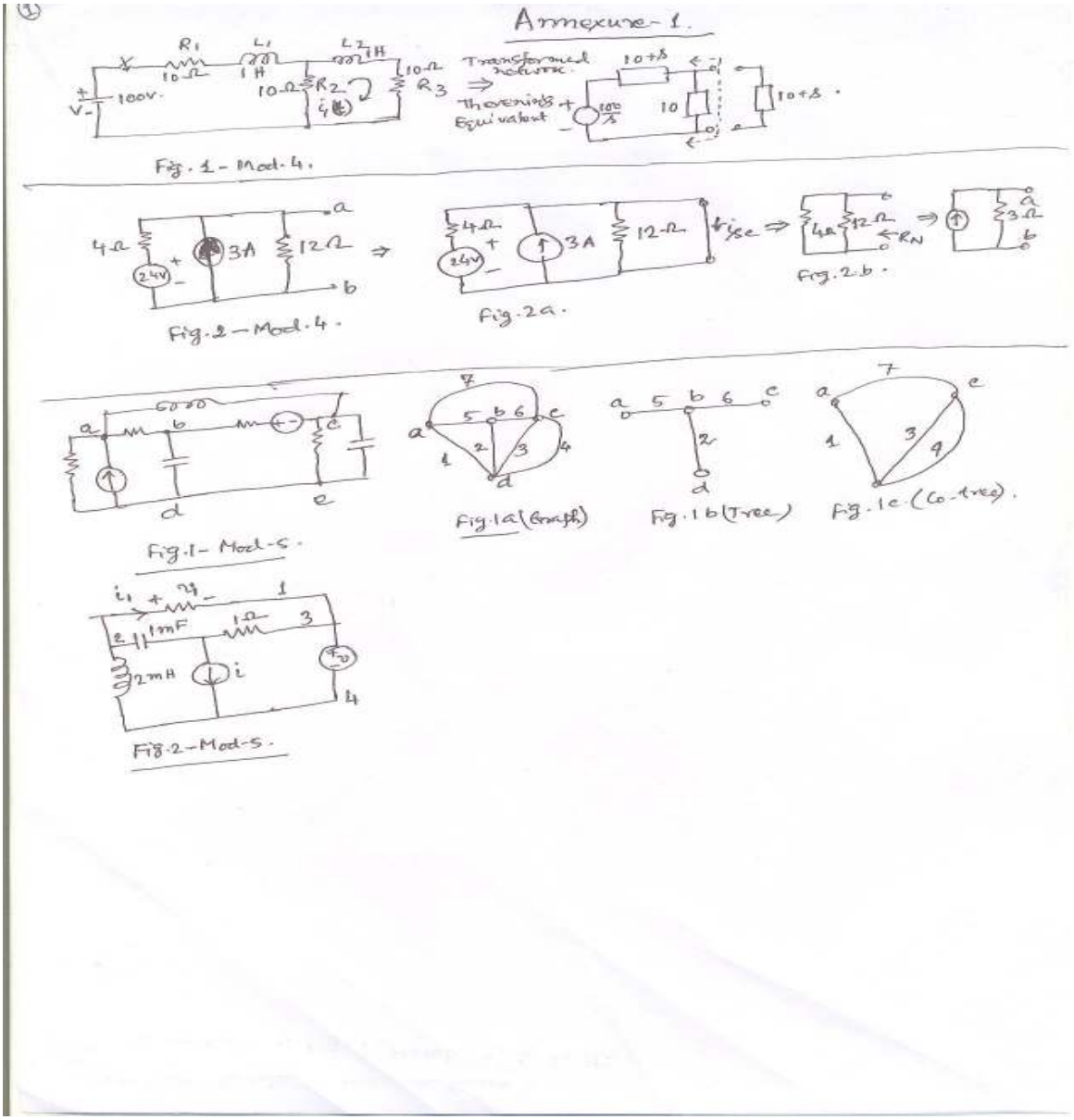
Tutorials: (*):Bold and Italics.

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- Cenage 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 non-degeneracy. ***(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 ***(1L)***;] JFET - behaviour, characteristics ***(1L)***; MOSFET - channel inversion, Ideal Threshold voltage ***(1L),*** 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, ***(1L)***; I-V characteristics with expressions for saturation and non-saturation regions (concepts but no detail derivations, empirical relations to be used for solving problems) ***(1L)***; Equivalent circuit for MOSFET ***(1L)***; MOSFET for VLSI - scaling issues (basic concept of Short Channel Effects only) ***(1L)***;]

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

Learning Outcome:

Module - 1: Student gains the ability to ***identify semiconductors*** which are elemental or compound type; Direct and indirect band-gap type so that they may be used in optical and non-optical devices; this empowers the student ***to explain the importance of Fermi level*** in identifying intrinsic and extrinsic n- and p-type semiconductors, to predict how Fermi-level changes with doping; ***identify degenerate and non-degenerate*** semiconductors; indicate the ***effect of temperature on carrier concentration***.
Module - 2: Focus is on understanding the junction phenomena including alignment of Fermi-level at the interface of a p-n junction and Schottky junction, and its non-alignment due to the application of junction potential. The student will be able to ***draw the I-V characteristics***; acquire the ability ***to evaluate the dependence*** of ***reverse saturation (drift) current on minority carrier concentration and forward diffusion component on potential barrier***; the student will ***calculate the junction capacitances*** and ***compare the switching capability*** of the minority carrier p-n diode with the majority carrier based Schottky diode; to highlight the importance of peak-inverse voltage for a diode and compare the peak inverse voltages of Si and Ge diodes.
Practical ability: Diode specification; Diode numbers and lead specification; Drawing diode characteristics and calculation of differential resistance; load-line analysis of simple diode circuits. [To be practiced in the laboratory]
Module - 3: The student will appreciate the importance of varying the reverse saturation current across the reverse biased base-collector junction by varying the minority carrier concentration using electrical means i.e. forward biased emitter-base junction; acquire the ability ***to treat the BJT as a two port device*** and ***explain transistor action*** for output current control by changing input current; The student will be able ***to use CE, CB and CC modes*** for different applications and ***design biasing circuits*** with BJTs.
Practical ability [For Laboratory Practice]: Transistor lead testing and transistor testing; Transistor biasing for different classes of amplifiers; [To be practiced in the laboratory]
Module - 4: Ability ***to calculate the threshold voltages*** for different MOSFETs; ability to ***compute the effect of Gate voltages on the junction capacitances***; ability ***to bias MOSFETs and JFETs***.
Practical ability [For Laboratory Practice]: JFET and MOSFET specifications; Biasing of FETs. [To be practiced in the laboratory]

SIGNALS AND SYSTEMS

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

Pre requisite: First year courses (semester I & II) covering
(1) Concepts in electrical and electronics circuits (Basic Electrical and Electronics Engg I & II).
(2) Knowledge in algebra and calculus with problem solving capability (studied in Mathematics-I).
(3) Fundamental concepts on Laplace Transformation (studied in Mathematics-II)
(4)
Genesis: The scope of this paper is to introduce a panoramic view of signals & systems so that the students may understand the basic

concepts of various systems and signal processing and the way the signals interact with the physical systems. This understanding is not only the prerequisite to study the subject DSP (to be introduced in the higher semester), but also crucial for understanding fundamental concepts in communication engineering in general and to some extent for other upcoming subjects such as control engineering and circuit analysis/ synthesis.

Outcome: The course will enable the students to study the various tools of signal analysis and acquire confidence in studying all other communication related subjects (in particular DSP) in the subsequent semesters.

Module No	Topic	Hrs
3.	**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**
4.	**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**
5.	**Laplace Transform:** Recapitulation, Analysis and characterization of LTI systems using Laplace transform: Computation of impulse response and transfer function using Laplace transform.	**2**
6.	**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**
7.	**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**
8.	**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 voltage regulator, 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

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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, Berkhausen 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 & non-inverting 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 El;ectronics, McGraw Hill.
2. Rashid-Microelectronic Circuits-Analysis and Design- Thomson (Cenage Learning)
3. Schilling & Belove—Electronic Circuit:Discrete & Integrated , 3/e , McGraw Hill
4. Razavi- Fundamentals of Microelectronic s- 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, Mc GrawHill.

9. Gayakwad R.A -- OpAmps and Linear IC's, PHI

10. Coughlin and Driscol – Operational Amplifier and Linear Integrated Circuits – Pearson Education

Tutorial Guidance:

Prerequisite: Basic knowledge about components R,L,C, Network Theorems(Kirchoffs law, Thevenin's theorem, Miller theorem etc.). Basic knowledge about the operation of semiconductor devices (Transistor, Diode, UJT, SCR etc.),Ohms Law, Voltage current equations. Basic knowledge of Differentiation , Integration, Differential equation, matrix etc.

Basic level of understanding: Current Voltage equation. Direction of current flow. Device limitations, Power consumptions and their limits, usage of appropriate device in the problem. Device selection and comparison, advantages and disadvantages.

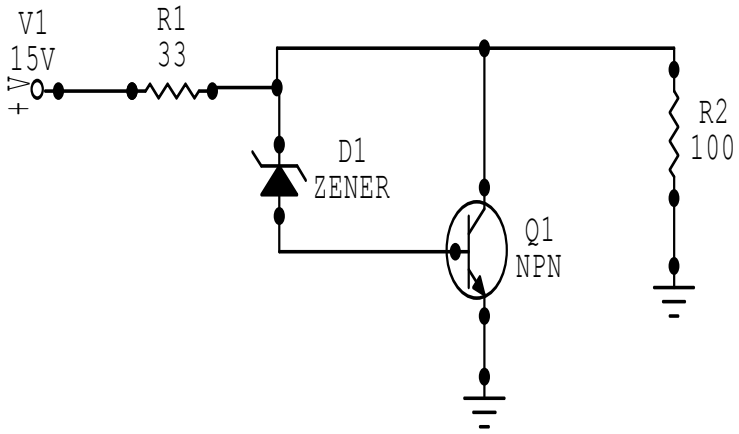
Outcome of learning: Students will be able to design, test and examine simple circuits with transistor, op-amp, amplifiers, oscillators etc. They will be able to test, repair, modify and take-up design exercise. They will have clear knowledge of basic circuit analysis and its functions and their limitations. Most importantly they will be able to recognize, understand, modify and repair majority of circuits used in professional equipment design.

Module:1 Filter and regulator

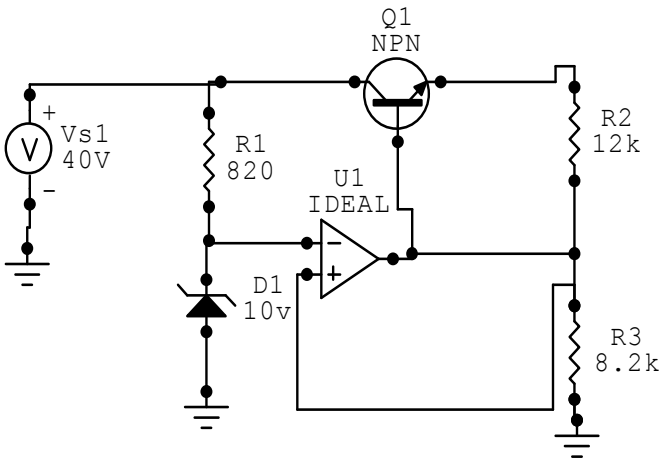
Topic	Reference book (optional)
Capacitor filter, Π section filter ripple factor, series and shunt voltage regulator, percentage regulator, 78xx and 79xx series, concepts of smps	Linear integrated circuits-D.Roy Choudhury, Shail B. Jain(Chapter 6&7) Electronic Devices and Circuit Theory-Boylested Chapter 18)

Assignment: (These are typical examples, indicative of the type of problems to be set for tutorials.)

1. Determine the regulated voltage and circuit currents for the shunt regulator.



2. Calculate the regulated output voltage in the ckt of fig.



3. A 500 μF capacitor provides a load current of 200 mA at 8% ripple; calculate the pick rectified voltage obtained from the 60 Hz supply and the dc voltage across the filter capacitor.

4. Calculate the size of the filter capacitor needed to obtained a filtered voltage with 7% ripple at a load of 200mA. The full wave rectified voltage is 30v, and the supply is 60 Hz

Moudule-2 : Transistor Biasing and stability

Topic	Reference Book (optional)
Q Point, self – Bias – CE, compensation technique, h-module of transistors. Expression for voltage gain, current, gain Input and output impedance, trans- resistance and Tran conductance emitter follower circuits	Electronics –fundamental— D Chattopadhaya & P.C. Rakhit (Chapter---8)
High frequency modes of transistor	Microelectronic circuits---Sedra & Smith (Chapter---3)

Assignment: (These are typical examples, indicative of the type of problems to be set for tutorials.

(1)Find the Q point of a self–bias transistor circuit with the following specification:- Vcc= 22.5 volt, R_L= 5.6 KΩ,R_E= 1 KΩ ,R_1= 90 KΩ, R_2= 10 KΩ V_{BE}=0.7 volt and β=55 Assume $I_b >> Ic_0$

(2) A CE transistor amplifier is characterised by h_{ie} = 2 KΩ, h_{re} $2*10^{-4}$, h_{fe}= 50 and h_{oe}= $20* 10^{-6}$ A/V. If the load resistance is 4 KΩ and the source resistance is 200 Ω determine the input resistance, the output resistance and the voltage, current and power gain.

(3) A particular BJT operating at Ic= 2mA has Cμ=I pf, Cπ =10 pf and β = 150. What are f_t& f_β for this situation?

Module -3: Transistor Amplifiers:

Topic	Reference Book.(optional)
RC coupled amplifier, function of all components equivalent circuit, derivation of voltage gain, current gain, input impedance, frequency response characteristics, lower and upper half frequencies, bandwidth and concept of wide band amplifier.	Electronics Devices and Circuits---- S Salivahanan N. Suresh kumar A. Vallavaraj

Assignment:

1. A CE-RC coupled amplifier uses transistors with the following h-parameters: h_{fe} = 50 , h_{ie} = 1100 Ω, h_{oe} = $10 *10^{-6}$ $m_{hos,}$ h_{re} = $2.5*10^{-4}$. The value of g_m at the operating point is $200m_{hos}$. The biasing resistor R1 &R2 may be neglected being large in comparison with RI. The load resistor R_c = 5 K Ω. Let the total shunt capacitance C= 200μf in the input Ckt. and the coupling capacitor Cc= 7 μf. Calculate for one stage of the amplifier (a) mid band current gain (b) mid band voltage gain (c) lower and higher 3 db frequencies and (d) gain-bandwidth product.

Module – 4: Feed back Amplifier and Oscillator

Topic	Reference Book(optional)
Feed back concept, negative and positive feed back, voltage/current, series / shunt feed back, bark house ,ulprits, Hartley's , phase shift, Wein bridge and crystal oscillator.	(1) Electronics devices and circuits (Chapter 14& 15) S Salivahanan N. Suresh kumar A. Vallavaraj (2) Electronics-Fundamentals and Applications----- D Chattopadhayay P. C. Rakhit (Chapter—10)

Assignment: (These are typical examples, indicative of the type of problems to be set for tutorials.)

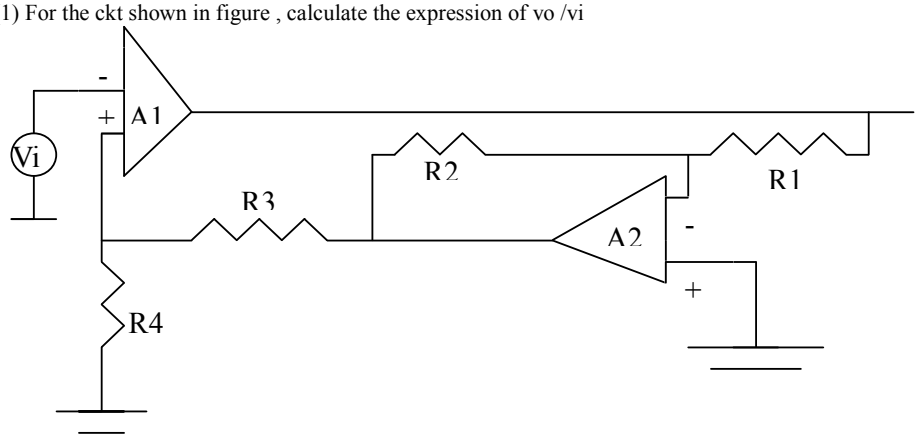
1. An Hartley oscillator is designed with $L_1 = 20$ µH, $L_2 = 2$ mH and a variable capacitance. Determine the range of capacitance values if the frequency is varied between 950 and 2050 Khz.
2. A Colpitts oscillator is designed with $C_2 = 100$pf and $C_1 = 7500$pf. The inductance is variable. Determine the range of inductance values, if the frequency of oscillator is vary between 0.950 and 2050 Khz
3. In an RC phase shift oscillator, if its frequency of oscillation is 955 Hz and $R_1 = R_2 = R_3 = 680$ KΩ, Find the value of capacitors.
4. In the Wein –Bridge oscillator, if the RC network consists of resistance of 200 KΩ and the capacitance of 300pf, find its frequency of oscillation.
5. A crystal has the following parameters: L = 0.33 H, C_1= 0.065 pf, C_L 1.0 pf and R = 5.5 KΩ. Find the series resonant frequency and Q factor of the crystal.
6. The open loop gain of an amplifier is -200. A voltage series negative feed back is used with a feed back ratio of -0.02. The input and the output impedance of the amplifier are 2 KΩ and 40 KΩ, respectively in the absence of feedback. Determine the closed loop gain, and the input and the output impedance when the feed back circuit is completed.

Module: 5 Operation Amplifier:

Topic:	Reference: (optional)
Ideal opAmp,CMRR,Open &Closed loop circuit, Importance of feedback loop(+ve&-ve),Inverting & Non inverting Amplifier	(1) Op amps and linear Integrated Circuits - R. A. Gayakwad
Constant Current source(Current mirror etc), Level shifter, Voltage follower/Buffer Circuit, Differential Amplifier	(2) Linear integrated circuits-D.Roy Choudhury, shail B.Jain

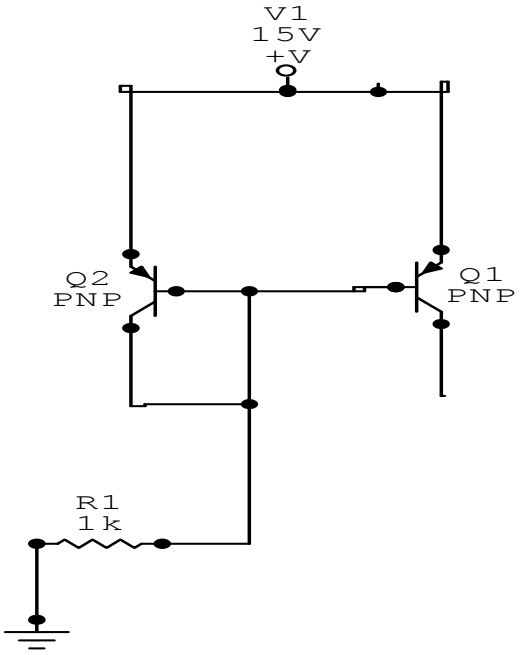
Assignment: (These are typical examples, indicative of the type of problems to be set for tutorials.)

(1) For the ckt shown in figure , calculate the expression of vo /vi



(2) Design a current source (current Mirror) for generating Io=25µA. Assume: vcc=15v, β=100

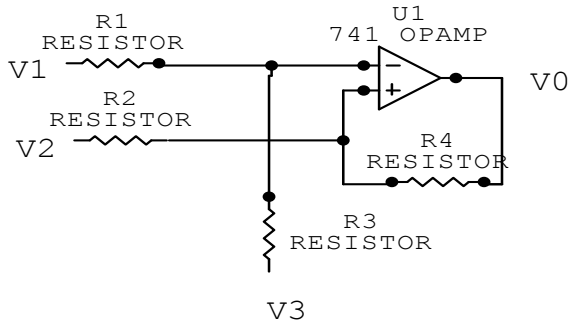
(3) For the current mirror shown in figure , determine R so that Io=100µA



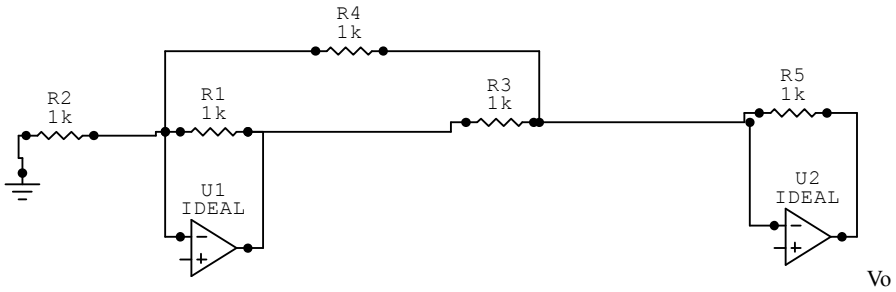
Module:6 Application of operational amplifier

Topic	Reference: book(optional)
Adder.Integrator,differentiator,comparator,schimit trigger, instrumentation amplifier, log& anti log amplifier,Transconductance multiplier, precision rectifier, v to I and I to v converter, free running oscillator	Linear integrated circuits-D Roy choudhury, shail B.Jain

Assignment:
(1) in the ckt of figure, it can be shown that Vo = a1V1+a2V2+a3V3. Find the values of a1, a2 and a3. Also find the value of Vo, if (1) R4 is short ckt (2) R4 removed (3) R1 is short circuited.

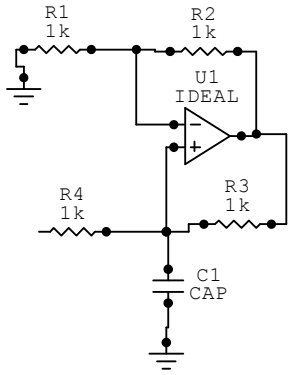


(2) For the instrumentation amplifier shown in figure, verify that Vo= (1+R2/R1+2R2/R1) (V2-V1)



[note- R1=R3, R2=R5]

(3) Prove that the circuit shown in figure is a non inverting integrator with Vo=2/Rc∫Vi dt; where R1=R2=R3=R4=R



Module: 7 power Amplifier
Assignment:

1. A transformer coupled class A power Amplifier supplies power to an 80 Ω load connected across the secondary of a step-down transformer having a turn ratio 5:1. Determine the maximum power output for a zero signal collector of 120 mA.
2. A CE power amplifier operates under Class A condition with a collector supply of 46 volt. The load line passes through the point (i)Vc=46 volt, Ic=0 and (ii) Vc=0, Ic=2A. The Q-point is chosen at Icq=0.8A and Vcq=27.6 volt, calculate the maximum ac power output, the dc power input and the efficiency.
3. A single turned amplifier has the following parameters: L=120μA, C=100P_F, R=10 Ω, h_{oe}=50*10^{-6}, h_{fe}=100, h_{ie}=2.5KΩ, R_T=10KΩ. Calculate (i) The resonant frequency (ii) The bandwidth (iii) the maximum voltage gain.

Module: 8 Multivibrator
Assignment:

1. In an Astable multivibrator, R_A=2.2 KΩ, R_B=6.8 KΩ, and C=0.01μF, calculate (i) $t_{HIGH,}$ (ii) $t_{LOW,}$ (iii) free running freq, (iv) duty cycle.
2. In a monostable multivibrator, the frequency of the input triggering is 15 KH_Z If the value of C=0.01μF, calculate the value of resistance R.

Module: 9 Special Functional Circuit

1. In the VCO, calculate the change in output Frequency if the supply voltage is varied between 9 volt and 11 volt. Assume V_{CC}= 12V, R_T= 6.8 KΩ, C_T= 75P_F, and R1= 15 KΩ, and R2= 100 KΩ.
2. Determine the dc control voltage Vc at lock if signal frequency fs=10KH_Z, VCO free running frequency is 10.66KH_Z, and the voltage to frequency transform coefficient of VCO is 6600H_Z/V.
3. Calculate the output frequency f_o, lock range Δf_L, and capture range Δfc of a 565 PLL if R_T= 10 KΩ, C_T= 0.01μF, and C= 10μF.

Reference Book(optional)

a) Linear Integrated Circuit:---------D.Roy Choudhary
S.B. Jain (Chapter-9)

b) Electronics Devices and Circuit Theory: ---------- Boylestad & Nashelshy.
c) Electronics Devices and Circuits: --------- Salivahanan,N.S.Kumar

Practical Detailed manuals will be uploaded later.

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 Runga-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

1. 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.

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.

Ph 401 : :Physics
Contacts : 3L + 1T
Credits : 4

Module 1:

Vector Calculus:

1.1 Physical significances of grad, div, curl. Line integral, surface integral, volume integral- physical examples in the context of electricity and magnetism and statements of Stokes theorem and Gauss theorem [No Proof]. Expression of grad, div, curl and Laplacian in Spherical and Cylindrical co-ordinates. 2L

Module 2 :

Electricity

2.1 Coulumbs law in vector form. Electrostatic field and its curl. Gauss's law in integral form and conversion to differential form . Electrostatic potential and field, Poisson's Eqn. Laplace's eqn (Application to Cartesian, Spherically and Cylindrically symmetric systems – effective 1D problems) Electric current, drift velocity, current density, continuity equation, steady current. 5L

2.2 Dielectrics-concept of polarization, the relation D=ε0E+P, Polarizability. Electronic polarization and polarization in monoatomic and polyatomic gases. 3L

Module 3:

Magnetostatics & Time Varying Field:

3. Lorentz force, force on a small current element placed in a magnetic field. Biot-Savart law and its applications, divergence of magnetic field, vector potential, Ampere's law in integral form and conversion to differential form. Faraday's law of electro-magnetic induction in integral form and conversion to differential form. 3L

Module 4:

Electromagnetic Theory:

4.1 Concept of displacement current Maxwell's field equations, Maxwell's wave equation and its solution for free space. E.M. wave in a charge free conducting media, Skin depth, physical significance of Skin Depth, E.M. energy flow, & Poynting Vector. 6L

Module 5:

Quantum Mechanics:

5.1 Generalised coordinates, Lagrange's Equation of motion and Lagrangian, generalised force potential, momenta and

energy. Hamilton's Equation of motion and Hamiltonian. Properties of Hamilton and Hamilton's equation of motion.

4L

Course should be discussed along with physical problems of 1-D motion

5.2 Concept of probability and probability density, operators, commutator. Formulation of quantum mechanics and Basic postulates, Operator correspondence, Time dependent Schrödinger's equation, formulation of time independent Schrödinger's equation by method of separation of variables, Physical interpretation of wave function ψ (normalization and probability interpretation), Expectation values, Application of Schrödinger equation – Particle in an infinite square well potential (1-D and 3-D potential well), Discussion on degenerate levels. 9L

Module 6:

Statistical Mechanics:

3.1 Concept of energy levels and energy states. Microstates, macrostates and thermodynamic probability, equilibrium macrostate. MB, FD, BE statistics (No deduction necessary), fermions, bosons (definitions in terms of spin, examples), physical significance and application, classical limits of quantum statistics Fermi distribution at zero & non-zero temperature, Calculation of Fermi level in metals, also total energy at absolute zero of temperature and total number of particles, Bose-Einstein statistics – Planck's law of blackbody radiation.. 7L

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.

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, $L_{10}(18\,\text{hr Index})$, Ld_n.

Noise pollution control. 1L

Environmental Management:

Environmental impact assessment, Environmental Audit, Environmental laws and protection act of India, Different international environmental treaty/ agreement/ protocol. 2L

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 - JD 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-McGaw-Hillr –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.

   Engineering Electromagnetics, 7thEdition-W.H.Hayt & J.A.Buck, Tata-McGraw-Hill

5. 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, EBDIC, 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

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. Morries 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- Cenage Learning.
9. Leach & Malvino—Digital Principles & Application, 5/e, Mc Graw Hill
10. Floyed & Jain- Digital Fundamentals-Pearson.
11. P.Raja- Digital Electronics- Scitech Publications

12. S.Aligahanan, S.Aribazhagan, Digital Circuit & Design- Bikas Publishing

Practical

TECHNICAL REPORT WRITING & LANGUAGE LABORATORY PRACTICE
Code: HU481
Cr-2

Guidelines for Course Execution:

Objectives of this Course: This course has been designed:

1. **To inculcate a sense of confidence in the students.**
2. **To help them become good communicators both socially and professionally.**
3. **To assist them to enhance their power of Technical Communication.**

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

Physics Lab-2
Code: PH-491
Contacts: (3P)
Credit: (2)

Group 1: Experiments on Electricity and Mangentism

1. Determination of dielectric constant of a given dielectric material.
3. Determination of resistance of ballistic galvanometer by half deflection method and study of variation of logarithmic decrement with series resistance.
4. Determination of the thermo-electric power at a certain temperature of the given thermocouple.
5. Determination of specific charge (e/m) of electron by J.J. Thomson's method.

Group 2: Quantum Physics

6. Determination of Planck's constant using photocell.
7. Determination of Lande'g factor using Electron spin resonance spetrometer.
8. Determination of Stefan's radiation constant
9. Verification of Bohr's atomic orbital theory through Frank-Hertz experiment.
10. Determination of Rydberg constant by studying Hydrogen/ Helium spectrum

Group 3: Modern Physics

11. Determination of Hall co-efficient of semiconductors.
12. Determination of band gap of semiconductors.

13. To study current-voltage characteristics, load response, areal characteristics and spectral response of photo voltaic solar cells.

a) A candidate is required to perform 3 experiments taking one from each group. Initiative should be taken so that most of the Experiments are covered in a college in the distribution mentioned above. Emphasis should be given on the estimation of error in the data taken.

b) In addition a student should perform one more experiments where he/she will have to transduce the output of any of the above experiments or the experiment mentioned in c] into electrical voltage and collect the data in a computer using phoenix or similar interface.

c) Innovative experiment: One more experiment designed by the student or the concerned teacher or both.

Note:

i. **Failure to perform each experiment mentioned in b] and c] should be compensated by *two* experiments mentioned in the above list.**

ii. **At the end of the semester report should sent to the board of studies regarding experiments, actually performed by the college, mentioned in b] and c]**
iii. **Experiment in b] and c] can be coupled and parts of a single experiment.**

Recommended Text Books and Reference Books:
For Both Physics I and II

1. B. Dutta Roy (Basic Physics)
2. R.K. Kar (Engineering Physics)
3. Mani and Meheta (Modern Physics)
4.. Arthur Baiser (Perspective & Concept of Modern Physics)

Physics I (PH101/201)

Vibration and Waves
6. Kingsler and Frey
7. D.P. Roychaudhury
8. N.K. Bajaj (Waves and Oscillations)
9. K. Bhattacharya
10. R.P. Singh (Physics of Oscillations and Waves)
11. A.B. Gupta (College Physics Vol.II)
12. Chattopadhya and Rakshit (Vibration, Waves and Acoustics)

Optics
3. Möler (Physical Optics)
4. A.K. Ghatak
5. E. Hecht (Optics)
6. E. Hecht (Schaum Series)
7. F.A. Jenkins and H.E. White
8. 6. Chita Ranjan Dasgupta (Degree Physics Vol 3)

Quantum Physics
4. Eisberg and Resnick
5. A.K. Ghatak and S. Lokenathan
6. S.N. Ghoshal (Introductory Quantum Mechanics)
7. E.E. Anderson (Modern Physics)
8. Haliday, Resnick and Crane (Physics vol.III)
9. Binayak Dutta Roy [Elements of Quantum Mechanics]

Crystallography
1. S.O. Pillai (a. Solid state physics b. Problem in Solid state physics)
2. A.J. Dekker
3. Aschroft and Mermin
4. Ali Omar
5. R.L. Singhal
6. Jak Tareen and Trn Kutty (Basic course in Crystallography

Laser and Holography
2. A.K. Ghatak and Thyagarajan (Laser)
3. Tarasov (Laser)
4. P.K. Chakraborty (Optics)
5. B. Ghosh and K.G. Majumder (Optics)
6. B.B. Laud (Laser and Non-linear Optics)
7. Bhattacharyya [Engineering Physics] Oxford

Physics II(PH 301)

Classical Mechanics (For Module 5.1 in PH 301)
H. Goldstein
A.K. Roychaudhuri
R.G. Takwal and P.S. Puranik
Rana and Joag
M. Speigel (Schaum Series)
J.C. Upadhya (Mechanics)

Electricity and Magnetism
9. Reitz, Milford and Christy
10. David J. Griffith
11. D. Chattopadhyay and P.C. Rakshit
12. Shadowitz (The Electromagnetic Field)

Quantum Mechanics
10. Eisberg and Resnick
11. A.K. Ghatak and S. Lokenathan
12. S.N. Ghoshal (Introductory Quantum Mechanics)
13. E.E. Anderson (Modern Physics)
14. Haliday, Resnick and Crane (Physics vol.III)
15. Binayak Dutta Roy [Elements of Quantum Mechanics]

Statistical Mechanics
1. Sears and Sallinger (Kinetic Theory, Thermodynamics and Statistical Thermodynamics)
2. Mondal (Statistical Physics)
3. S.N. Ghoshal (Atomic and Nuclear Physics)
4. Singh and Singh
5. B.B. Laud (Statistical Mechanics)
6. F. Reif (Statistical Mechanics)

Dilectrics
8. Bhattacharyya [Engineering Physics] Oxford

Electromagnetic Wave and Transmission Lines
Code: EC491
Contacts: 3P
Credits: 2

[At least THREE experiments from Module I and FOUR experiments from Module II]

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.
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.

Syllabus for B.Tech(Electronics & Communication Engineering) Second Year & 3rd Year (Proposed)

Revised Syllabus of B.Tech ECE (for the students who were admitted in Academic Session 2010-2011)

ECE Proposed 3rd Year Syllabus

Third Year - Fifth Semester

A. THEORY							
Sl.No	**Field**	**Theory**	**Contact Hours/Week**				**Cr. Pts**
			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	**EI(ECE)502**	Microprocessors & Microcontrollers	3	**1**	0	4	4
4	**EC503**	Control System	3	0	0	3	3
5	**Free Elective-** **EC504A** **EC504B**	Computer Architecture Data structure & C	3	1	0	4	4
Total of Theory						**18**	**18**
B. PRACTICAL							
6	**EC -591**	Analog Communication*	0	0	3	3	2
7	**EI(ECE)592**	Microprocessors & Microcontrollers*	0	0	3	3	2
8	**EC593**	Control System*	0	0	3	3	2
9	**Free Elective-** **EC594A** **EC594B**	Computer Architecture Data structure & C	0	0	3	3	2
Total of Practical						**12**	**8**
Total of Semester						**30**	**26**

Laboratories to have both physical experiments and simulation. Only virtual laboratory is not accepted

Third Year - Sixth Semester

A. THEORY							
Sl.No.	**Field**	**Theory**	**Contact Hours/Week**				**Cr. Pts**
			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	**EC604A** **EC604B** (No Lab)	Antenna Theory & Propagation Information Theory & Coding	3	0	0	3	3
6	**F. E.** EC605A EC605B EC605C	OOPS & JAVA (CSE/IT) Principles of Programming Language (CSE) Electronic Measurement & Instrumentation(EI)	3	0	0	3	3
Total of Theory						**17**	**17**
B. PRACTICAL							
8	EC691	Digital Communications	0	0	3	3	2
9	EC 692	Digital Signal Processing	0	0	3	3	2
10	**F.E.** EC695A EC695B EC695C	OOPS & JAVA (IT) Programming Language (CSE) Electronic Measurement & Instrumentation	0	0	3	3	2
11		Seminar	0	0	3	3	2
Total of Practical						**12**	**8**
Total of Semester						**29**	**25**

SEMESTER - V
Theory

Economics for Engineers
HU-501
Contracts: 3L
Credits- 3

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.
3. Cash Flow, Interest and Equivalence: Cash Flow – Diagrams, Categories & Computation, Time Value Of Money, Debt repayment, Nominal & Effective Interest.
4. 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.
5. 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.
6: 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.
7. 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.
8. Replacement Analysis - Replacement Analysis Decision Map, Minimum Cost Life Of A New Asset, Marginal Cost, Minimum Cost Life Problems.
9. 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.
10. Accounting – Function, Balance Sheet, Income Statement, Financial Ratios Capital Transactions, Cost Accounting, Direct and Indirect Costs, Indirect Cost Allocation.

Readings

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

Analog Communication
Code: EC501
Contact: 3L + 1T
Credits: 4

Sr No	Topic	Hrs
1.	**Introduction:** Elements of Communication System-Transmitters, transmission channels and receivers**;**Concepts of modulation.	2
2.	**Continuous Wave Linear Modulation:** *Amplitude modulation (AM)*:- Time domainexpression of baseband signal; modulation index, frequency domain (spectral) representations,phasor diagram, AM transmission bandwidth; AM for a single tone message- carrier and side band components; Transmission requirements for AM, normalized power and side band power. *Double side band suppressed carrier modulation(DSBSC/DSB)* - time and frequency domain expressions; Transmission requirements for DSB, bandwidth and transmission power for DSB; Generationof DSB, square law modulators, balanced modulators, ring modulators, switching modulators. *Single side band modulation (SSB)*:-Basic concept, SSB with suppressed/reduced carrier, advantages and generation of SSB; transmit band width and power, side band filter examples. *Vestigial side band modulation (VSB)*- Basic concept and application	8
3.	**Demodulation of Linear Modulated Signals:** *Demodulation of AM signals*- square law and envelope detectors; The super heterodyne receiver for standard AM radio; Synchronous demodulation of AM,DSB and SSB using synchronous detection, Effects of frequency and phase	6

	errors in the local oscillator in DSB and SSB Demodulation of SSB with pilot carrier, use of SSB in telephony. *Phase-Locked Loop(PLL):-* Carrier recovery circuits, Basic operation of PLL , mathematical analysis, applications.	
4.	**Angle Modulation (FM/PM):** Instantaneous frequency instantaneous phase, time domain representation for FM and PM, Narrow band angle modulation with frequency and phase, modulation index, Phasor diagram. FM and PM signals for a single tone message, spectral representation, power and effective bandwidth. Generation of wide band FM using Armstrong method, commercial FM requirements. Detection of FM and PM signals, limiter discriminator.' Demodulation of PM using PLL. FM broadcasting and stereo FM radio.	8
5.	**Random Signals and Noise:** Random Process- Stationary Process, Auto-correlation and power spectral density function (PSDP), Representation of band limited and band pass processes. Noise sources, White noise, thermal noise, shot noise, PSDF of white signals. Input and output relationship for random signals and noise passed through a linear invariant system, band limited noise, ARC filtering of white noise. The noise bandwidth of a linear time invariant system and its use in communication. Narrow band noise representation, generation of narrow band noise and PSDF time domain expression for narrow band noise.	6
6.	**Noise Performance of Analog Communication Systems:** Signal-to-noise ratio (SNR) in linear modulation, synchronous detection of DSB. SNR for AM -DSB and SSB, comparison of DSB, SSB and AM Effect of noise in envelope and square law detection of AM, threshold effects in nonlinear detectors. SNR for FM, SNR improvement using pre-emphasis and de-emphasis. FM threshold effects, noise clicks in FM system. Comparison of linear and exponential modulation system for additive white band-limited noise channels.	6

Total 36 Hours

Text Books:

1. P Ramakrishna Rao , "Analog Communication",., Mc-Graw Hill
2. B.P.Lathi -Communication Systems- BS Publications
2. V Chandra Sekar – Analog Communication- Oxford University Press

References:

13. A.B.Carlson—Communication System,4/e ,Mc-Graw Hill
14. Taub and Schilling , "Principles of Communication Systems", 2nd ed., Mc-Graw Hill
15. Proakis & Salehi Fundamentals of Communication Systems- Pearson
16. Singh & Sapre—Communication Systems: 2/e, TMH
17. P K Ghosh- Principles of Electrical Communications- University Press
18. Blake, Electronic Communication Systems- Cengage Learning
19. S Sharma, Analog Communication Systems- Katson Books

Microprocessors & Microcontrollers
Code: EC502
Contact: 3L + 1T
Credits: 4

Introduction to Microcomputer based system. History of evolution of Microprocessor and Microcontrollers and their advantages and disadvantages. 1L

Architecture of 8085 Microprocessor. Address/data bus demultiplexeing, status Signals and the control signal generation. Instruction set of 8085 microprocessor, Classification of instruction, addressing modes, timing diagram of the instructions (a few examples). 7L

Assembly language programming with examples, Interrupts of 8085 processor, programming using interrupts. 5L

Serial and parallel data transfer – programmed I/O, interrupts driven I/O, DMA, asynchronous and synchronous serial transmission using SID and SOD pins of 8085 processor. 2L

Introduction to MCS-51 microcontroller –Architecture, pin details, memory organization, Hardwar features of MCS-51, external memory interfacing, timers, interrupts, power management, serial port, addressing modes, assembly language programming. 5L

THE 8086 microprocessor- Architecture, pin details, addressing modes, instruction set, Assembly language programming interrupts. 3L

Support IC chips- 8255, 8253, 8259, 8279 and 8251 and their interfacing with 8085, 8086 and microcontroller 8051. 8L

Keyboard and Multiplexed display, LCD interfacing, with 8085, 8086, and 8051. 3L

Memory interfacing with 8085, 8086, and 8051- ADC and DAC interfacing with the processor 8085, 8086 and 8051. 2L

Brief introduction to PIC microcontroller (16F877) 1L

TEXTS :

1. Microprocessors and microcontrollers - N. Senthil Kumar, M. Saravanan and Jeevananthan (Oxford university press)
2. 8051 Microcontroller – K. Ayala (Cengage learning)
3. MICROPROCESSOR architecture, programming and Application with 8085 - R.Gaonkar (Penram international Publishing LTD.)
4. 8051 Microprocessor –V. Udayashankara and M.S Mallikarjunaswami (TMH).
5. Microprocessor 8085 and its Interfacing—S Mathur (PHI)
6. An Introduction to Microprocessor and Applications –Krishna Kant (Macmillan)

Reference:
1. 8086 Microprocessor –K Ayala (Cengage learning)
2. The 8085 Microprocessor, Architecture, Programming and Interfacing- K Uday Kumar, B .S Umashankar (Pearson)
3. The X-86 PC Assembly language, Design and Interfacing - Mazidi, Mazidi and Causey (PEARSON)
4. The 8051 microcontroller and Embedded systems - Mazidi, Mazidi and McKinley (PEARSON)
5. Microprocessors – The 8086/8088, 80186/80386/80486 and the Pentium family – N. B. Bahadure (PHI).
6. The 8051 microcontrollers – Uma Rao and Andhe Pallavi (PEARSON).

Control System
Code: EC503
Contact: 3L
Credits: 3

1] Introduction to Control Systems

Introduction to automatic control, open loop and closed loop control system, mathematical modeling of a system with typical examples. Block diagram representation. [1L]

2] Transfer Function Representation

Transfer function for single input single output system, characteristic equation, poles and zeroes, effect of parameter variations, effect of feedback on sensitivity gain and stability. Laplace transform effect of steps, ramp and impulse response on first order, second order and higher order systems in terms of steady state error and time constant, signal flow graph from transfer function and differential equations, block diagram from signal-flow graph Mason's gain formula. [5L]

3] State Space Analysis

Advantages of state space techniques, state space representation for electrical network, with order differential equation, transfer function solution of time-invariant state equation, Laplace transform method, properties of state transition matrices, solution of non-homogeneous state equations, transfer matrix Eigen values and vectors, multiple input multiple of system, controllability and observability, Kalman's test, state space representation in canonical form – controllable, observable and diagonal commercial form, decomposition transfer function – direct, cascade & parallel decomposition, effect of pole-zero cancellation. [6L]

4] Stability Analysis

Concept of stability effect of location of poles on stability, conditions of stability, Routh Hurwitz criteria, Relative stability analysis, Root locus, rules for construction of root lock mapping of closed contour and principle of agreement, Nyquist contour, Nyquist plot, polar plot, Lyapanov's stability analysis. [6L]

5] Frequency domain Analysis

Bode plot, Minimum and non-minimum phase systems, phase margin and gain margin, Relative and absolute stability, constant magnitude and phase circles (M & N circles) gain adjustment by M-circles. [4L]

6] Compensation Techniques

Types of compensation, design of compensation using Bode's plot – phase lead & lag network, analysis using root locus. [3L]

7] Non-linear system analysis

Common types of non-linearities – saturation, dead zone, friction, relays backlash, function description of the non-linear systems, stability analysis, phase-plane technique-phase trajectory of a second order system using method of isoclines, asymptotic stability [4L]

8] Controllers

.Response of first order and second order systems with proportional control, derivative control, integral control, P&D control, P&I control, PID control, practical method.

.Introduction to Digital Control system .PLC & Application Case Studies: Speed control of DC Motors, Temp control Introduction to Fuzzy logic applications in control engineering. [11L]

Text Books:

1.Control systems engineering – Nagrath & Gopal, New Age International Ltd.
2.Modern control Engineering, 4/e – Ogata, PHI/Pearson
3. Control System , Madan Gopal, MH

Reference Books:

1. Automatic Control System, Kuo, PHI
2. Control Systems (TMH WBUT Series), Purkait, Satpati, Mondal & Mallik,TMH
3.Digital control & state variables, M.Gopal
4.Control Engineering, Theory & Practice, M.N. Bandyopadhyay, PHI
5. Digital control systems – Kuo, Oxford
6. Systems and Control – Stanislawhizak, Oxford
7. Automatic control systems – S. Hasan Saeed, S.K. Kataria & Sons
8. Neural networks and fuzzy systems – Bart Kosko, Prentice Hall/Pearson.
9. Fuzzy Logic Applications in Engineering Science – J. Harries Springer.
10.Introduction to Linear & Digital Control System,-A.K Ghosh, PHI
11.Control System-Theory & Application- S. Ghosh- Pearson.

Free Electives

Computer Architecture
Code: EC504A
Contact: 3L + 1T
Credits: 4

Pre-requisite: Basic Electronics in First year, Introduction to Computing in second semester, Analog & Digital Electronics and Computer Organisation in Third semester.

Module – 1: [12 L]
Introduction: Review of basic computer architecture (Revisited), Quantitative techniques in computer design, measuring and reporting performance. (3L)
Pipelining: Basic concepts, instruction and arithmetic pipeline, data hazards, control hazards and structural hazards, techniques for handling hazards. Exception handling. Pipeline optimization techniques; Compiler techniques for improving performance. (9L)

Module – 2: [8L]
Hierarchical memory technology: Inclusion, Coherence and locality properties; Cache memory organizations, Techniques for reducing cache misses; Virtual memory organization, mapping and management techniques, memory replacement policies. (8L)

Module – 3: [6L]
Instruction-level parallelism: basic concepts, techniques for increasing ILP, superscalar, superpipelined and VLIW processor architectures. Array and vector processors. (6L)

Module – 4: [12 L]
Multiprocessor architecture: taxonomy of parallel architectures; Centralized shared- memory architecture: synchronization, memory consistency, interconnection networks. Distributed shared-memory architecture. Cluster computers. (8L)

Non von Neumann architectures: data flow computers, reduction computer architectures, systolic architectures. (4L)

Learning Outcome:
This course is a formidable prerequisite for the course Operating System to be offered in the subsequent semester.

Text books:
[To be detailed]

Data Structure & C
Code: EC504B
Contact: 3L + 1T
Credits: 4

Pre-requisites: *CS 201 (Basic Computation and Principles of C), M101 & M201 (Mathematics), basics of set theory*

Module -I. [8L] Linear Data Structure
Introduction (2L):
Why we need data structure?
Concepts of data structures: a) Data and data structure b) Abstract Data Type and Data Type.
Algorithms and programs, basic idea of pseudo-code.
Algorithm efficiency and analysis, time and space analysis of algorithms – order notations.
Array (2L):
Different representations – row major, column major.
Sparse matrix - its implementation and usage. Array representation of polynomials.
Linked List (4L):
Singly linked list, circular linked list, doubly linked list, linked list representation of polynomial and applications.

Module -II: [7L] Linear Data Structure
[Stack and Queue (5L):
Stack and its implementations (using array, using linked list), applications.
Queue, circular queue, dequeue. Implementation of queue- both linear and circular (using array, using linked list), applications.
Recursion (2L):
Principles of recursion – use of stack, differences between recursion and iteration, tail recursion.
Applications - The Tower of Hanoi, Eight Queens Puzzle.

Module -III. [15L] Nonlinear Data structures
Trees (9L):
Basic terminologies, forest, tree representation (using array, using linked list).
Binary trees - binary tree traversal (pre-, in-, post- order), threaded binary tree (left, right, full) - non-recursive traversal

algorithms using threaded binary tree, expression tree.
Binary search tree- operations (creation, insertion, deletion, searching).
Height balanced binary tree – AVL tree (insertion, deletion with examples only).
B- Trees – operations (insertion, deletion with examples only).
Graphs (6L):
Graph definitions and concepts (directed/undirected graph, weighted/un-weighted edges, sub-graph, degree, cut-vertex/articulation point, pendant node, clique, complete graph, connected components – strongly connected component, weakly connected component, path, shortest path, isomorphism).
Graph representations/storage implementations – adjacency matrix, adjacency list, adjacency multi-list.
Graph traversal and connectivity – Depth-first search (DFS), Breadth-first search (BFS) – concepts of edges used in DFS and BFS (tree-edge, back-edge, cross-edge, forward-edge), applications.
Minimal spanning tree – Prim's algorithm (basic idea of greedy methods).

Module - IV. Searching, Sorting (10L):
Sorting Algorithms (5L): Bubble sort and its optimizations, insertion sort, shell sort, selection sort, merge sort, quick sort, heap sort (concept of max heap, application – priority queue), radix sort.
Searching (2L): Sequential search, binary search, interpolation search.
Hashing (3L): Hashing functions, collision resolution techniques.

Recommended books:

13. "Data Structures And Program Design In C", 2/E by Robert L. Kruse, Bruce P. Leung.
14. "Fundamentals of Data Structures of C" by Ellis Horowitz, Sartaj Sahni, Susan Anderson-freed.
15. "Data Structures in C" by Aaron M. Tenenbaum.
16. **"**Data Structures" by S. Lipschutz.
17. "Data Structures Using C" by Reema Thareja.
18. "Data Structure Using C", 2/e by A.K. Rath, A. K. Jagadev.
19. **"**Introduction to Algorithms" by Thomas H. Cormen, Charles E. Leiserson, Ronald L. Rivest, Clifford Stein.

Learning outcome:

Ideally this course should act as a primer/pre-requisite for CS 503 (Design and Analysis of Algorithms). On completion of this course, students are expected to be capable of understanding the data structures, their advantages and drawbacks, **how to implement them in C**, how their drawbacks can be overcome and **what the applications are** and **where they can be used**. Students should be able to learn about the data structures/ methods/algorithms mentioned in the course with a comparative perspective so as to make use of the most appropriate data structure/ method/algorithm in a program to enhance the efficiency (i.e. reduce the run-time) or for better memory utilization, based on the priority of the implementation. Detailed time analysis of the graph algorithms and sorting methods are expected to be covered in CS 503 but it is expected that the students will be able to understand at least the efficiency aspects of the graph and sorting algorithms covered in this course. The students should be able to convert an inefficient program into an efficient one using the knowledge gathered from this course.

Practical

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

(Will be uploaded shortly)

Microprocessors & Microcontrollers Lab
Code: EI(ECE)592
Contact: 3P
Credits: 2

Sl. No.	Name of the Experiments	No.of hours
c)	Study of prewritten programs on trainer kit using the basic instruction set (data transfer, Load/Store, Arithmetic, Logical) Assignments based on above.	3
d)	a) Familiarization with 8085 & 8051simulator on PC. Study of prewritten programs using basic instruction set (data transfer, Load/Store, Arithmetic, Logical) on the simulator. Assignments based on above	3
e)	**Programming using kit and simulator for:** i) Table look up ii) Copying a block of memory	6

	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	
f)	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.	**3**
g)	**:Study of timing diagram of an instruction on oscilloscope..**	**3**
h)	Interfacing of 8255**: Keyboard and Multi-digit Display with multiplexing using 8255**	**6**
i)	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.	**3**
j)	Serial communication between two trainer kits	**3**

Total 30 hours (10 classes each of 3 periods)

Control System Lab
Code: EC593
Contact: 3P
Credits: 2

Sl.No.	Name of the Experiment	Periods
4	Familiarization with MATLAB Control System tool Box, MATLAB-SIMULINK tool box & pSPICE.	3
5	Determination of step response for 1st order & 2nd order system with amity feedback on CRO & calculation of control system specifications for variations of system design.	3
6	Simulation of step response & impulse response for Type-I & Type-II system with unity feedback using MATLAB & pSPICE.	3
7	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
8	Determination of PI, PD, and PID controller action on 1st order simulated process.	3
9	Determination of approximate transfer function experimentally using Bode Plot.	3
1(	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
1	Study of position control system using servomotor.	3
1	Design and hardware implementation of a temperature controller using microprocessor/microcontroller.	6

Total 33 hours (11 classes each of 3 periods)

Computer Architecture Lab
Code: EC594A
Contact: 3P
Credits: 2

All laboratory assignments are based on Hardware Description Language (VHDL or Verilog) Simulation.
[Pre-requisite: The hardware based design has been done in the Analog & Digital Electronics laboratory and Computer Organisation laboratory]
HDL introduction
Basic digital logic base programming with HDL
8-bit Addition, Multiplication, Division
8-bit Register design
Memory unit design and perform memory operatons.
8-bit simple ALU design

8-bit simple CPU design
Interfacing of CPU and Memory

Data Structure & C Lab
Code: EC594B
Contact: 3P
Credits: 2
Experiments should include but not limited to :

Implementation of array operations:

Stacks and Queues: adding, deleting elements Circular Queue: Adding & deleting elements Merging Problem :

Evaluation of expressions operations on Multiple stacks & queues :

Implementation of linked lists: inserting, deleting, inverting a linked list. Implementation of stacks & queues

using linked lists:

Polynomial addition, Polynomial multiplication

Sparse Matrices : Multiplication, addition.

Recursive and Nonrecursive traversal of Trees

Threaded binary tree traversal. AVL tree implementation

Application of Trees. Application of sorting and searching algorithms

Hash tables implementation: searching, inserting and deleting, searching & sorting techniques.

(Detailed instructions for Laboratory Manual to follow for further guidance. The details will be uploaded in the website from time to time)

SEMESTER - VI
Theory

Principles of Management
HU-601
Contracts: 2L
Credits- 2

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.
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
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.
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.

Readings:

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, distinguishibility 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:

9. Digital Communications, S. Haykin, Wiley India.
10. Principles of Communication Systems, H. Taub and D.L.Schilling, TMH Publishing Co.
11. Wireless Communication and Networks : 3G and Beyond, I. Saha Misra, TMH Education.
12. Digital Communications, J.G.Proakis, TMH Publishing Co.

13. REFERENCE BOOKS:

16. Digital Communications Fundamentals and Applications, B. Sklar and P.K.Ray, Pearson.
17. Modern Digital and Analog Communication Systems, B.P.Lathi and Z.Ding, Oxford University Press.
18. 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, Perseval'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:
4. Digital Signal Processing – Principles, Algorithms and Applications, J.G.Proakis & D.G.Manolakis, Pearson Ed.
5. Digital Signal processing – A Computer Based Approach, S.K.Mitra, TMH Publishing Co.
6. Digital Signal Processing Signals, Systems and Filters, A. Antoniou, TMH Publishing Co.
7. VLSI Digital Signal Processing Systems Design and Implementation, Wiley International Publication.
8. Digital Signal Processing with Field Programmable Gate Arrays, U.Meyer-Baese, Springer.

REFERENCE BOOKS:
1. Digital Signal Processing, P. Rameshbabu, Scitech Publications (India).
2. Digital Signal Processing, S.Salivahanan, A.Vallabraj & C. Gnanapriya, TMH Publishing Co.
3. Digital Signal Processing; A Hands on Approach, C. Schuler & M.Chugani, TMH Publishing Co.
4. Digital Signal Processing, A. Nagoor Kani, TMH Education
5. Digital Signal Processing S. Poornachandra & B. Sasikala, MH Education
6. Digital Signal Processing; Spectral Computation and Filter Design Chi-Tsong Chen, Oxford University Press
7. Texas Instruments DSP Processor user manuals and application notes.
8. Xilinx FPGA user manuals and application notes.
9. Digital Signal Processing: A MATLAB-Based Approach, V.K.Ingle and J.G.Proakis, Cengage Learning

10. Modern Digital Signal Processing,V. Udayashankara, PHI Learning

Telecommunication System
EC-603
Contracts: 3L
Credits- 3

Module No.	Topic	Periods/Classes
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
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
3.	**Subscriber Loop Systems**: BORSCHT Functions; Switching hierarchy & routing, signaling techniques-in channel & common channel signaling, SS7.	4
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
5.	**Stored Program Control**: Software architecture, Application software;. Electronic Exchanges, Introduction to cordless telephones and Digital PABX	4
6.	**Traffic Engineering**: Blocking network, blocking probability, grade of service, traffic load, Erlang-B and C-congestion formulas-case studies	4
7.	**Modems and Their Standards**: RS 232C; DTE and DCE, Facsimile Transmission, Broad band transmission-ISDN, DSL and ADSL, ISDN and B-ISDN	4
8.	**IP Telephony**: Voice over IP, Session initiation protocol, H.323 signaling, IP multimedia service	4

TOTAL LECTURE HOURS: 35

Text Books:

1. T. Viswanathan, " Telecommunications Switching Systems & Networks", PHI
2. 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

Professional Elective

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 λ/2 dipole; discussion on λ/4 monopole antenna; Current distribution and Radiation patterns of center-fed dipoles of length λ, 3λ/2 and 2 λ. 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)

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

Reference Book

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

Information Theory & Coding
EC-604B
Contracts: 3L
Credits- 3

(Will be uploaded shortly)

Free Elective

OOPS & Java
Code: EC605A
Contact: 3L
Credits: 3

Prerequisites of Object Oriented Programming & UML:

The fundamental point in learning programming is to develop the critical skills of formulating programmatic solutions for real problems. It will be based on basic knowledge of algorithms and procedural programming language. Once the basic skill of writing programs using loop, methods and arrays will be clear then the student can develop object oriented software using class encapsulation and inheritance.

Module-1: [10L]
Introduction:
Why object orientation, History and development of object oriented programming language, concepts of object oriented programming language. [1L] Difference between OOP and other conventional programming – advantages and disadvantages. [1L] Data types, variables. Array, operators. [1L] String, I/O. [1L] Control statements. [1L]
Object oriented design:
Major and minor elements, class fundamentals. [1L]; Declaring objects, instantiation of class, introducing methods. [1L]; Constructing objects using constructor. [1L]; Static variable, constants. [1L]; Visibility modifiers. [1L]

Learning outcome of Introduction of OOP:

Students will be able to implement basic data structure and control statements in object oriented programming. They can write programs around its data i.e, objects and a set of well-defined interfaces to that data. Student will be able to design class with its basic features.

Module-2: [8L]
Object Properties: Introduction to basic features of a class (encapsulation, polymorphism etc) [1L]; Data field encapsulation. [1L]; Passing objects to methods. [1L]; Array of objects, 'This' keyword [1L]; Relationships among objects: aggregation, composition, dependency, links. [1L]; Relationship among classes: association, aggregation. [1L]
Meta class, meta object. [1L]; Grouping constructs. [1L]

Learning outcome of Object oriented design:

Student will be able to design object oriented programs with the concept of object, class, abstraction, encapsulation, inheritance etc. to provide flexibility, modularity and re-usability in programming. They can also be able to design Meta classes and grouping construct.

Module-3: [11L]
Basic concepts of object oriented programming using Java:
Using objects as parameters, closure look at argument passing, returning objects. [1L]; Introducing access control, Final keyword, garbage collection, Nested and inner classes. [1L]; Class abstraction and encapsulation, Overloading of methods (overloading of constructor). [1L]; Super class, subclasses, super keyword, inheritance, types, member access.[1L]; Multilevel hierarchy, process of constructor calling in inheritance. [1L]; Overriding methods, overriding vs. overloading, polymorphism. [1L]; Abstract class, interface & comparison between abstract class and interface [1L]; Packages, importing packages. [1L]; Exception handling basics, types, using try &catch, throw, throws & finally. [1L];
Threading, synchronization & priorities, thread class, creating thread. [1L]; Basic applet programming. Life cycle. [1L];

Learning outcome of OOP using Java:

Students can write programs using Java to implement OOP i.e, encapsulation, polymorphism, aggregation etc., by which they will be able to compare the difference between OOP and other conventional programming languages. They will write programs by using the built-in support for multithreaded programming in java. They will also implement the GUI based event-driven application using Java applets.

Module-4: [8L]
Fundamentals of Object Oriented design in UML:
Introduction to UML: Why Modeling, Overview of UML, Conceptual Model, Architecture of UML [1L]; UML Modeling Types: Structural Modeling, Behavioral Modeling, Architectural Modeling [1L]; Basic Notations in UML [1L]; Class Diagram [1L]; Interaction and Collaboration Diagrams. [1L]; Sequence Diagram. [1L]; State chart Diagram and Activity Diagram. [1L]; Implementation Diagram and UML extensibility- model constraints.[1L]

Learning outcome of Object oriented design in UML:
Student will be able to design software through UML diagrams and identify the components of object oriented design and develop the relationship among them. They can also able to use UML to design software like Payroll Management System, Library Management System etc.

Textbooks/References:

11. Rambaugh, James Michael, Blaha-"Object Oriented Modelling and Design"-Prentice Hall, India
12. Ali Bahrami,-"Object Oriented System Development"-Mc Graw Hill
13. Patrick Naughton, Herbert Schildt-"The complete reference-Java2"-TMH
14. Sourav Sahay-"Object-Oriented Programming with C++"-Oxford
15. Jason T. Roff, UML: A Beginner's Guide, TMH
16. Grady Booch, Ivar Jacobson, James Rumbaugh, , "The Unified Modeling Language Reference Manual", Pearson Ed.
17. Blaha, Rumbaugh, "Object-Oriented Modeling and Design with UML", Pearson Ed.

Principles of Programming Language
Code: EC605B
Contact: 3L
Credits: 3

Concepts of structural program development; concept of data types; precedence and associatively of operators; conditional

transfer; deterministic and in-deterministic loops; recursions; functions and procedures - call by value, call by reference and their differences; programming for numerical methods; records.

Data-type handling and various constructs (conditional, loop, functions etc); pointers: concept of pointers and passing parameters using pointers, non-numeric processing, concept of arrays of pointers and pointers to pointers; structures and unions – advantage of using structures, concept of information hiding, pointers to structures; files - basic concept of various types of file access methods: sequential, indexed sequential, random, various statements for file handling

Advanced Programming Languages like C++, ADA, LISP, PROLOG, and PASCAL. Comparison of various languages

Text books:

1. Tennence W.Pratt, "Programming languages design and implementation", Prentice Hall of India.
2. Allen B. Tucker, "Programming Languages", Tata McGraw Hill.
3. Gottfried BS – Programming with C, TMH pub.
4. Balagurusamy:ANSI C TMH
5. Kanetkar, Yashvant – Understanding Pointers in C- 2nd Edn. BPB
5. Kanetkar, Yashvant - Let us C. - 3rd revised Edn. BPB
6. Roosta- Foundation of Programming Languages,Vikas
7. Jeyapoovan- A First Course in Prog with C, Vikas
8. Programming In C++, Y.I. Shah and M.H. Thaker, ISTE/EXCEL BOOKS
9. Fundamentals of Programming Languages, R. Bangia,Cyber Tech

ELECTRONIC MEASUREMENT AND INSTRUMENTATION
Code: EC605C
Contact: 3L
Credits: 3

Module	Topic	Hrs
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.	6
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	**7**
Module III	**Signal Generator and Analysis** Function Generators- RF Signal Generators- Sweep Generators – Frequency Synthesizer-Wave Analyzer-Harmonic Distortion Analyzer – Spectrum Analyzer	**7**
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.	7
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.	**7**
	Total Lecture Hours	**34**

Books:

13. Modern Electronic Instrumentation & Measurement Techniques – Albert D. Helfrick & William D. Copper, Prentice Hall of India, 2003
14. Elements of Electornics Instrumentation & Measurement, Pearson Education 2003
15. Measurement System- Application & Design – Ernest O.Doeblin, Tata McGraw Hill 2004
16. OOPS & JAVA – CSE Syllabus
17. Principles of Programming Landuage – CSE Syllabus

Practical

Digital Communication Lab
Code: EC691
Contact: 3P
Credits: 2

7. Design, implementation and study of all the properties of 7-length and 15-length pn sequences using shift register.

8. Study of PAM and demodulation.
9. Study of PCM and demodulation.
10. Study of line coders: polar/unipolar/bipolar NRZ ,RZ and Manchester.
11. Study of delta modulator and demodulator.
12. Study of adaptive delta modulator and demodulator.
13. Study of BPSK modulator and demodulator.
14. Study of BFSK modulator and demodulator.
15. Study of ASK modulator and demodulator.
16. Study of QPSK modulator and demodulator.
17. Simulation study of probability of symbol error for BPSK modulation.
18. 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:

b) Sampled sinusoidal signal, various sequences and different arithmetic operations.
c) Convolution of two sequences using graphical methods and using commands- verification of the properties of convolution.
d) Z-transform of various sequences – verification of the properties of Z-transform.
e) Twiddle factors – verification of the properties.
f) DFTs / IDFTs using matrix multiplication and also using commands.
g) Circular convolution of two sequences using graphical methods and using commands, differentiation between linear and circular convolutions.
h) Verifications of the different algorithms associated with filtering of long data sequences and Overlap –add and Overlap-save methods.
i) Butterworth filter design with different set of parameters.
j) FIR filter design using rectangular, Hamming and Blackman windows.

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

7. Writing & execution of small programs related to arithmetic operations and convolution using Assembly Language of TMS320C 5416/6713 Processor, study of MAC instruction.

8. Writing of small programs in VHDL and downloading onto Xilinx FPGA.
9. Mapping of some DSP algorithms onto FPGA.

OOPS & JAVA Lab
Code: EC695A
Contact: 3P
Credits: 2

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

Note: Use Java for programming.

Programming Language
Code: EC695B
Contact: 3P
Credits: 2
Concepts of flow charts and decision tables, Examples and practice problems

Introduction to Digital Computers and its components, Introduction to DOS and UNIX Operating System

Development of Computer Program using C language- Roots of quadratic and Cubic equations; Summation of N Natural numbers; Arranging numbers in ascending and descending orders; Separation of odd and even numbers, problems on recursion, Arrays, Pointers, and File handling, etc.

ELECTRONIC MEASUREMENT AND INSTRUMENTATION
Code: EC695C
Contact: 3P
Credits: 2

(Will be uploaded shortly)

Proposed

Fourth Year - Seventh Semester

		A. THEORY		
Sl	**Field**	**Theory**	**Contact Hours/Week**	**Cr. Pts**

No.			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 Engg. B. Optical Communication & N/W C. Computer Networks D. FPGA & Reconfigurable Computing E. Power Electronics	3	0	0	3	3
4	**EC704** (No Lab)	A. Radar Engg B. Embedded Systems C. Cellular & Mobile Communication D. Biomedical Instrumentation	3	0	0	3	3
5	**F. E.**	18. Artificial Intelligence 19. Robotics 20. Data Base Management System 21. Mobile Computing	3	0	0	3	3
		Total of Theory				**15**	**15**
		B. PRACTICAL					
6	**HU**	Group Discussion	0	0	0	3	2
7	**EC792**	VLSI Design	0	0	3	3	2
8	**EC793**	A. RF & Microwave Engg. B. Optical Communication & N/W C. Computer Networks D. FPGA & Reconfigurable Computing E. Power Electronics	0	0	3	3	2
9	**F.E791**	(8) Artificial Intelligence (9) Robotics (10) Data Base Management System (11) Mobile Computing	0	0	3	3	2
10		**Industrial training**	**4 wks during 6th -7 th Sem-break**				2
11		**Project part 1**				3	2
		Total of Practical				**15**	**12**
		Total of Semester				**30**	**27**

EC701: WIRELESS COMMUNICATION AND NETWORKS

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 (CT2), 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-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, Super-frames 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-real-time 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:

k) Wireless Networks: Applications and Protocols, T. S. Rappaport, Pearson Education
l) Wireless Communication and Networks : 3G and Beyond, I. Saha Misra, TMH Education.
m) Wireless Communications: Principles and Practice, T.S.Rappaport, PHI Learning.
n) Wireless Communications, Goldsmith, Cambridge University Press.

REFERENCE BOOKS:

d) Lee's Essentials of Wireless Communications, MH Prof. Med/Tech
e) Wireless Digital Communications: Modulations and Spread Spectrum Applications,
f) K. Feher, Prentice Hall.
g) Wireless Communications and Networking, J.W.Mark and W. Zhuang, PHI.

Wireless Communication Technology R. Blake, Cengage Learning

Microelectronics & VLSI Designs – to be updated later

RF & Microwave Engineering

Total Lectures: 39 periods (minimum) :

Module	Topics	Hours
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, TE_{10} 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
2	**4.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
	5.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
3	**6.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
	7.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
	8.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
4	**9.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:

20. Microwave Engineering-Passive Circuits, PA Rizzi , Pearson Education.

21. *Foundation of Microwave Engineering, 2ed edition, Robert E Collin, McGraw Hill, Inc.*

22. *Microwave Devices & Circuit Design , GP Srivastava & VL Gupta, PHI*

EC793A: Microwave Engineering Laboratory

Experiments

10. Determination of phase and group velocities in a waveguide carrying TE_{10} Wave from Dispersion diagram [ω−β Plot].

11. 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

12. Study of the characteristics of a Reflex Klystron oscillator

13. Study of Gunn-oscillator Characteristics using X-band waveguide test bench.

14. Measurement of coupling factor, Directivity, Insertion loss and Isolation of a Directional coupler using X-band waveguide test bench set up.

15. Scattering matrix of a magic tee / E-plane tee / H-plane tee using waveguide test bench at X-band.

16. Experimental/Simulation Study of filter (LPF, HPF,BPF) response.

17. 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.
2) M Sucher and J Fox, Handbook of Microwave Measurements, Vol I, Wiley-Interscience Inc.

Optical Communication & N/W - To be updated later
Computer Networks – To be updated later
FPGA & Reconfigurable Computing – To be updated later

POWER ELECTRONICS

Code: PE 601 (iii) Contact per week: 3-1-0 Credit: 4

Module	Topic	Hrs
Module I	**A dvances 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.	6
Module II	Rectifiers Single phase and three phase controlled Rectifiers with inductive loads, RL load Effect of source inductance- performance parameters .Dual Converters.	6
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.	4
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.	6
Module V	AC Voltage Controllers, Single phase and three phase Cycloconveters – Power factor control and Matrix Converters.	4

Module VI	**DC and AC Drives** DC Motor Speed control Induction Motor Speed Control Synchronous Motor Speed Control	8
	Total Lecture Hours	**34**

Books:

19. P.C. Sen, Power Electronics
20. M.H. Rashid, Power Electronics, PHI/ Pearson Education
21. C.W. Lander, Power Electronics, McGraw Hill
22. B.K.Bose, Modern Power Electronics, JAICO
23. Mohan, N Undeland, TM & Robbins, WP- Power Electronics, John Wiley & Sons

Radar Engg - To be updated later
Embedded Systems –To be updated later
Cellular & Mobile Communication – To be updated later

P.E. 702(D) **Syllabus for Biomedical Instrumentation** (ECE 4th year / 7th Semester)

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]

2.2Biological 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 : Opthalmic, 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:-

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

ix) M E Valentiniuzzi:- Understanding the Human Machine- A Primer for Bioengineering [Freely Downloadable in PDF] (World Scientific Publishing Co. Pte. Ltd, Singapore)

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

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

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

xiii) 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 – To be updated later
Robotics – To be updated later
Data Base Management System – To be updated later
Mobile Computing – To be updated later

Proposed
Fourth Year - Eighth Semester

	A. THEORY					
Sl. No.	**Theory**	**Contact Hours/Week**				**Cr. Pts**
		L	**T**	**P**	**Total**	
1 **HU**	Organisational Behaviour	2	0	0	2	2
2**EC801**	k) Smart Antenna l) Digital Image Processing m) Audio & Speech Processing n) Adaptive Signal Processing	3	0	0	3	3
F. E.-8013	10. Neural N/W & Applications 11. Material Sc & Engg 12. Satellite Communication & Remote Sensing 13. Nonconventional Energy	3	0	0	3	3
	Total of Theory				**8**	**8**
	B. PRACTICAL					
4**Design**	Design Lab / Industrial problem related practical training	0	0	6	6	4
5**Project.**	Project-2	0	0	12	12	6
	10**Grand Viva**					3
	Total of Practical				**18**	**13**
	Total of Semester				**26**	**21**

Smart Antenna – To be updated later

P.E. 801(B) Syllabus for Image Processing (Elective) ECE 4th yr/8th semester

Objective: The course provides grounding in digital filter and transforms techniques for image processing and feature extraction, and an overview of common heuristic algorithms for Image Processing. The different representations of digital images, the importance of adequate sampling frequencies and the appearance of artifacts. Also how the important features in an image may be related to significant abstractions from the raw image. Prerequisite: Digital Signal Processing, Signals and Systems.

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).

EC801(C) Syllabus for Audio & Speech Processing (Elective) ECE 4th yr/8th sem.

Objective: The course provides fundamentals in human speech and music analysis, modeling and processing using digital filters and Pattern Recognition techniques, and an overview of Hidden Markov Models for speech encoding. The different representations of digitized human speech, the importance of adequate voiced and unvoiced speech sounds grouped into phonemes, are used along with spectrograms for speech recognition, articulation and understanding. Also covered are - how the dominant features of speech may be analyzed to form significant abstractions for speaker identification and speaker-independent linguistic comprehension. Prerequisites: Audio Systems, Analog Filters, Digital Signal Processing.

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 :

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

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

13. B.Plannerer : An Introduction to Speech Recognition [Freely downloadable e-Book]

14. F.Mihelic & J.Zibert : Speech Recognition (InTech) [Freely downloadable e-Book]

15. I. Mcloughlin :Applied Speech and Audio Processing with MATLAB examples (Cambridge University Press)

Reference Books :

9. G. Young :-The Application of Hidden Markov Models in Speech Recognition [freely downloadable e-Book]

10. M.Grimm & K.Kroschel :-Robust Speech Recognition & Understanding (Intech)[Freely downloadable]

11. L. R.Rabiner & R.W.Schafer : Theory and Applications of Digital Speech Processing (Hewlett-Packard Labs/Pearson Pub)

12. C. Schmandt :- Voice Communication with Computers-Conversational Systems (Van Norstrand Reinhold Computers Series)

13. SOUND FORGE software package (SONY) for practice sessions [freely downloadable]

Adaptive Signal Processing – To be updated later
Neural N/W & Applications - To be updated later
Material Sc & Engg – To be updated later
Satellite Communication & Remote Sensing – To be updated later
Nonconventional Energy – To be updated later