Syllabus for B.Tech(Electronics & Communication Engineering) Up to Fourth Year

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

ECE SECOND YEAR: THIRD SEMESTER

A. THEORY							
Sl.No.	**Field**	**Theory**	**Contact Hours/Week**				**Cr. Points**
			L	**T**	**P**	**Total**	
1	**M(CS)301**	Numerical Methods	2	1	0	3	2
2	**M302**	Mathematics-III	3	1	0	4	4
3	**EC301**	1. Circuit Theory & Networks	3	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

A. THEORY							
Sl.No.	**Field**	**Theory**	**Contact Hours/Week**				**Cr. Points**
			L	**T**	**P**	**Total**	
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) Up to Fourth Year

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

Third Year - Fifth Semester

Sl.No	Paper Code	Theory	Contact Hours/Week				Cr. Pts
			L	T	P	Total	
		A. THEORY					
1	HU-501	Economics for Engineers	3	0	0	3	3
2	EC-501	Analog Communication	3	1	0	4	4
3	EC-502	Microprocessors & Microcontrollers	3	1	0	4	4
4	EC-503	Control System	3	0	0	3	3
5	F. E.- EC 504A EC-504B	Computer Architecture Data structure & C	3	1	0	4	3/4
		Total of Theory				18	18
		B. PRACTICAL					
6	EC-591	Analog Communication*	0	0	3	3	2
7	EC-592	Microprocessors & Microcontrollers*	0	0	3	3	2
8	EC -593	Control System*	0	0	3	3	2
9	F.E. EC-594A EC-594B	 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

Sl.No.	Field	Theory	Contact Hours/Week				Cr. Pts
			L	T	P	Total	
		A. THEORY					
1	HU-601	Principles of Management	2	0	0	2	2
2	EC601	Digital Communications	3	0	0	3	3
3	EC602	Digital Signal Processing	3	0	0	3	3
4	EC 603	Telecommunication System	3	0	0	3	3
5	(No Lab) EC-604A EC-604B	 Antenna Theory & Propagation Information Theory & Coding	3	0	0	3	3
6	(With Lab) EC-605A EC-605B EC-605C	 Object Oriented Programming (IT) 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. EC-695A EC-695B EC-695C	 Object Oriented Programming (IT) Programming Lanuage (CSE) Electronic Measurement & Instrumentation	0	0	3	3	2
11	EC-681	Seminar	0	0	3	3	2
		Total of Practical				12	8
		Total of Semester				29	25

Proposed

Fourth Year - Seventh Semester

Sl. No.	Field	Theory	Contact Hours/Week				Cr. Pts
		A. THEORY					
		Name of Paper	**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	3	0	0	3	3
4	**EC704** (No Lab)	A. Radar Engg B. Embedded Systems C. Biomedical Instrumentation	3	0	0	3	3
5	**F. E. EC705**	A. Artificial Intelligence (CSE) B. Robotics (CSE) C. Data Base Management System D. Power Electronics	3	0	0	3	3
		Total of Theory				**15**	**15**
		B. PRACTICAL					
		Name of Paper					
6	**HU781**	Group Discussion	0	0	3	3	2
7	**EC792**	VLSI Design Lab	0	0	3	3	2
8	**EC793**	A. RF & Microwave Engg. Lab B. Optical Communication & N/W Lab C. Computer Networks Lab D. FPGA & Reconfigurable Computing lab	0	0	3	3	2
9	**F.E EC795**	A.Artificial Intelligence Lab(CSE) B.Robotics lab(CSE) C.Data Base Management System Lab (CSE) D.Power Electronics Lab(EE)	0	0	3	3	2
10	**EC781**	**Industrial training**	**4 wks during 6th -7 th Sem-break**				2
11	**EC782**	**Project part 1**				3	2
		Total of Practical				**15**	**12**
		Total of Semester				**30**	**27**

Fourth Year - Eighth Semester

Sl. No.	Field	Theory	Contact Hours/Week				Cr. Pts
		A. THEORY					
		Paper Name	**L**	**T**	**P**	**Total**	
1	**HU801A**	Organisational Behaviour	2	0	0	2	2
3	**EC801** (No Lab)	A. Smart Antenna B. Digital Image Processing C. Satellite Communication & Remote Sensing	3	0	0	3	3
	EC802 (No Lab)	A. Neural N/W & Applications (CSE) B. Material Sc. & Engg (Mat. Sc) C. Renewable Energy (EE) D. Audio & Speech Processing (CSE)	3	0	0	3	3
		Total of Theory				**8**	**8**
		B. PRACTICAL					
	EC881	Design Lab / Industrial problem related practical training	0	0	6	6	4
	EC882	Project part-2	0	0	12	12	6
	EC893	Grand viva					3
		Total of Practical				**18**	**13**
		Total of Semester				**26**	**21**

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: $\int_0^{\infty} \frac{\sin x}{x} dx$, $\int_0^{2\pi} \frac{d\theta}{a + b\cos\theta + c\sin\theta}$, $\int_C \frac{P(z)}{Q(z)} dz$ (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, I= 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.

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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.

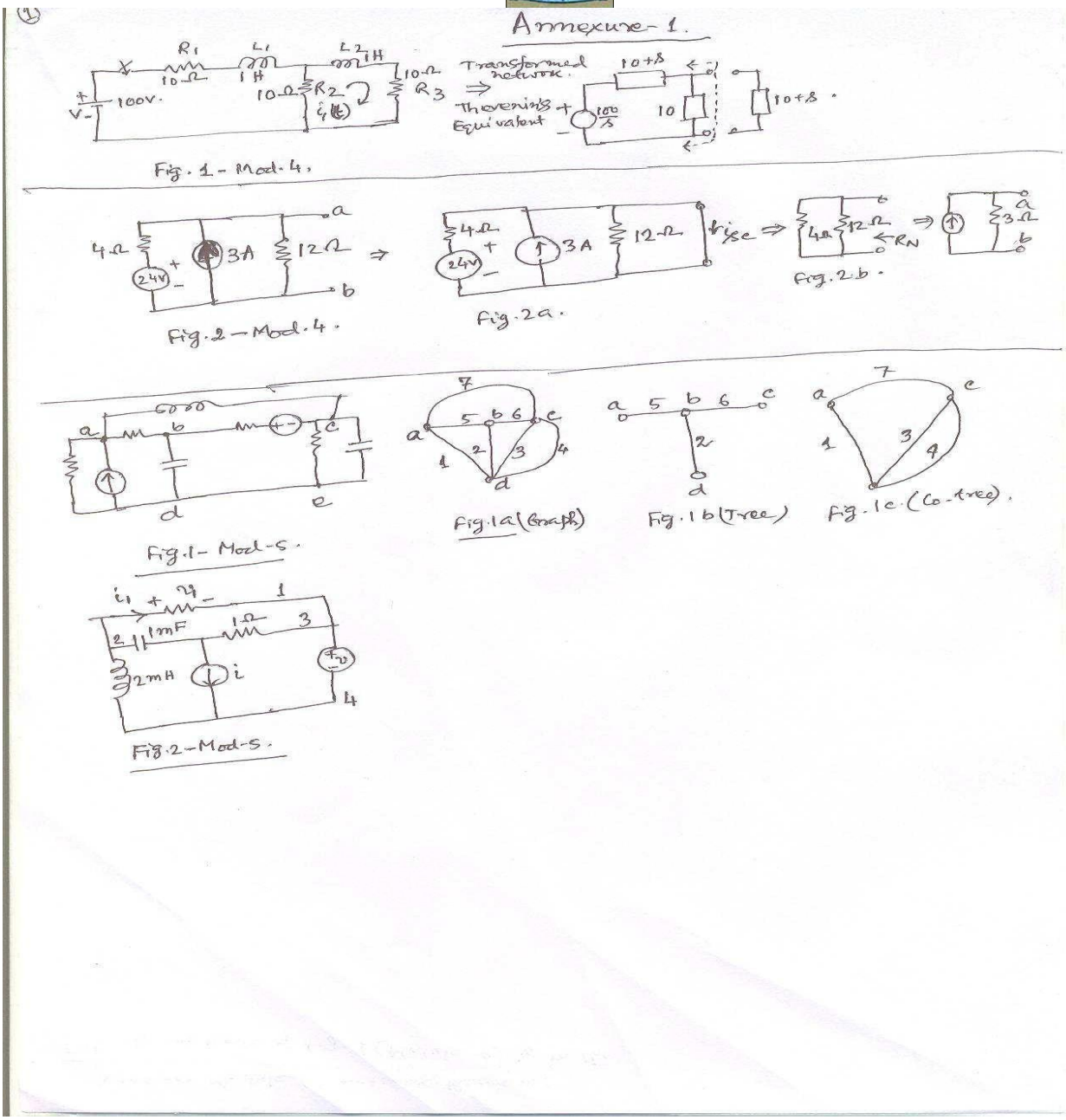
Tutorials: (*):Bold and Italics.

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, "AText 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, LM78xx and LM79xx series, concept of SMPS Analysis of buck converter – TPS54160 & LM3475, Switched Mode power Supply (SMPS), study of TPS40200, TPS40210 LDO devices . [4]

b) Transistor Biasing and Stability: Q-point, Self Bias-CE, Compensation techniques, h-model of transistors. Expression for voltage gain, current gain, input and output impedance, trans-resistance & trans-conductance; Emitter follower circuits, High frequency model of transistors. [6]

Module -2: [10]

1. Transistor Amplifiers: RC coupled amplifier, functions of all components, equivalent circuit, derivation of voltage gain, current gain, input impedance and output impedance, frequency response characteristics, lower and upper half frequencies, bandwidth, and concept of wide band amplifier. [6]

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

Module -3: [10]
1. Operational Amplifier: Ideal OPAMP, Introduction, Block diagram, characteristics and equivalent circuits of an ideal op-amp, various types of Operational Amplifiers e.g. TL0XX, LMXXX, TLVXXX, OPAXXX, THSXXX etc and their applications, Differential Amplifier, Constant current source (current mirror etc.), level shifter, CMRR, Open & Closed loop circuits, importance of feedback loop (positive & negative), inverting & noninverting amplifiers, voltage follower/buffer circuit based on LM741IC and TL082 General Purpose OPAMP. [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 and TL082. [2]
3. Special Functional Circuits: VCO and PLL Introduction to analog multiplier e.g.MPY634,Basic application of Analog multiplier:AM,FM,FSK; Typical application using op-AMP and analog multipliers: Voltage Controlled Oscillator, Phase Locked Loop. [2]

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
11. ASLK Pro Manual: ASLK Manual
12. PMLK Lab manual

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 ordinary differential equation: Euler's and Runga-Kutta methods.
5. 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.

LAB SETUP REQUIREMENT:

Dual Channel Cathode Ray Oscilloscope (0-20 MHz), Function Generator (10MHz and above), Dual Power Supply , TL082, MPY634, ASLKPRO, standard regulator ICs – TPS40200, TPS40210, TPS 7A4901,TPS7A8300, PMLK LDO, Clip Probes, digital multimeter,System with installed circuit simulation software(Tina/Pspice/MultiSim)

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. Design an AGC and AVC using TL082 and MPY634 for a given peak amplitude of sine wave on ASLK PRO.
5. Study of characteristics curves of B.J.T & F.E.T
6. Design a two-stage R-C coupled amplifier & study of it's gain & Bandwidth.
7. Study of class A & class B power amplifiers.
8. Study of class C & Push-Pull amplifiers.
9. Realization of current mirror & level shifter circuit using TL082 Operational Amplifiers.
10. Study of timer circuit using NE555 & configuration for monostable, astable multivibrator and Bistable multivibrator .
11 . Study of Switched Mode Power Supply & construction of a linear voltage regulator using regulator IC chip. Design and test a Low Dropout regulator using op-amps for a given voltage regulation characteristic and compare the characteristics with TPS7250 IC
12. Design of a switched mode power supply that can provide a regulated output voltage for a given input range and compare the characteristics using the TPS40200 IC.
    1. Impact of operating conditions on efficiency of BUCK Converter TPS54160
    2. Impact of passive devices and switching frequency on current and voltage ripples of BUCK Converter TPS54160
    3. Impact of cross-over frequency and passive devices on load transient response of BUCK Converter TPS54160
12. Design a simple function generator and VCO using TL082 operational amplifier and MPY634 analog multiplier.
13. Realization of a V-to-I & I-to-V converter using Op-Amps.
14b. Examine the operation of a PLL designed using TL082 operational amplifier and MPY634 analog multiplier and to determine the free running frequency, the capture range and the lock in range of PLL.
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 $D=\varepsilon_0 E+P$, 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.
5. Engineering Electromagnetics, 7thEdition-W.H.Hayt & J.A.Buck, Tata-McGraw-Hill

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.

SEMESTER - V
Theory

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

Module-I

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

Module-II

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

Module-III

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

Module-IV

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

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

EC501 - Analog Communication

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

Sr No	Topic	Hrs
Mod-1	**Introduction to Analog Communication:** Elements of communication system - Transmitters, Transmission channels & receivers (1), Concept of modulation, its needs (1). **Continuous Wave Linear Modulation:** a) Amplitude modulation(AM-DSB/TC): Time domain representation of AM signal (expression derived using a single tone message), modulation index [1], frequency domain (spectral) representations, illustration of the carrier and side band components; transmission bandwidth for AM; Phasor diagram of an AM signal; [2] Calculation of Transmitted power & sideband power & Efficiency ; concept of under, over and critical modulation of AM-DSB-TC.[2] b) Other Amplitude Modulations: Double side band suppressed carrier (DSBSC) modulation: time and frequency domain expressions, bandwidth and transmission power for DSB.[1] Single side band modulation (SSB) both TC & SC and only the basic concept of VSB, Spectra and band-width. [2]	9
Mod-2	**Generation & Detection of Amplitude Modulation**: a) Generation of AM: Concept of i) Gated and ii) Square law modulators, Balanced Modulator. [2] b) Generation of SSB: Filter method, Phase shift method and the Third method [2] **Demodulation for Linear Modulation:** Demodulation of AM signals: Detection of AM by envelope detector [1], Synchronous detection for AM-SC, Effects of Frequency & Phase mismatch, Corrections. [2] **Principle of Super heterodyne receivers:** Super heterodyning principle, intermediate frequency, Local oscillator frequency, image frequency. [2]	9
Mod-3	**Angle Modulation:** a) Frequency Modulation (FM) and Phase Modulation (PM): Time and Frequency domain representations, Spectral representation of FM and PM for a single tone message, Bessel's functions and Fourier series. (2); Phasor diagram (1); b) **Generation of FM & PM:** Narrow and Wide-band angle modulation, Basic block diagram representation of generation of FM & PM, Concept of VCO & Reactance modulator (2) c) **Demodulation of FM and PM:** Concept of frequency discriminators (1), Phase Locked Loop (2)	8

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

Total 36 Hours

Text Books:

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

References:

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

Learning outcome:
Module – 1: The learner must be able to appreciate the need for modulation and calculate the antenna size for different carrier frequencies.
From the functional representation of the modulated carrier wave, the learner must be able to identify the type of modulation, calculate the side-band frequencies, identify the modulating and carrier frequencies, decide the type of generation method to be adopted. Solve problems.

Module – 2: After understanding the basic concepts the learner must be able to compare between the different demodulation methods, design an envelope detector, calculate the IF and image frequencies for the superheterdyne receivers given the carrier and modulating frequencies, calculate the oscillator frequency.

Module – 3: From the functional representation of the modulated carrier wave, the learner must be able to identify the type of modulation, calculate the side-band frequencies, identify the modulating and carrier frequencies, decide the type of generation method to be adopted. Solve problems.

Module – 4: Appreciate the importance of Multiplexing, find out their application areas. The learner must be able to calculate the Noise temperature & SNR for different systems, also compare between the performance of the different modulation methods by comparing their SNR.

Microprocessor & Microcontroller
Code: EC502
Contact: 3L + 1T
Credits: 4

Module -1: [8L]

History of evolution of Microprocessor and Microcontrollers and their advantages and disadvantages. [1L]

Introduction to 8085 and 8086 microprocessors, Pin description and block diagram of 8085, Comparing the instruction set and addressing modes of 8085 and 8086. [2L]

Concept of Address/data bus Demultiplexing, Status Signals and the control signals in 8085 . [1L]

Timing diagram of the instructions of 8085 (a few examples). [1L]

Module -2: [9L]

8085 Assembly language programming with examples, Counter and Time Delays, Stack and Subroutine [6L]

Interrupts of 8085 processor (software and hardware), I/O Device Interfacing-I/O Mapped I/O and Memory Mapped I/O, Memory Mapped Peripherals, programming system registers, Serial (using SID and SOD pins and RIM, SIM Instructions) and Parallel data transfer [3L]

Module 3: [10L]

CISC vs RISC design philosophy, Comparison between 8051 and MSP430 Microcontroller –Architecture, Pin Details. [3L]

Addressing modes, Instruction set, Examples of Simple Assembly Language and Embedded C.
GPIO control in 8051 & MSP430 I/O pin multiplexing, MSP430 low power modes, Active vs Standby current consumption, Interrupts in 8051 and MSP430. [4L]

Module -4: [9L]

Memory interfacing with 8085 and 8086. [2L]

Support IC chips for 8085/86 processors- 8255 ,8251,8237/8257,8259; Timers and DMA controller in MSP430, MSP430's Serial communication basics, Implementing and programming UART and SPI interface using MSP430. [5L]

Interfacing of 8255 PPI with 8085, Interfacing external devices with 8051 and MSP430
Case Study: MSP430 based embedded system application using the interface protocols for communication with external devices: "A Low-Power Battery less Wireless Temperature and Humidity Sensor with Passive Low Frequency RFID" [2L]

Learning Outcome:
Additional Tutorial Hours will be planned to meet the following learning outcome.

Through this course, the students will be exposed to hardware details of 8085 microprocessor and MSP430 with the related signals and their implications. They will also learn programming and interfacing of 8085 and MSP430. The students will understand the difference between the architecture of 8085, 8086 and MSP430. They will also be aware of the 8051and MSP430 architecture and its programming. Lastly the students will have a basic idea on PIC microcontroller (16F877)

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.Getting Started with the MSP430 Launchpad by Adrian Fernandez, Dung Dang, Newness publication ISBN-13: 978-0124115880
5.Microcontrollers:Principles&Applications , Ajit Pal, PHI 2011.
6.Naresh Grover, "Microprocessor comprehensive studies Architecture, Programming and Interfacing"Dhanpat Rai, 2003
7. 8051 Microprocessor –V. Udayashankara and M.S Mallikarjunaswami (TMH).
8. Microprocessor 8085 and its Interfacing—S Mathur (PHI)
9. An Introduction to Microprocessor and Applications –Krishna Kant (Macmillan)
10. MSP430 microcontroller basics 1st Edition by John H. Davies (Author), Newnes Publication ISBN- 13: 978-0750682763

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 SYSTEMS
Code: EC503
Contact: 3L
Credits: 3

Module – I:
a) INTRODUCTION
Concepts of Control Systems- Open Loop and closed loop control systems and their differences- Different examples of control systems- Classification of control systems, Feed-Back Characteristics, Effects of feedback. Mathematical models – Differential equations, Impulse Response and transfer functions - Translational and Rotational mechanical systems
[4L]

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

Module – II:
a) TIME RESPONSE ANALYSIS
Standard test signals - Time response of first order systems – Characteristic Equation of Feedback control systems, Transient response of second order systems - Time domain specifications – Steady state response - Steady state errors and error constants.
[5L]

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

Module – III:
a) FREQUENCY RESPONSE ANALYSIS
Introduction, Frequency domain specifications-Bode diagrams-Determination of Frequency domain specifications and transfer function from the Bode Diagram-Phase margin and Gain margin-Stability Analysis from Bode Plots. [6L]
b) : STABILITY ANALYSIS IN FREQUENCY DOMAIN
Polar Plots, Nyquist Plots Stability Analysis. [4L]

Module - IV :
a) CLASSICAL CONTROL DESIGN TECHNIQUES
Compensation techniques – Lag, Lead, Lead-Lag Controllers design in frequency Domain, PID Controllers. [5L]
b) STATE SPACE ANALYSIS OF CONTINUOUS SYSTEMS
Concepts of state, state variables and state model, derivation of state models from block diagrams, Diagonalization- Solving the Time invariant state Equations- State Transition Matrix and it's Properties – Concepts of Controllability and Observability
[6L]

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

REFERENCE BOOKS:

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

Syllabus for B.Tech(ECE) Second Year

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

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

Pre-requisite: Basic Electronics in First year, Introduction to Computing in second semester, Digital Electronic & Integrated Circuits in 4th semester.

Module 1: Computer Organization & Architecture, Basic functional Unit, Computer component structure [Eg. Structure of IAS Computer, IBM Machine configuration], Harvard & Von Neumann architecture, BUS architecture, ALU designs [combinational ALU & sequential ALU], Instruction set: Instruction format & types. [8L]
[**Learning Outcome**: Students will come to know about basic of computer organization & architecture]

Module 2: Memory Organization: Memory system overview, Cache memory organizations, Techniques for reducing cache misses; Hierarchical memory technology: Inclusion, Coherence and locality properties; Virtual memory organization, mapping and management techniques, memory replacement policies [10L]
[**Learning Outcome**: Students will come to know about basic of computer memory structure & different mapping technique]

Module 3: CPU Organization: Fundamentals, Processor-memory communication [Clock cycles and Timing Diagram], Instruction cycle, RISC & CISC based architecture. [4L]
[**Learning Outcome**: Students will come to know about different CPU architecture & Processor-memory communication technique]

Module 4: Pipelining: Basic concepts, instruction and arithmetic pipeline, data hazards, control hazards and structural hazards, techniques for handling hazards, Flynn's classification –SISD, SIMD, MISD, MIMD architectures, Pipeline optimization techniques. [7L]
[**Learning Outcome**: Students will come to know about pipelining architecture]

Module 5: Instruction-level parallelism: basic concepts, techniques for increasing ILP, superscalar, super pipelined and VLIW processor architectures, Array and Vector processors. [6L]
[**Learning Outcome**: Students will come to know about parallelism]

Module 6: Overview of HDL: VHDL basics programming concept, Structural, dataflow, behavioural & mixed style modeling techniques. [3L]
[**Learning Outcome**: Students will come to know about VHDL programming techniques]

[**Overall Learning Outcome**: This course is a formidable prerequisite for the course Operating System, Embedded System to be offered in the subsequent semester.]

Text & Reference books:

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

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:

19. "Data Structures And Program Design In C", 2/E by Robert L. Kruse, Bruce P.Leung.
20. "Fundamentals of Data Structures of C" by Ellis Horowitz, Sartaj Sahni, Susan Anderson-freed.
21. "Data Structures in C" by Aaron M. Tenenbaum.
22. **"**Data Structures" by S. Lipschutz.
23. "Data Structures Using C" by Reema Thareja.
24. "Data Structure Using C", 2/e by A.K. Rath, A. K. Jagadev.
25. **"**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

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

Microprocessors & Microcontrollers Lab

Code:EC-592
Contact: 3P
Credits: 2

1. [3 hrs.]
Familiarization and Study of 8085 trainer kit and MSP430 Kit

Programs using basic instruction set (data transfer, Load/Store, Arithmetic, Logical) on 8085 trainer kit
Interfacing and programming GPIO ports in embedded C using MSP430 (blinking LEDs, push buttons)

2. Basic Programming using ALP on 8085 trainer kit: [10 hrs]

Table look up
Copying a block of memory
Shifting a block of memory
a)Packing and unpacking of BCD numbers
Addition of BCD numbers
Binary to ASCII conversion and vice-versa (Using Subroutine Call)
BCD to Binary Conversion and vice-versa
b)String Matching, Multiplication

3. [10 hrs]

1. Program using IN/OUT instructions and 8255 PPI on the trainer kit e.g. subroutine for delay,
   a. Glowing all the LEDs one by one with particular delay
   b. Reading switch state and glowing LEDs accordingly.

3. Usage of Low Power Modes:
   Use MSPEXP430FR5969 as hardware platform and demonstrate the low power modes and measure the active mode and standby mode current.
4. GPIO Interrupts programming on MSP430
5. PWM generation using Timers on MSP430

4. [3 hrs]
1. Serial communication between two 8085 trainer kits and Connect the MSP430 to terminal on PC and echo back the data
2. Connect the MSP430 to terminal on PC and echo back the data using the UART module

5. [3 hrs]

Study of Prewritten programs on 8051 Microcontroller Kit using the basic instruction set (data transfer, Load/Store, Arithmetic, Logical).
Or,
Familiarization with 8051 Simulator on PC. Study of prewritten programs using basic instruction set (data transfer, Load/Store, Arithmetic, Logical)

Total 30 hours (10 classes each of 3 periods)

Control System
Lab Code: EC583
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
10.	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
11.	Study of position control system using servomotor.	3
12.	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 Digital Electronic & Integrated Circuits in 4th semester.]

HDL introduction
Basic digital logic base programming with
HDL 8-bit Addition, Multiplication, Division
8-bit Register design
Memory unit design and perform memory
operations. 2-bit, 4-bit, 8-bit simple ALU design
8-bit simple CPU design
Interfacing of CPU and
Memory

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)

Syllabus for B.Tech(ECE) Second Year

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

SEMESTER - VI

Theory

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

Module-I

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

Module-II

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

Module-III

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

Module-IV

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

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:

k) Digital Communications, S. Haykin, Wiley India.
l) Principles of Communication Systems, H. Taub and D.L.Schilling, TMH Publishing Co.
m) Wireless Communication and Networks : 3G and Beyond, I. Saha Misra, TMH Education.
n) Digital Communications, J.G.Proakis, TMH Publishing Co.

o) REFERENCE BOOKS:

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

Digital Signal Processing
EC- 602
Contracts: 3L
Credits- 3

MODULE – I:

Discrete-time signals:

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

LTI Systems:

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

MODULE –II:

Z-Transform:

Definition, mapping between s-plane and z-plane, unit circle, convergence and ROC, properties of Z-transform, Z-transform on sequences with examples and exercises, characteristic families of signals along with ROCs, convolution, correlation and multiplication using Z-transform, initial value theorem, 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:

1. Digital Signal Processing – Principles, Algorithms and Applications, J.G.Proakis & D.G.Manolakis, Pearson Ed.
2. Digital Signal processing – A Computer Based Approach, S.K.Mitra, TMH Publishing Co.
3. Digital Signal Processing Signals, Systems and Filters, A. Antoniou, TMH Publishing Co.
4. VLSI Digital Signal Processing Systems Design and Implementation, Wiley International Publication.
5. Digital Signal Processing with Field Programmable Gate Arrays, U.Meyer-Baese, Springer.

REFERENCE BOOKS:

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

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

(to be modified as per workshop decision)

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	4
4.	channel & common channel signaling, SS7.	
5.	**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
6.	**Stored Program Control**: Software architecture, Application software;. Electronic Exchanges, Introduction to	4
7.	cordless telephones and Digital PABX	
8.	**Traffic Engineering**: Blocking network, blocking probability, grade of service, traffic load, Erlang-B and C-congestion formulas-case studies	4
9.	**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:

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

Reference Books:

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

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)

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

Reference Book

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

Information Theory & Coding
EC604B
Contracts: 3L
Credits- 3

Source Coding [7L]
Uncertainty and information, average mutual information and entropy, information measures for continuous random variables, source coding theorem, Huffman codes.

Channel Capacity And Coding [7L]
Channel models, channel capacity, channel coding, information capacity theorem, The Shannon limit.

Linear And Block Codes For Error Correction [8L]
Matrix description of linear block codes, equivalent codes, parity check matrix, decoding of a linear block code, perfect codes, Hamming codes.

Cyclic Codes [7L]
Polynomials, division algorithm for polynomials, a method for generating cyclic codes, matrix description of cyclic codes, Golay codes.

BCH Codes [8L]
Primitive elements, minimal polynomials, generator polynomials in terms of minimal polynomials, examples of BCH codes.

Convolutional Codes [8L]

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

Books

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

Free Elective

Object Oriented Programming
Code: EC605A
Contact: 3L
Credits: 3
Object oriented design [10 L]
Concepts of object oriented programming language, Major and minor elements, Object, Class, relationships among objects, aggregation, links, relationships among classes-association, aggregation, using, instantiation, meta-class, grouping constructs.

Object oriented concepts [4 L]
Difference between OOP and other conventional programming – advantages and disadvantages. Class, object, message passing, inheritance, encapsulation, polymorphism

Basic concepts of object oriented programming using Java [22 L]
Implementation of Object oriented concepts using Java.
Language features to be covered:
Class & Object properties [6L]
Basic concepts of java programming – advantages of java, byte-code & JVM, data types, access specifiers, operators, control statements & loops, array, creation of class, object, constructor, finalize and garbage collection, use of method overloading, this keyword, use of objects as parameter & methods returning objects, call by value & call by reference, static variables & methods, garbage collection, nested & inner classes, basic string handling concepts-String (discuss charAt() , compareTo(), equals(), equalsIgnoreCase(), indexOf(), length() , substring(), toCharArray() , toLowerCase(), toString(), toUpperCase() , trim() , valueOf() methods) & StringBuffer classes (discuss append(), capacity(), charAt(), delete(), deleteCharAt(), ensureCapacity(), getChars(), indexOf(), insert(), length(), setCharAt(), setLength(), substring(), toString() methods), concept of mutable and immutable string, command line arguments, basics of I/O operations – keyboard input using BufferedReader & Scanner classes.

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

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

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

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

Programming Languages
Code: EC605B
Contacts: 3L
Credits: 3

Introduction [3L]
Programming paradigms,Language translator, **B**asics of OOP, Structure of C++ program, Class and object, Abstraction and encapsulation, Polymorphism, Inheritance, Static and dynamic binding.

Declaration, Expression and statements [4L]
Data types, Variables, Constants, Operator and expression, Operator precedence and associativity. Statements: Labelled, Expression, Compound, Control, Jump, Declaration, Try-throw-catch.

Array, pointer and function [4L]
Array,Addresses, Pointer. Function: Declaration, Definition and call, Inline function, Main function argument, Reference variable, Function overloading, Default argument, Parameter passing, Recursion, Scope of variable, Return-by-value and Return-by-reference, Pointer to function

Data abstraction through classes and user defined data types [6L]
Class, Members, Constructor and destructor, Copy constructor.
Dynamic memory management: Operators new and delete, Malloc and free, Static member, Scope of class names, Scope of variables.

Operator Overloading [5L]
Overloading unary and binary operator, Overloaded function calls, Subscripting, class member access, Non-member operator, New and delete, Cast operator.

Class relationships [6L]
Introduction, Polymorphism, Coercion, Overloading, Parametric and inclusion polymorphism
Inheritance: direct and indirect superclasses, Multiple inheritance, Virtual base class,Friend, Virtual function, Abstract class, Overriding and hiding, Dynamic binding of functions, Virtual destructor and operators.

Template and Exception Handling [5L]
Class template, Member function inclusion, Function template, Specialization,Inheritance, Namespace.
Concept of exception handling, Catch block, Nested try-catch block, Condition expression in throw expression, Constructor & destructor, Runtime standard exception

Standard Library in C++ [3L]
Standard library function, Input and output, Iostream class hierarchy, Class ios, Other stream classes.

Object oriented design and modelling [4L]
Software development, Qualities of software system, Software architecture, Process life cycle, phases, Modularity, OO methodology, Modeling, UML overview, Object oriented design patterns.

Textbooks/References:

1. Schildt, H., *The Complete Reference C++*, McGraw – Hill.
2. C++ object oriented programming paradigm, Debasish Jana, PHI
3. Pooley, R and P. Stevens, *Using UML* , Addison-Wesley.
4. Programming In C++, Y.I. Shah and M.H. Thaker, ISTE/EXCEL BOOKS
5. Rambaugh, James Michael, Blaha – "Object Oriented Modelling and Design" – Prentice Hall, India
6. Rajaram: Object Oriented Programming and C++, New Age International

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:

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

Practical

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

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

Digital Signal Processing Lab
Code: EC692
Contact: 3P
Credits: 2

Simulation Laboratory using standard Simulator:

1. Sampled sinusoidal signal, various sequences and different arithmetic operations.
2. Convolution of two sequences using graphical methods and using commands- verification of the properties of convolution.
3. Z-transform of various sequences – verification of the properties of Z-transform.
4. Twiddle factors – verification of the properties.
5. DFTs / IDFTs using matrix multiplication and also using commands.
6. Circular convolution of two sequences using graphical methods and using commands, differentiation between linear and circular convolutions.
7. Verifications of the different algorithms associated with filtering of long data sequences and Overlap –add and Overlap-save methods.
8. Butterworth filter design with different set of parameters.
9. FIR filter design using rectangular, Hamming and Blackman windows.

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

1. Writing & execution of small programs related to arithmetic operations and convolution using Assembly Language of TMS320C 5416/6713 Processor, study of MAC instruction.
2. Writing of small programs in VHDL and downloading onto Xilinx FPGA.
3. Mapping of some DSP algorithms onto FPGA.

Object Oriented Programming Laboratory
EC695A
L-0, T-0, P-3;
Cr 2

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

Note: Use Java for programming
Preferably download "**java_ee_sdk-6u4-jdk7-windows.exe**" from
http://www.oracle.com/technetwork/java/javaee/downloads/java-ee-sdk-6u3-jdk-7u1-downloads-523391.html

Programming Language Laboratory:
EC695B
l-0, t-0, p-3
Cr 3

To be uploaded later.

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

1. Study of Static Characteristics of a Measuring Instrument

2. Study of Dynamic Characteristics of a Measuring Instrument
3. Acquaintance with basic structure of DMM and measurement of different electrical parameters
4. Realization of Data Acquisition system
5. Wave and spectrum analysis using Q meter
6. Realization of a V-to-I & I-to-V converter.
7. Statistical analysis of errors in measurement.
8. Study of VCO (Voltage controlled oscillator) & PLL (Phase Locked Loop).

Proposed
Syllabus
VII Semester
Theory

WIRELESS COMMUNICATION AND NETWORKS
EC701
Contacts: 3L
Credits: 3

MODULE – I:

Cellular Mobile Wireless Networks: Systems and Design Fundamentals:

Brief introduction to mobile wireless communication and systems, Description of cellular system, Cellular Structure, Frequency Reuse, Cell clustering, Capacity enhancement techniques for cellular networks, cell splitting, antenna sectoring, Co-channel and Adjacent channel interferences, Channel assignment schemes – Fixed channel, Dynamic channel and Hybrid channel, mobility management – location management and handoff management, handoff process, different types of handoff. 6L

Characteristics of wireless channel and propagation path loss models:

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

MODULE – II:

Modern Mobile Wireless Communication Systems

Evolution strategies – First Generation (1G) to Fourth Generation (4G), Personal Area Networks :PAN, Low Tier Wireless System: Cordless Telephone, Second Generation (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:

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

REFERENCE BOOKS:

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

Microelectronics & VLSI Designs
EC702
Contacts: 3L
Credits: 3

Pre-requisite: Knowledge about MOS, MOS-Characteristics, MOS Capacitors, Short Channel MOS, CMOS inverters, MOS Gates etc done in ES201 (Basic Electronics of second semester), EC302 (solid state devices of third semester), Analog Circuit Theory and Digital Circuits done in semesters 3 & 4 respectively.

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

VLSI Design Concepts, Moor's Law, Scale of Integration (SSI, MSI, LSI, VLSI, ULSI – basic idea only), Types of VLSI Chips (Analog & Digital VLSI chips, General purpose, ASIC, PLA, FPGA)(2L), Design principles (Digital VLSI – Concept of Regularity, Granularity etc), Design Domains (Behavioral, Structu12L);

Module 2: Micro-electronic Processes for VLSI Fabrication: **[10]**
Silicon Semiconductor Technology- An
Overview, Wafer processig (1L), Oxidation, Epitaxial deposition, Ion-implantation & Diffusion (1L),
Cleaning, Etching (1L), Photo-lithography – Positive & Negative photo-resist
(1L); Basic CMOS Technology – (Steps in fabricating CMOS (1L)), Basic n-well CMOS process, p-well CMOS process, Twin tub process (1L), Silicon on insulator
(1L); Layout Design Rule: Stick diagram with examples (2L), Layout rules (1L).

Module – 3: CMOS for Digital VLSI Circuits: [10]
Recapitulation of MOS (2L); CMOS, CMOS inverter characteristics (1L); CMOS logic circuits, NAND & NOR Gates (1L), Complex logic circuits (1L), CMOS Full Adder (1L), CMOS Transmission GATE (1L), Advanced CMOS Logic circuits; Sequential CMOS logic circuits (1L); SR Latch circuit, clocked JK Latch/ Master-Slave JK (1L), CMOS D-latch & Edge triggered flip-flop (1L);

Module – 4: Analog VLSI Circuits: [8L]
Analog VLSI design steps (1L); Basic building blocks of Analog VLSI chips (1L); MOS switch (1L); Active load / resistors; Voltage dividers (1L); CMOS Current source & sink; CMOS Voltage references/voltage dividers [Basic circuits only] (1L); CMOS Differential amplifier; Output amplifiers [Basic circuits only] (1L); CMOS OPAMP (1L); Switched capacitor filter (1L)

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

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

RF & Microwave Engg
EC703A
Contacts: 3L
Credits: 3

Total Lectures: 39 periods (minimum) :

Module	Topics	Hours
1	**26. Introduction** RF & Microwave Spectrum, Typical applications of RF and Microwave, Safety considerations.	1
	27. 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
	28. 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:

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

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

Introduction to communication systems: [2]
Principles, components; Different forms of communications in brief, advantages of optical fibre communication, spectral characteristics.

Optical Fibre wave guide: [2]
Structure, Single and Multimode operation; Attenuation, Material and wave guide dispersion.

Optical Sources: [5]
Light Emitting Diode; principle, structures, power and efficiency, coupling to fibres.
Laser diodes; principle, double heterostructure, gain and index guiding, distributed lasers.
Quantum Well Lasers; Modes and narrow linewidth lasers.
Modulation; Bandwidth for modulation, Optical transmitters: components.

Optical Detectors: [2]
Device types, optical detection principles, efficiency, responsivity, bandwidth. Preamplifiers; noise sources, signal to noise ratio.

Point-to-point link and Wavelength Division Multiplexing: [11]
Building blocks; Multiplexing; Intensity Modulation/Direct Detection system; Principle of Regeneration; WDM link, Optical amplifiers; EDFA, SOA, Raman amplifier, Fabry-Perot filters. Dispersion compensation and management, Link analysis and Bit-Error-Rate calculation.

Optical Network: [4]
LAN, MAN, WAN; Topologies: bus, star, ring; Ethernet; FDDI; Telecom networking:SDH/SONET.
Different forms of access networks: [4]
Telephony; ISDN; Cable TV; Broadcast and Switched Networks; HFC networks; FTTC and FTTH

networks; All optical networks.

Books:

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

Computer Networks
EC703C
Contacts: 3L
Credits: 3

Module I
Overview of Data Communication and Networking: [4L]
Introduction; Data communications: components, data representation (ASCII,ISO etc.), direction of data flow (simplex, half duplex, full duplex); network criteria, physical structure (type of connection, topology), categories of network (LAN, MAN,WAN); Internet: brief history, Protocols and standards; Reference models: OSI reference model, TCP/IP reference model, their comparative study.
Physical Level: [6L]
Overview of data(analog & digital), signal(analog & digital), transmission (analog & digital) & transmission media (guided & unguided); Circuit switching: time division & space division switch, TDM bus; Telephone Network;
Module II
Data link Layer: [5L]
Types of errors, framing(character and bit stuffing), error detection & correction methods; Flow control; Protocols: Stop & wait ARQ, Go-Back- N ARQ, Selective repeat ARQ, HDLC;
Medium Access sub layer: [5L]
Point to Point Protocol, LCP, NCP, Token Ring; Reservation, Polling, Multiple access protocols: Pure ALOHA, Slotted ALOHA, CSMA, CSMA/CD, CSMA/CA Traditional Ethernet, fast Ethernet(in brief);
Module III
Network layer: [8L]
Internetworking & devices: Repeaters, Hubs, Bridges, Switches, Router, Gateway; Addressing : IP addressing, subnetting; Routing : techniques, static vs. dynamic routing , Unicast Routing Protocols: RIP, OSPF, BGP; Other Procols: ARP, IP, ICMP, IPV6;.
Transport layer: [4L]
Process to Process delivery; UDP; TCP; Congestion Control: Open Loop, Closed Loop choke packets; Quality of service: techniques to improve QoS: Leaky bucket algorithm, Token bucket algorithm,
Module IV
Application Layer [5L]
Introduction to DNS, SMTP, SNMP, FTP, HTTP & WWW; Security: Cryptography (Public, Private Key based), Digital Signature, Firewalls.
Modern topics: [5L]
ISDN services & ATM, DSL technology, Cable Modem: Architecture & Operation in brief
Wireless LAN: IEEE 802.11, Introduction to blue-tooth.
Text Books:
1. B. A. Forouzan – "Data Communications and Networking (3rd Ed.) " – TMH
2. A. S. Tanenbaum – "Computer Networks (4th Ed.)" – Pearson Education/PHI
3. W. Stallings – "Data and Computer Communications (5th Ed.)" – PHI/ Pearson Education
4. Zheng & Akhtar, Network for Computer Scientists & Engineers, OUP
5. Black, Data & Computer Communication, PHI
6. Miller, data Communication & Network, Vikas
7. Miller, Digital & Data Communication, Jaico
8. Shay, Understanding Data Communication & Network, Vikas
Reference Books:
1. Kurose and Rose – " Computer Networking -A top down approach featuring the internet" – Pearson Education
2. Leon, Garica, Widjaja – "Communication Networks" – TMH
3. Walrand – "Communication Networks" – TMH.
4. Comer – "Internetworking with TCP/IP, vol. 1, 2, 3(4th Ed.)" – Pearson Education/PHI

FPGA & Reconfigurable Computing
EC703D
Contacts: 3L
Credits: 3

Module –I: Introduction to Reconfigurable Computing (RC)
History, State-of-the-Art and Future Trends, Computing requirements as Power, Area and VLSI scaling, Mapping of Algorithm-analysis and speed-up, RC architectures- Fine Grain and Coarse Grain, Hybrid and Embedded Architectures, Supercomputers.
5L
Module-II: Reconfigurable Logic Devices:
FPGA and its internal architecture, computing elements, LUT, BRAM, interconnects, I/O Blocks, programming of FPGA and

interfacing case study, ALU design, designing with embedded processors, introduction to Power PC and ARM processors. 6L

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

6L

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

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

Module VI: RC applications:
RC for DSP, DSP application building blocks, RC for Image processing, Bioinformatics and Network Security

5L

Text Books:

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

Reference Books:

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

Radar Engineering
EC704A
Contacts: 3L
Credits: 3

Module –I: Introduction to Radar
Historical background, radar terminology, radar band designations, Radar block diagram, radar equation: detection of signals in noise and signal-to-noise ratio, Probabilities of detection & False alarm, integration of radar pulses, radar cross section, distributed targets, Transmitted power, pulse-repetition frequency, antenna parameters & system losses, introduction to radar clutter. 6L

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

8L

Module –III: Radar signals & clutter
Basic radar measurement, theoretical accuracy of radar measurements, Range and velocity ambiguities, the ambiguity diagram, pulse compression-principles, the matched filter, chirp waveforms, Waveform design: nonlinear FM, phase codes, waveform generation and compression
Descriptions of land & sea clutter, statistical models for surface clutter, detection of targets in clutter.

10L

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

Text Books :
1. Introduction to Radar Systems-3/E , M. I. Skolnik, TataMcGrawhill

2. Principles of Modern radar system , M. H. Carpentier, Artech House

Reference Books:

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

Embedded Systems
EC704B
Contacts: 3L
Credits: 3

UNIT-I: Introduction to Embedded systems 8hrs

Embedded system overview and applications, features and architecture considerations-ROM, RAM, timers, data and address bus, Memory and I/O interfacing concepts, memory mapped I/O. CISC Vs RISC design philosophy, Von-Neumann Vs Harvard architecture, instruction set, instruction formats, and various addressing modes of 32-bit. Fixed point and floating point arithmetic operations.
Introduction ARM architecture and Cortex – M series, Introduction to the Tiva family viz. TM4C123x & TM4C129x and its targeted applications, Tiva block diagram, address space, on-chip peripherals (analog and digital) Register sets, Addressing modes and instruction set basics.

UNIT-II: Microcontroller Fundamentals for Basic Programming using TM4C processor 8hrs

I/O pin multiplexing, pull up/down registers, GPIO control, Memory Mapped Peripherals, programming System registers, Watchdog Timer, need of low power for embedded systems, System Clocks and control, Hibernation Module on Tiva, Active vs Standby current consumption. Introduction to Interrupts, Interrupt vector table, interrupt programming.
Case Study: Tiva based embedded system application bringing up the salient features of GPIO, Watchdog timer, etc.

UNIT- III :Timers, PWM and Mixed Signals Processing using TM4C processor 6hrs

Timer, Basic Timer, Real Time Clock (RTC), Timing generation and measurements, Analog interfacing and data acquisition: ADC, Analog Comparators, DMA, Motion Control Peripherals: PWM Module & Quadrature Encoder Interface (QEI).
Case Study: Tiva based embedded system application using ADC & PWM.

UNIT-IV: Serial Communication Protocols using TM4C processor 8 hrs

Synchronous/Asynchronous interfaces (like UART, SPI, I2C, USB), serial communication basics, baud rate concepts, Interfacing digital and analog external device, I2C protocol, SPI protocol & UART protocol. Implementing and programming I2C, SPI & UART interface using Tiva. CAN & USB interfaces on Tiva platform. Case Study: Tiva based embedded system application using the interface protocols for communication with external devices "Sensor Hub BoosterPack"

UNIT V Embedded networking and Internet of Things 8hrs

Embedded Networking fundamentals, Ethernet, TCP/IP introduction IoT overview and architecture, Overview of wireless sensor networks and design examples. Various wireless protocols and its applications: NFC (e.g., RF430CL330H, RF430CL331H, RF430FRL15xH), ZigBee (e.g. CC2538), Bluetooth (e.g., CC256x), Bluetooth Low Energy (e.g., CC2640), Wi-Fi (e.g. CC3100). Adding Wi-Fi capability to the Microcontroller, Embedded Wi-Fi (e.g., CC3200), User APIs for Wireless and Networking applications Building IoT applications using CC3100 user API: connecting sensor devices using Tivaware sensor library.
Case Study: Tiva based Embedded Networking Application: "Smart Plug with Remote Disconnect and Wi-Fi Connectivity"

Text Books:

1.Embedded Systems: Real-Time Interfacing to ARM Cortex-M Microcontrollers,2014, Jonathan W Valvano CreateSpace publications ISBN: 978-1463590154.
2.Embedded Systems: Introduction to ARM Cortex - M Microcontrollers, 5th edition Jonathan W Valvano, CreateSpace publications ISBN-13: 978-1477508992
3.Embedded Systems 2E Raj Kamal, Tata McGraw-Hill Education, 2011 ISBN-0070667640, 9780070667648

Other References:

1.http://processors.wiki.ti.com/index.php/HandsOn_Training_for_TI_Embedded_Processors
2.http://processors.wiki.ti.com/index.php/MCU_Day_Internet_of_Things_2013_Workshop
3.http://www.ti.com/ww/en/simplelink_embedded_wi-fi/home.html
4.RF430CL330H :
- Datasheet: http://www.ti.com/lit/ds/symlink/rf430cl330h.pdf

5.RF430CL331H:
- Datasheet: http://www.ti.com/lit/ds/symlink/rf430cl331h.pdf

6.Datasheet: RF430FRL15xH:
- Datasheet: http://www.ti.com/lit/ds/symlink/rf430frl152h.pdf
- User Guide: http://www.ti.com/lit/ug/slau506/slau506.pdf

7. CC2538:
- Datasheet: http://www.ti.com/lit/ds/symlink/cc2538.pdf

8.CC256x:
- Datasheet: http://www.ti.com/lit/ds/symlink/cc2560.pdf

9.CC2640:
- Datasheet: http://www.ti.com/lit/ds/symlink/cc2640.pdf
- User Guide: http://www.ti.com/lit/ug/swcu117f/swcu117f.pdf

10.CC3100 and CC3200: http://www.ti.com/lit/ug/swru368a/swru368a.pdf

Biomedical Instrumentation
EC704C
Contacts: 3L
Credits: 3

Module -1 (Fundamentals)

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

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

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

Module 2 (Measurement & Analysis)

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

2.2Biological 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:-

2) R S Khandpur:- Handbook of Biomedical Instrumentation (Tata –Mcgraw Hill Education) [Partly Downloadable]
3) M E Valentiniuzzi:- Understanding the Human Machine- A Primer for Bioengineering [Freely Downloadable in PDF] (World Scientific Publishing Co. Pte. Ltd, Singapore)
4) L Cornwell, F.J. Weibell & E.A. Pfeiffer:- Biomedical Instrumentation and Measurements(Prentice Hall/ Medical)
5) J G Webster & J W. Clark:- Medical Instrumentation – Application & Design (Houghton Miffin Pub)
6) J J Carr & JM Brown:- Introduction to Bio-medical Equipment Technology(Regents / Prentice Hall)
7) J Tompkins & J G Webster :-Design of Micro- controller based Medical Instrumentation (Prentice Hall Inc)

Reference Books:

1. W.B. Blesser :- A systems approach to Biomedicine (McGraw Hill.,NY)
2. J H U Brown, J E Jacobs & L Stark:- Biomedical Engineering (Davis Co, Philadelphia, USA)
3. L A Geddes & L E Baker :- Principles of Applied Biomedical Instrumentation (John Wiley & sons, NY)
4. J H Milsum:- Biological Control Systems(Mc Graw Hill, NY)
5. R Plonsey:- Bioelectric Phenomena (McGraw-Hill Co, NY)

Artificial Intelligence
EC705A
Contacts: 3L
Credits: 3

Introduction [2]

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

Intelligent Agents [2]

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

Problem Solving [2]

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

Search techniques [5]

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

Heuristic search strategies [5]

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

Adversarial search [3]

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

Knowledge & reasoning [3]

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

representation.

Using predicate logic [2]

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

Representing knowledge using rules [3]

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

Probabilistic reasoning [4]

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

Planning [2]

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

Natural Language processing [2]

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

Learning [2]

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

Expert Systems [2]

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

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

Books:

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

Robotics
EC705B
Contacts: 3L
Credits: 3

Robot Anatomy Arm Geometry-Direct & Inverse Kinematics Problem.Arm Dynamics,D Alembert Equations of Motion, Synthesis of elements with movalulity constraints,manipulations-trajectory planning,joint interpolated trajectories. [15L]

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

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

Robot Programming Language Characteristics of Robot Level & Task Level languages.Robot intelligence-State Space search, Robot

learning,Robot Task Planning,Knowledge Engineering. [10L]

References:

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

Database Management System
EC705C
Contacts: 3L
Credits: 3

Introduction [4L]
Concept & Overview of DBMS, Data Models, Database Languages, Database Administrator, Database Users, Three Schema architecture of DBMS.

Entity-Relationship Model [6L]
Basic concepts, Design Issues, Mapping Constraints, Keys, Entity-Relationship Diagram, Weak Entity Sets, Extended E-R features.

Relational Model [5L]
Structure of relational Databases, Relational Algebra, Relational Calculus, Extended Relational Algebra Operations, Views, Modifications Of the Database.

SQL and Integrity Constraints [8L]
Concept of DDL, DML, DCL. Basic Structure, Set operations, Aggregate Functions, Null Values, Domain Constraints, Referential Integrity Constraints, assertions, views, Nested Subqueries, Database security application development using SQL, Stored procedures and triggers.

Relational Database Design [9L]
Functional Dependency, Different anamolies in designing a Database., Normalization using funtional dependencies, Decomposition, Boyce-Codd Normal Form, 3NF, Nomalization using multi-valued depedencies, 4NF, 5NF

Internals of RDBMS [7L]
Physical data structures, Query optimization : join algorithm, statistics and cost bas optimization. Transaction processing, Concurrency control and Recovery Management : transaction model properties, state serializability, lock base protocols, two phase locking.

File Organization & Index Structures [6L]
File & Record Concept, Placing file records on Disk, Fixed and Variable sized Records, Types of Single-Level Index (primary, secondary, clustering), Multilevel Indexes, Dynamic Multilevel Indexes using B tree and B+ tree .
Text Books:

8. Henry F. Korth and Silberschatz Abraham, “Database System Concepts”, Mc.Graw Hill.
9. Elmasri Ramez and Novathe Shamkant, “Fundamentals of Database Systems”, Benjamin Cummings Publishing. Company.
10. Ramakrishnan: Database Management System , McGraw-Hill
11. Gray Jim and Reuter Address, “Transaction Processing : Concepts and Techniques”, Moragan Kauffman Publishers.
12. Jain: Advanced Database Management System CyberTech
13. Date C. J., “Introduction to Database Management”, Vol. I, II, III, Addison Wesley.
14. Ullman JD., “Principles of Database Systems”, Galgottia Publication.

Reference:

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

Power Electronics
EC705D
Contacts: 3L
Credits: 3

Module	Topic	Hrs
Module I	**A dvances in Power Electronics** Power Semiconductor Switches: Rectifier diodes, fast recovery diodes, Schottky barrier diode, Power	6

	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.	
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:

b) P.C. Sen, Power Electronics
c) M.H. Rashid, Power Electronics, PHI/ Pearson Education
d) C.W. Lander, Power Electronics, McGraw Hill
e) B.K.Bose, Modern Power Electronics, JAICO
f) Mohan, N Undeland, TM & Robbins, WP- Power Electronics, John Wiley & Sons

Practical

Group Discussion
HU781
Contacts: 3
Credits: 2

To be incorporated

Embedded
Systems Lab
EC709B
Contacts: 3
Credits: 2
Minimum 10 experiments

1. Interfacing and programming GPIO ports in C using Tiva (blinking LEDs , push buttons)
2. Interrupt programming examples through GPIOs
3. Use Hibernation mode and wake on RTC interrupt
4. PWM generation using PWM Module on Tiva
5. Interfacing potentiometer with Tiva GPIO
6. PWM based Speed Control of Motor controlled by potentiometer connected to Tiva GPIO
7. Connect the Tiva to terminal on PC and echo back the data using UART
8. Interfacing an accelerometer with Tiva using I2C
9. Experiment on USB (Sending data back and forth across a bulk transfer-mode USB connection.)
10. Using IQmath Library for implementing Low pass FIR filter
11. Review of User APIs for TI CC3100 & Initialization and Setting of IP addresses
12. A basic Wi-Fi application – Communication between two Tiva based sensor nodes using TIVA sensor library in TivaWare
13. Setting up the CC3100 as a HTTP server

Text Books:

1. Embedded Systems: Real-Time Interfacing to ARM Cortex-M Microcontrollers, 2014, Createspace publications ISBN: 978-1463590154.
2. Embedded Systems: Introduction to ARM Cortex - M Microcontrollers, 5th edition
Jonathan W Valvano, Createspace publications ISBN-13: 978-1477508992

Other References:

1. http://processors.wiki.ti.com/index.php/Hands-On_Training_for_TI_Embedded_Processors

2. http://processors.wiki.ti.com/index.php/MCU_Day_Internet_of_Things_2013_Workshop
3. http://www.ti.com/ww/en/simplelink_embedded_wi-fi/home.html

VLSI Design Lab
EC792
Contacts: 3
Credits: 2

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

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

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

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

Laboratory 5. Standars cell Design (3 Hrs.)

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

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

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

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

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

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

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

References:

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

RF & Microwave Engg Lab
EC793A
Contacts: 3
Credits: 2

Experiments

1. Determination of phase and group velocities in a waveguide carrying TE_{10} Wave from Dispersion diagram [$\omega-\beta$ Plot].
2. Measurement of unknown impedance using shift in minima technique using a waveguide test bench/ Measurement of the susceptance of an inductive and or a capacitive window using shift in minima technique using a waveguide test bench
3. Study of the characteristics of a Reflex Klystron oscillator
4. Study of Gunn-oscillator Characteristics using X-band waveguide test bench.
5. Measurement of coupling factor, Directivity, Insertion loss and Isolation of a Directional coupler using X-band waveguide test bench set up.
6. Scattering matrix of a magic tee / E-plane tee / H-plane tee using waveguide test bench at X-band.
7. Experimental/Simulation Study of filter (LPF, HPF,BPF) response.
8. Measuring of dielectric constant of a material using waveguide test bench at X-band.

Reference Books

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

Optical Communication & N/W Lab
EC793B
Contacts: 3
Credits: 2

Experiment with Optical fibre :
To calculate attenuation constant, bending loss and numerical aperture of optical fibre.
Experiments using LED module : Study of DC characteristics.
I-V characteristics of LED (i) using optical fibre between LED and power meter and (ii) without using optical fibre.
P-I characteristics of LED (i) using optical fibre between LED and power meter and (ii) without using optical fibre.
Experiment with fibre Optic analog link :
Input-output characteristics using long optical fibre. Calculation of attenuation per unit length of optical fibre.

Computer Networks lab
EC793C
Contacts: 3
Credits: 2

8) IPC (Message queue)
9) NIC Installation & Configuration (Windows/Linux)
10) Familiarization with
    11) Networking cables (CAT5, UTP)
    12) Connectors (RJ45, T-connector)

13) Hubs, Switches
14) TCP/UDP Socket Programming
15) Multicast & Broadcast Sockets
13. Implementation of a Prototype Multithreaded Server
16) Implementation of
    17) Data Link Layer Flow Control Mechanism (Stop & Wait, Sliding Window)
    18) Data Link Layer Error Detection Mechanism (Cyclic Redundancy Check)
    19) Data Link Layer Error Control Mechanism (Selective Repeat, Go Back N)

FPGA & Reconfigurable Computing
EC793D
Contacts: 3
Credits: 2

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

Artificial Intelligence Lab
EC795A
Contacts: 3
Credits: 2

Programming Languages such as PROLOG & LISP

Robotics Lab
EC795B
Contacts: 3
Credits: 2

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

Database management System Lb
EC795C
Contacts: 3
Credits: 2

Structured Query Language

1. Creating Database
4. Creating a Database
5. Creating a Table
6. Specifying Relational Data Types
7. Specifying Constraints
8. Creating Indexes

2. Table and Record Handling
10. INSERT statement

11. Using SELECT and INSERT together
12. DELETE, UPDATE, TRUNCATE statements
13. DROP, ALTER statements

3. Retrieving Data from a Database

7. The SELECT statement
8. Using the WHERE clause
9. Using Logical Operators in the WHERE clause
10. Using IN, BETWEEN, LIKE , ORDER BY, GROUP BY and HAVING *Clause*
11. Using Aggregate Functions
12. Combining Tables Using JOINS
13. Subqueries

4. Database Management

6. Creating Views
7. Creating Column Aliases
8. Creating Database Users
9. Using GRANT and REVOKE

Cursors in Oracle PL / SQL
Writing Oracle PL / SQL Stored Procedures

Power Electronics Lb EC795D
Contacts: 3
Credits: 2

List of Experiments:

1. Study of the characteristics of an SCR.
2. Study of the characteristics of a Triac
3. Study of different triggering circuits of an SCR
4. Study of firing circuits suitable for triggering SCR in a single phase full controlled bridge.
5. Study of the operation of a single phase full controlled bridge converter with R and R-L load.
6. Study of performance of single phase half controlled symmetrical and asymmetrical bridge converters.
7. Study of performance of step down chopper with R and R-L load.
8. Study of performance of single phase controlled converter with and without source inductance (simulation)
9. Study of performance of step up and step down chopper with MOSFET, IGBT and GTO as switch (simulation).
10. Study of performance of single phase half controlled symmetrical and asymmetrical bridge converter.(simulation)
11. Study of performance of three phase controlled converter with R & R-L load. (simulation)
12. Study of performance of PWM bridge inverter using MOSFET as switch with R and R-L load.
13. Study of performance of three phase AC controller with R and R-L load (simulation)
14. Study of performance of a Dual converter. (simulation)
15. Study of performance of a Cycloconverter (simulation)

Institute may develop experiments based on the theory taught in addition to experiments mentioned.

. **Reference books:**

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

Organisational Behaviour
HU801A
Contacts: 2L
Credits: 2

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

References:

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

Smart Antenna
EC801A
Contacts: 3L
Credits: 3

MODULE –I:

INTRODUCTION:

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

4L

MODULE –II:

SMART ANTENNAS FOR WIRELESS COMMUNICATIONS:

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

10L

MODULE –III:

ADAPTIVE PROCESSING:

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

8L

MODULE –IV:

DIRECTION OF ARRIVAL ESTIMATION (DOA) METHODS:

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

8L

MODULE –V:

IMPLEMENTATION OF SMART ANTENNA SYSTEM:

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

6L

TEXT BOOKS:

1. Smart Antenna for Wireless Communication ,
T.S.Rappaport and J.C.Liberti, Prentice Hall, 1999
2. Smart Antennas,
L.C.Godra, CRC Press, 2004
3. Adaptive Filter Theory,
S. Haykin. Prentice Hall, 1985
4. Introduction to Smart Antennas,
C.A.Balanis, Morgan and Claypool, 2007

Digital Image Processing
EC801B
Contacts: 3L
Credits: 3

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 P r o c e s s i n g . 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:
Fundamental s, 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, V ideo compression standards. [6]

Module 5
Morphological Image Processing:
Introduction, Dilation, Erosion, Opening, closing, Hit -or-miss transformation, Morphological algorithm operations on binary Images, Morphological algorithm operations on gray-scale Images. [6]

Module 6
Image Segmentation, Representation and Description: Detection of discontinuities, Edge linking and Boundary detection, Thresholding Region based segmentation, Image Representation schemes, Boundary descriptors, and Regional descriptors. [7]

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

Reference Books:
1. W. K. Pratt :- Digital Image Processing, - 2nd Edition, (John Wiley & Sons).
2. B. Chanda & D. Dutta Majumder, Digital Image Processing and Analysis, (Prentice-Hall, India)

3. M. A. Sid-Ahmed :- Image Processing- Theory, Algorithms & Architecture, (McGraw-Hill).

Satellite Communication & Remote Sensing
EC801C
Contacts: 3L
Credits: 3

Historical background, Basic concepts, Freguency allocation for satellite services, orbital & spacecraft problems, comparision of networks and services, modulation techniques used for satellite communication.(2)
Orbits- Two body problem, orbital mechanics, geostationary orbit, change in longitude, orbital maneuvers, orbital transfer, obital perturbations. (2)
Launch Vehicles- principles of Rocket propulsion, powered flight, Lauchvehicles for communication satellite (1)
RF link- noise, the basic RF link, satellite links (up and down) , optimization RF link, intersatellite link, noise temperature, Antenna temperature, overallsystem temperature, propagation factors, rain attenuation model. Tropospheric and Ionospheric EFFECT. (5)
Multiple access- FDMA, TDMA, CDMA techniques, comperision of multiple access techniques, error connecting codes.(5)
Satellite subsystems and satellite link design- AOCS, TT&C , power system, spacecraft antenna, transponder, Friis transmission equation, G/T ratio of earth station. (6)

Remote Sensing:
1. Basic of remote sensing, Electromagnetic Radiation principles, Atmospheric window, Indian satellite sensing satellite system, Active, Passive, ground based andspace based remote sensing. (3)
2. Spatial, spectral, Radiometric and temporal resolution, satellite sensors, detectors and scanning technique, FOV and error sources, Image analysis and Interpretation weather RADAR, LIDAR, acoustic sounding systems, TRMM, AURA-MLS, Megha Tropiques Alitmeter , Scatterometer, Radiometer.(9)
3. Ground based and radio oceulation techniques, spectral response of water, Sea surface temperature, wind spced, colour monitor, clouds andacrosal, water vopor, convective system, Trace gases.(7)

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

Neural Network & Applications
EC802A
Contacts: 3L
Credits: 3

Module-1
Introduction to neural networks: Human brain and models of a neuron, artificial neurons and activation functions; Learning processes: Introduction to Supervised, Unsupervised and Reinforcement Learning, Memory-based learning, Hebbian learning, competitive learning, Boltzman learning, Adaptive Linear Neuron (Adaline); [8L]

Module-2
Single-layer perceptrons: Unconstrained optimization, LMS algorithm, learning curves, perceptrons, convergence theorem, limitations of single-layer perceptrons; Multi-layer perceptrons: Back-propagation algorithm, XOR problem, feature detection, accelerated convergence of back-propagation algorithm, limitations; [8L]

Module-3
Radial Basis function networks: Theorems on separability of patterns, interpolation problem, regularization theory and regularization networks, generalized RBF, approximation properties of RBF, Wavelet Neural Network, comparison of RBF and back-propagation; [6L]

Module-4
Associative Memory Networks: Training Algorithm for Pattern Association-Hebb Rule, Bidirectional Associative Memory, Hopfield Networks- Continuous and Discrete, Hamming Network;
Self- Organizing maps: Feature mapping models, SOM algorithm, learning vector quantization, adaptive vector quantization; Stochastic machines: Statistical mechanics, Markov chains, Simulated annealing, Gibbs sampling, Boltzman machine, Sigmoid belief networks; [10L]

Module-5

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

Text Books:

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

Reference Books:

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

Material Science & Engineering
EC802B
Contacts: 3L
Credits: 3

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

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

Magnetic Properties : Elementary ideas of classification of magnetic materials – Diamagnetism, Paragnetism, Ferrognetism, Ferrimagnetism, Magnetic Domains. [2]

Superconductors : Basic concepts of superconductivity, Transition temperature, Meissner effect High-T superconductors, Haed and Soft Materials, SQUID. [3]

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

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

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

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

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

Books:

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

Renewable Energy
EC802C
Contacts: 3L
Credits: 3

Classification of Energy Sources (2)
Advantages of Non Conventional Energy Sources over Conventional Sources Economics, Impact on Environment
Electricity Generation from Non Conventional Energy Sources:

Solar Energy: (12)
Solar radiation and its Characteristics, Solar Collector: flat Plate, focusing, Solar Energy use for water heating, Solar thermal power generation, Hybrid solar power
Principle of energy conversion in solar cells, Photovoltaics, Different types of PV Cells, Mono-poly crystalline and amorphous Silicon solar cells. Design of PV array. Efficiency and cost of PV systems.
Wind Energy: (7)
Wind as energy source, Design of Wind turbine, Selection of site of Wind farm, characteristics of different types of wind generators used with wind turbines
Hydel Energy: (2)
Electricity generation from micro hydel plants, location, auxiliaries and associated problems.
Bio Energy: (4)
Resources and conversion process: bio gas conversion, bio gas plant, bio mass gasifier. co generation
Bio diesel; (2)
Sources, usability and advantages over mineral product,
Tidal Energy: Principle, selection of site, Economics and future prospect (2) Wave Energy: Principle , selection of site and future prospect (2)
Geo thermal Energy: Principle , location , economics and prospect (2)
Fuel Cells: (5)
Principle of fuel cells, Different types of fuel cells, advantages and limitations
Magneto hydrodynamics energy conversion: (2)
Principle, Economics and environmental aspect of MHD generation

Audio & Speech Processing
EC802D
Contacts: 3L
Credits: 3

Objective: The course p rovides 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 d o m i n a n t features o f 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 :

14. B.Gold & N.Morgan :- Speech & Audio Signal Processing -*Processing and Perception of Speech & Music* (Wiley Student edition)
15. L.R. Rabiner & B.H.Juang :- Fundamentals of Speech Recognition (Prentice-Hall Signal Processing series)
16. B.Plannerer : An Introduction to Speech Recognition [Freely downloadable e-Book]

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

Reference Books :

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

Practical

Design Lab
Contacts: 6L
Credits: 4

Objective: To impart the essential knowledge of electronic circuit design and fault analysis, to enhance hands on experience and to encourage innovativeness.

Modus operandi: The subject will be a sessional subject so that students can employ all their resources in order to excel.

Total 18 designs have been indicated in the syllabus classified in 4 groups. Each student has to complete at least 8 designs in a semester taking two from each group.

At the end of the semester, the student will be interviewed by a panel of examiners, constituted by the head of the department/institution.

Guidelines: Each design given in the syllabus indicates the basis. On this basis, the teacher will prepare an exact design problem with specified parameters and assign to the student.

Objective of the job in brief is also given in the syllabus. As such the teacher can further elaborate or specialize the problem creating enough room for the student to learn and innovate.

If same job is assigned to more than one student/group, it must be with different parameter values.

The students will find their own design solutions with minimum input from the teacher. Of course there can be more than one solution but the student should ultimately know their comparative merits/demerits.

The hardware assembly and testing has to be done only during assigned class hours under general supervision of a teacher. The student must always make a comparative study between the theoretical and measured performance parameters and analyze their causes.

At the end of each job, the student will prepare a report including detail technical specification of his design, circuit diagram, design calculations, theoretical & measured values, graphs, references etc.

Scoring: The total score of 100 will be in two parts, e.g. a) continuous evaluation-60 and b) semester end viva-40.

A full mark of 10 is allotted to each job. At the end of each job, the teacher will evaluate the performance on the basis of initiative, innovativeness, speed and insight. The sum of 6 such evaluations will make the total for continuous evaluation.

At end semester, each student will be interviewed to assess his expertise in various facets of electronic design, and a score out of 40 will be allotted.

A. DISCRETE ANALOG CIRCUITS.

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

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

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

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

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

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

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

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

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

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

B. OPAMP BASED ANALOG CIRCUITS

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

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

2. Adder and subtractor.

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

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

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

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

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

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

(To learn designing 555 based timer circuits.)

DIGITAL LOGIC CIRCUITS

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

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

2. Design and implement a 4-digit frequency counter with a clock generator.
(To learn designing a digital circuit using available standard gate, FF, counter and display Ics.)

3. Designing logic circuits using multiplexers, demultiplexers and gates to implement logic functions.
(To learn the use multiplexers and demultiplexers)

4. Design and implement a sequence detector.
(To learn designing a sequential circuit, whose output is 1 or 0 when any input bit is preceded or succeeded by a predefined binary sequence. To define the input & output sequence from a given physical problem, to prepare a state diagram, derive a minimal state table, to find the simplified state equation, to implement the same & verify the result)

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

D. Power Electronics

1. Design a Single-phase full & shaft controlled converter.
2. Design of Microprocessor based Triggering socket.