Syllabus for B.Tech(ECE) Second Year

Revised Syllabus of B.Tech in ECE (To be followed from the academic session, July 2011, i.e. 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**

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SEMESTER - III

Theory

NUMERICAL METHODS
Code : M(CS) 301
Contacts : 2L+1T
Credits :2

Approximation in numerical computation: Truncation and rounding errors, Fixed and floating-point arithmetic, Propagation of errors. (4)

Interpolation: Newton forward/backward interpolation, Lagrange's and Newton's divided difference Interpolation. (5)

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

Numerical solution of a system of linear equations:
Gauss elimination method, Matrix inversion, LU Factorization method, Gauss-Seidel iterative method. (6)

Numerical solution of Algebraic equation:
Bisection method, Regula-Falsi method, Newton-Raphson method. (4)

Numerical solution of ordinary differential equation: Euler's method, Runge-Kutta methods, Predictor-Corrector methods and Finite Difference method. (6)

Text Books:

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

References:

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

MATHEMATICS

Code: M 302

Contacts: 3L +1T = 4

Credits: 4

Note 1: The entire syllabus has been divided into four modules.
Note 2: Structure of Question Paper
There will be two groups in the paper:

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

Group B: Five questions, each carrying 10 marks, are to be answered out of (at least) 8 questions.
Students should answer at least one question from each module.
[At least 2 questions should be set from each of Modules II & IV.

At least 1 question should be set from each of Modules I & III. Sufficient questions should be set covering the whole syllabus for alternatives.]

Module I: Fourier Series & Fourier Transform [8L]
Topic: Fourier Series:
Sub-Topics: Introduction, Periodic functions: Properties, Even & Odd functions: Properties, Special wave forms: Square wave, Half wave Rectifier, Full wave Rectifier, Saw-toothed wave, Triangular wave. (1)
Euler's Formulae for Fourier Series, Fourier Series for functions of period 2π, Fourier Series for functions of period $2l$, Dirichlet's conditions, Sum of Fourier series. Examples. (1)
Theorem for the convergence of Fourier Series (statement only). Fourier Series of a function with its periodic extension. Half Range Fourier Series: Construction of Half range Sine Series, Construction of Half range Cosine Series. Parseval's identity (statement only). Examples. (2)

Topic: Fourier Transform:
Sub-Topics: Fourier Integral Theorem (statement only), Fourier Transform of a function, Fourier Sine and Cosine Integral Theorem (statement only), Fourier Cosine & Sine Transforms. Fourier, Fourier Cosine & Sine Transforms of elementary functions. (1)

Properties of Fourier Transform: Linearity, Shifting, Change of scale, Modulation. Examples. Fourier Transform of Derivatives. Examples. (1)

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

Module II : Calculus of Complex Variable [13L]

Topic: Introduction to Functions of a Complex Variable.

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

Analytic functions, Cauchy-Riemann Equations (statement only). Sufficient condition for a function to be analytic. Harmonic function and Conjugate Harmonic function, related problems. (1)

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

Topic: Complex Integration.

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

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

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

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

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

Sub-Topics: Zero of an Analytic function, order of zero, Singularities of an analytic function. Isolated and non-isolated singularity, essential singularities. Poles: simple pole, pole of order m.
Examples on determination of singularities and their nature. (1)

Residue, Cauchy's Residue theorem (statement only), problems on finding the residue of a given function, evaluation of definite integrals: $\int_0^{\infty} \frac{\sin x}{x} dx$, $\int_0^{2\pi} \frac{d\theta}{a + b\cos\theta + c\sin\theta}$, $\oint_C \frac{P(z)}{Q(z)} dz$ (elementary cases, P(z) & Q(z) are polynomials of 2nd order or less). (2)

Topic: Introduction to Conformal Mapping.

Sub-Topics: Concept of transformation from z-plane to w-plane. Concept of Conformal Mapping. Idea of some standard transformations. Bilinear Transformation and determination of its fixed point. (1)

Module III: Probability [8L]
Topic: Basic Probability Theory
Sub-Topics: Classical definition and its limitations. Axiomatic definition.
Some elementary deduction: i) P(O)=0, ii) $0 \le P(A) \le 1$, iii) P(A')=1-P(A) etc. where the symbols have their usual meanings. Frequency interpretation of probability. (1)

Addition rule for 2 events (proof) & its extension to more than 2 events (statement only). Related problems. Conditional probability & Independent events. Extension to more than 2 events (pairwise & mutual independence). Multiplication Rule. Examples. Baye's theorem (statement only) and related problems. (3)

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

Some important discrete distributions: Binomial & Poisson distributions and related problems.
Some important continuous distributions: Uniform, Exponential, Normal distributions and related problems. Determination of Mean & Variance for Binomial, Poisson & Uniform distributions only.
(2)

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

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

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

Sub-Topics:
PDE I: One dimensional Wave equation. (2)
PDE II: One dimensional Heat equation. (2)
PDE III: Two dimensional Laplace equation. (2)

Topic: Introduction to series solution of ODE.

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

Topic: Bessel's equation.

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

Topic: Legendre's equation.

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

TOTAL LECTURES : 42

Text Books:

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

References:

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

CIRCUIT THEORY & NETWORKS

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

Module	Content	Hrs
1.	**a) *Resonant Circuits***: Series and Parallel resonance [1L], (*) ***Impedance and Admittance Characteristics, Quality Factor, Half Power Points, Bandwidth [2L], Phasor diagrams, Transform diagrams [1L], Practical resonant and series circuits, Solution of Problems [Tutorial - 1L]***. **b) Mesh Current Network Analysis**: Kirchoff's Voltage law, Formulation of mesh equations [1L], Solution of mesh equations by Cramer's rule and matrix method [2L], Driving point impedance, Transfer impedance [1L], Solution of problems with DC and AC sources [1L].	4 6
2.	**a) Node Voltage Network Analysis**: Kirchoff's Current law, Formulation of Node equations and solutions [2L], driving point admittance, transfer Admittance [1L], Solution of problems with DC and AC sources [1L]. **b) Network Theorems**: Definition and Implication of Superposition Theorem [1L], Thevenin's theorem, Norton's theorem [1L], Reciprocity theorem, Compensation theorem [1L], maximum Power Transfer theorem [1L], Millman's theorem, Star delta transformations [1L], Solutions and problems with DC and AC sources [1L].	4 6
3.	***Graph of Network***: Concept of Tree and Branch [1L], tree link, junctions, ***(*) Incident matrix, Tie set matrix [2L], Determination of loop current and node voltages [2L]***. **Coupled Circuits**: Magnetic coupling, polarity of coils, polarity of induced voltage, concept of Self and mutual inductance, Coefficient of coupling, Solution of Problems. **Circuit transients**: DC transients in R-L and R-C Circuits with and without initial charge, ***(*) R-L-C Circuits, AC Transients in sinusoidal R-L, R-C and R-L-C Circuits, Solution of Problems [2L].***	4 4 2
4.	**Laplace transform**: Concept of Complex frequency [1L], transform of f(t) into F(s) [1L], transform of step, exponential, over damped surge, critically damped surge, damped and un-damped sine functions [2L], properties of Laplace transform [1L], linearity, real differentiation, real integration, initial value theorem and final value theorem [1L], inverse Laplace transform	8

	[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.	4

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

Problems for Module 1a:

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

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

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

Problems for Module 1b and 2:

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

See Annexure-1 for the figures

Problems for Module- 2a:

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

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

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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.

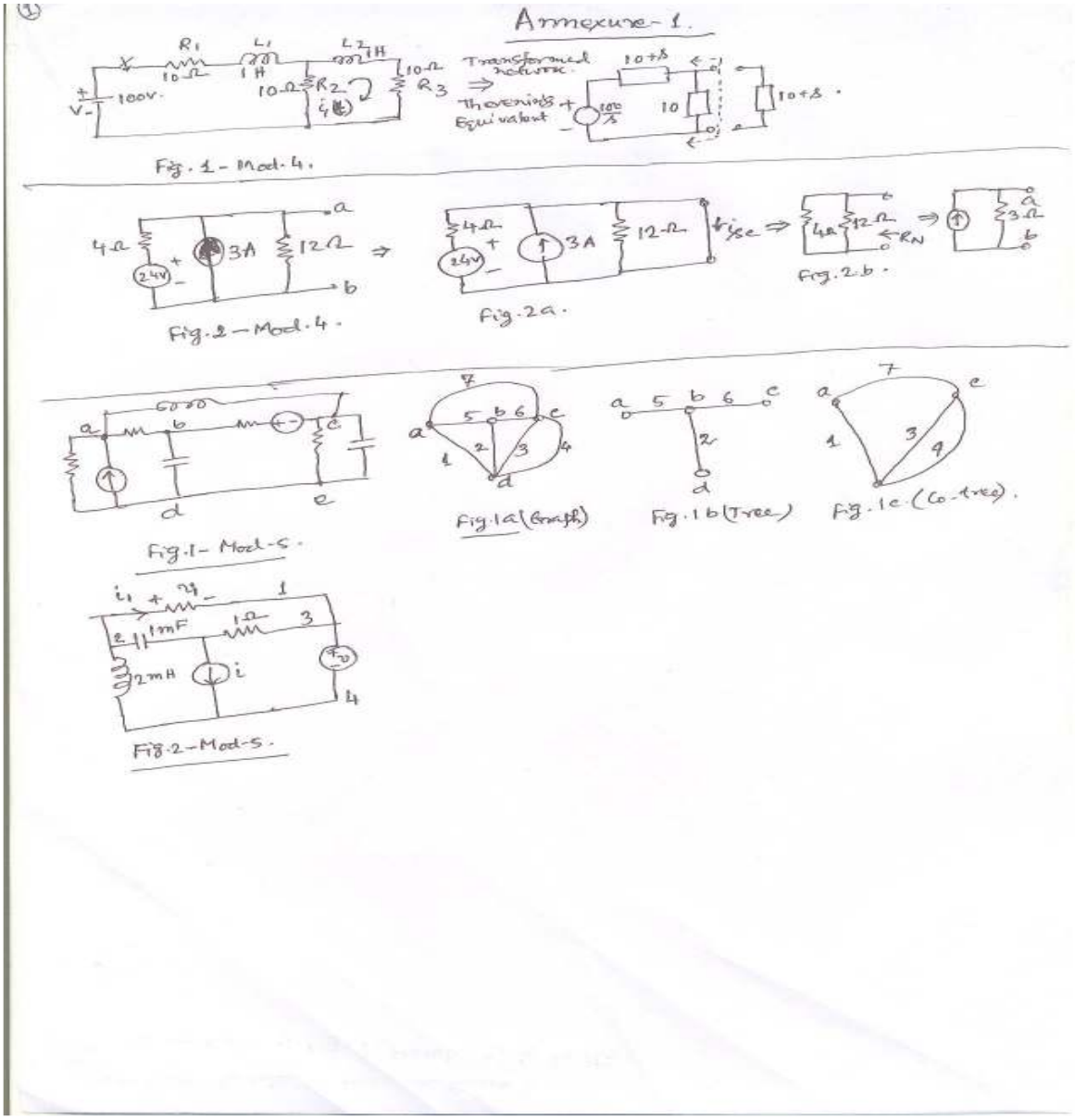
Tutorials: (*):Bold and Italics.

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, "A Text Book of Network Theory & Circuit Analysis",Cyber Tech

12. Reza F. M. and Seely S., "Modern Network Analysis", Mc.Graw Hill .

13. M. H. Rashid: "Introduction to PSpice using OrCAD for circuits and electronics", Pearson/PHI

14. Roy Choudhury D., "Networks and Systems", New Age International Publishers.

15. D.Chattopadhyay and P.C.Rakshit: "Electrical Circuits" New Age

SOLID STATE DEVICES

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

Module - 1: Energy Bands and Charge Carriers in Semiconductors- Energy-band (E-k) diagram, effective mass, wave vector, Debye length, Direct & indirect band-gap semiconductors; Carrier distribution, Fermi-level, Intrinsic & Extrinsic semiconductors, Non-equilibrium in carrier distribution; drift, diffusion, scattering; Piezo & Hall effects. **[8]**
Details: [Recapitulation of Conductor, Insulator & Semiconductor with special emphasis on the concept of energy bands and band-gaps, E-k diagrams for direct and indirect band-gap semiconductors ***(1L)***];
Concept of the effective mass & crystal momentum, concept of wave-vector 'k'; Intrinsic & extrinsic semiconductors, idea about degeneracy and non-degeneracy. ***(2L)***
Carrier concentration in terms of bulk Density of states and Fermi-Dirac distribution (no derivation, expression and significance only); Concept of Fermi level, F.L. shift with doping & temperature; ***(2L)***
Non-equilibrium condition: Drift & diffusion of carriers with simple expressions; Hall effect & Piezo-electric effect, Carrier scattering (basic idea only). Generation and re-combination, quasi-Fermi energy level (concept only) ***(3L)***

Module - 2: Rectifier and detector diodes: P-N junction & Schottky junction physics, I-V relation, Junction capacitances, Diode switching, Optical devices & Solar cells, Tunnel diode. **[10]**
Details: Homo- and Hetero-junctions – examples of semiconductor-semiconductor junction (Homo) & Metal-metal, Metal-S.C. junctions (Hetero-) ***(1L);***
[Recapitulation of the rectifying properties of these two types of junctions***;***] Homo-junction – Semiconductor-semiconductor p-n junction & rectification (recapitulation) ***(1L);*** Plot of junction voltage, field and depletion charge with distance by solving simple 1D Poisson's Equation (Gradual Channel & Depletion Approximations) ***(1L);*** Schottky contact & Schottky diode ***(1L);*** Junction capacitances in p-n diodes (recapitulation) and their expressions; Application of Diode capacitance in Varactor Diodes ***(1L);*** Derivation for Forward and Reverse current, piece-wise linear diode-characteristics, concept of Diode resistance & Differential diode resistance, ***(1L)***; Diode switching & diode switch, properties of rectifier and switching diodes ***(1L);*** Importance of reverse current in optical detectors, photo-diodes, solar cells ***(1L);*** Spontaneous emission & Stimulated emission - optical devices (basic idea only) ***(1L).***], Tunnel diode -(basic principle only - importance of negative resistance) ***(1L).***

Module - 3: Bipolar Junction Transistors: Physical mechanism, current gain, minority current distribution; Punch-through and avalanche effect; High voltage and high power transistors; Frequency limitations, high frequency transistors, Power transistors. **[8]**

Details: [Emphasis on BJT as a current controlled device, amplification property of BJT ***(1L);*** I-V characteristics (input & output) with derivation, input & output characteristics for CB. CE & CC mode, current amplification factors α for CB mode and β for CE mode ***(2L)***; Eber's Moll model for Static behaviour & Charge controlled model (without derivation) for dynamic behaviour, equivalent circuits. ***(2L)***; Basic idea about Photo-transistors & Power transistors (only their features Vis-à-vis the ordinary transistors) ***(1L);*** PNPN transistors - simple working principle, I-V characteristics, triggering, mention of Triacs, Diacs & Thyristors. ***(2L)***]

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

Details: [Concept of Field effect device (recapitulation), channel modulation & channel isolation ***(1L)***;] JFET - behaviour, characteristics ***(1L)***; MOSFET - channel inversion, Ideal Threshold voltage ***(1L),*** MOS capacitances, depletion width, surface field and potential (by solving Poisson's equation with gradual channel & depletion approximations) ***(2L);*** Real MOSFET & Threshold voltage for real MOSFET, ***(1L)***; I-V characteristics with expressions for saturation and non-saturation regions (concepts but no detail derivations, empirical relations to be used for solving problems) ***(1L)***; Equivalent circuit for MOSFET ***(1L)***; MOSFET for VLSI - scaling issues (basic concept of Short Channel Effects only) ***(1L)***;]

Text Books :

Neamen- Semiconductor Physics and Devices TMH
Bhattacharya & Sharma- Solid State Electronic Devices- Oxford
Maini & Agrawal- Electronics Devices and Circuits- Wiley

Reference Books :

Milman, Halkias & Jit- Electronics Devices and Circuits- TMH
Bell-Electronics Devices and Circuits-Oxford
Bhattacharya & Sharma- Solid State Electronic Devices- Oxford
Singh & Singh- Electronics Devices and Integrated Circuits –PHI
Bogart, Bisley & Rice- Electronics Devices and Circuits- Pearson
Kasap-Principles of Electronic Materials and Devices- TMH
Boylestad & Nashelsky- Electronics Devices and Circuit Theory- Pearson
Salivahanan, Kumar & Vallavaraj- Electronics Devices and Circuits- TMH

Learning Outcome:

Module - 1: Student gains the ability to ***identify semiconductors*** which are elemental or compound type; Direct and indirect band-gap type so that they may be used in optical and non-optical devices; this empowers the student ***to explain the importance of Fermi level*** in identifying intrinsic and extrinsic n- and p-type semiconductors, to predict how Fermi-level changes with doping; ***identify degenerate and non-degenerate*** semiconductors; indicate the ***effect of temperature on carrier concentration***.

Module - 2: Focus is on understanding the junction phenomena including alignment of Fermi-level at the interface of a p-n junction and Schottky junction, and its non-alignment due to the application of junction potential. The student will be able to ***draw the I-V characteristics***; acquire the ability ***to evaluate the dependence*** of ***reverse saturation (drift) current on minority carrier concentration and forward diffusion component on potential barrier***; the student will ***calculate the junction capacitances*** and ***compare the switching capability*** of the minority carrier p-n diode with the majority carrier based Schottky diode; to highlight the importance of peak-inverse voltage for a diode and compare the peak inverse voltages of Si and Ge diodes.

Practical ability: Diode specification; Diode numbers and lead specification; Drawing diode characteristics and calculation of differential resistance; load-line analysis of simple diode circuits. [To be practiced in the laboratory]

Module - 3: The student will appreciate the importance of varying the reverse saturation current across the reverse biased base-collector junction by varying the minority carrier concentration using electrical means i.e. forward biased emitter-base junction; acquire the ability ***to treat the BJT as a two port device*** and ***explain transistor action*** for output current control by changing input current; The student will be able ***to use CE, CB and CC modes*** for different applications and ***design biasing circuits*** with BJTs.

Practical ability [For Laboratory Practice]: Transistor lead testing and transistor testing; Transistor biasing for different classes of amplifiers; [To be practiced in the laboratory]

Module - 4: Ability ***to calculate the threshold voltages*** for different MOSFETs; ability to ***compute the effect of Gate voltages on the junction capacitances***; ability ***to bias MOSFETs and JFETs***.

Practical ability [For Laboratory Practice]: JFET and MOSFET specifications; Biasing of FETs. [To be practiced in the laboratory]

SIGNALS AND SYSTEMS

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

Pre requisite: First year courses (semester I & II) covering

(1) Concepts in electrical and electronics circuits (Basic Electrical and Electronics Engg I & II).

(2) Knowledge in algebra and calculus with problem solving capability (studied in Mathematics-I).

(3) Fundamental concepts on Laplace Transformation (studied in Mathematics-II)

(4)

Genesis: The scope of this paper is to introduce a panoramic view of signals & systems so that the students may understand the basic concepts of various systems and signal processing and the way the signals interact with the physical systems. This understanding is not only the prerequisite to study the subject DSP (to be introduced in the higher semester), but also crucial for understanding fundamental concepts in communication engineering in general and to some extent for other upcoming subjects such as control engineering and circuit analysis/ synthesis.

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

Module No	Topic	Hrs
3.	**Introduction to signal and systems**: Continuous and discrete time signals: Classification of Signals – Periodic aperiodic even – odd – energy and power signals – Deterministic and random signals – complex exponential and sinusoidal signals – periodicity –unit impulse – unit step – Transformation of independent variable of signals: time scaling, time shifting. System properties: Linearity, Causality, time invariance and stability. Dirichlet's conditions, Determination of Fourier series coefficients of signal.	8
4.	**Signal Transformation**: Fourier transformation of continuous and discrete time signals and their properties. Laplace transformation- analysis with examples and properties. Parseval's theorem; Convolution in time (both discrete and continuous) and frequency domains with magnitude and phase response of LTI systems.	8
5.	**Laplace Transform:** Recapitulation, Analysis and characterization of LTI systems using Laplace transform: Computation of impulse response and transfer function using Laplace transform.	2
6.	**Sampling Theorem**: Representation of continuous time signals by its sample –Types of sampling, Sampling theorem. Reconstruction of a Signal from its samples, aliasing –sampling of band pass signals.	4
7.	**Z-Transforms:** Basic principles of z-transform - z-transform definition –, Relationship between z-transform and Fourier transform, region of convergence – properties of ROC – Properties of z-transform – Poles and Zeros – inverse z-transform using Contour integration - Residue Theorem, Power Series expansion and Partial fraction expansion	6
8.	**Random Signals & Systems:** Definitions, distribution & density functions, mean values & moments, function of two random variables, concepts of correlation, random processes, spectral densities, response of LTI systems to random inputs.	4

Total: 32 hrs

Text Books:

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

References:

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

ANALOG ELECTRONIC CIRCUITS

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

Module-1: [10]

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

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

Module -2: [10]

1. Transistor Amplifiers: RC coupled amplifier, functions of all components, equivalent circuit, derivation of voltage gain, current gain, input impedance and output impedance, frequency response characteristics, lower and upper half frequencies, bandwidth, and concept of wide band amplifier. [6]
2. Feedback Amplifiers & Oscillators: Feedback concept, negative & positive feedback, voltage/ current, series/shunt feedback, Berkhausen criterion, Colpitts, Hartley's, Phase shift, Wein bridge and crystal oscillators. [4]

Module -3: [10]

1. Operational Amplifier: Ideal OPAMP, Differential Amplifier, Constant current source (current mirror etc.), level shifter, CMRR, Open & Closed loop circuits, importance of feedback loop (positive & negative), inverting & non-inverting amplifiers, voltage follower/buffer circuit. [6]
2. Applications of Operational Amplifiers: adder, integrator & differentiator, comparator, Schmitt Trigger. Instrumentation Amplifier, Log & Anti-log amplifiers, Trans-conductance multiplier, Precision Rectifier, voltage to current and current to voltage converter, free running oscillator. [6]

Module -4: [8]

1. Power amplifiers – Class A, B, AB, C, Conversion efficiency, Tuned amplifier [4]
2. Multivibrator – Monostable, Bistable, Astable multivibrators; Monostable and astable operation using 555 timer. [2]
3. Special Functional Circuits: VCO and PLL. [2]

Total: 40 hrs

Text Books:

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

Reference Books:

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

Tutorial Guidance:

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

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

Outcome of learning: Students will be able to design, test and examine simple circuits with transistor, op-amp,

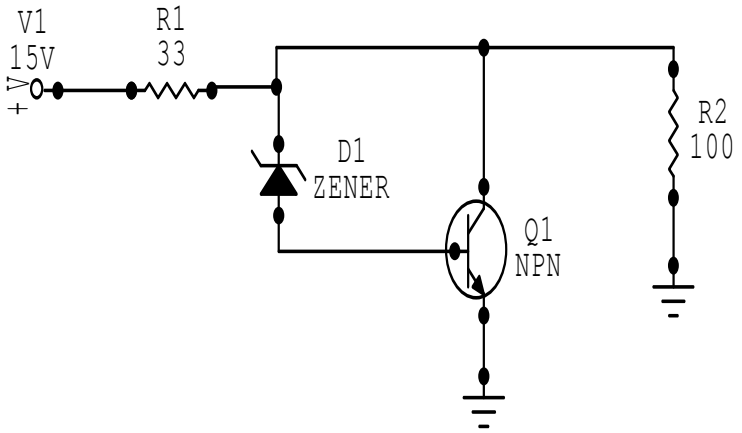
amplifiers, oscillators etc. They will be able to test, repair, modify and take-up design exercise. They will have clear knowledge of basic circuit analysis and its functions and their limitations. Most importantly they will be able to recognize, understand, modify and repair majority of circuits used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

Module:1 Filter and regulator

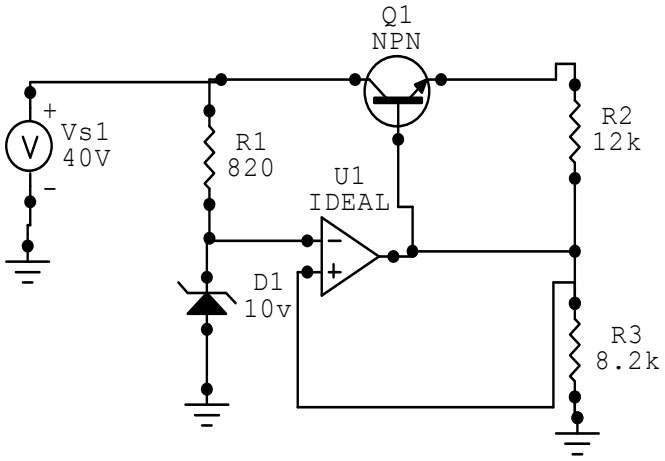
Topic	Reference book (optional)
Capacitor filter, Π section filter ripple factor, series and shunt voltage regulator, percentage regulator, 78xx and 79xx series, concepts of smps	Linear integrated circuits-D.Roy Choudhury, Shail B. Jain(Chapter 6&7) Electronic Devices and Circuit Theory-Boylested Chapter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

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

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



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



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

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

Moudule-2 : Transistor Biasing and stability

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

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

(1)Find the Q point of a self–bias transistor circuit with the following specification:- Vcc= 22.5 volt, R_L= 5.6 KΩ,R_E= 1 KΩ ,R_1= 90 KΩ, R_2= 10 KΩ V_{BE}=0.7 volt and β=55 Assume $I_b >> I_{c0}$

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

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

Module -3: Transistor Amplifiers:

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

Assignment:

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

Module – 4: Feed back Amplifier and Oscillator

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

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

1. An Hartley oscillator is designed with L_1 = 20 μH, L_2 = 2 mH and a variable capacitance. Determine the range of capacitance values if the frequency is varied between 950 and 2050 Khz.
2. A Colpitts oscillator is designed with C_2 = 100pf and C_1 = 7500pf. The inductance is variable. Determine the range of inductance values, if the frequency of oscillator is vary between 0.950 and 2050

Khz

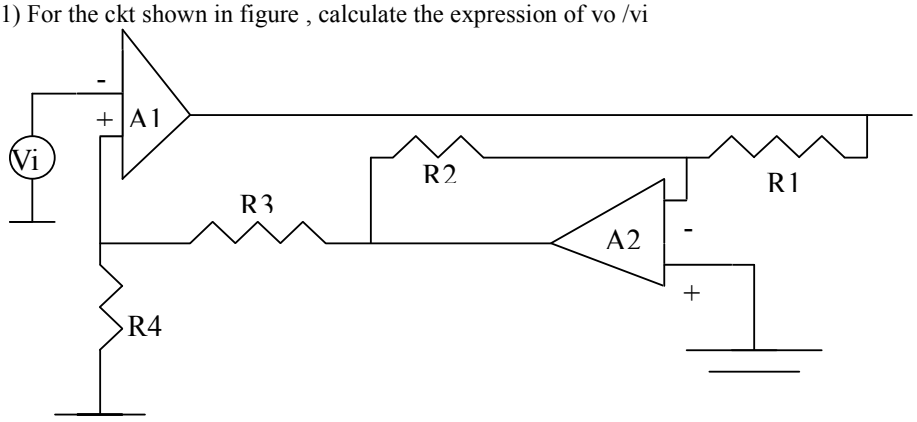
3. In an RC phase shift oscillator, if its frequency of oscillation is 955 Hz and $R_1 = R_2 = R_3 = 680$ KΩ, Find the value of capacitors.
4. In the Wein –Bridge oscillator, if the RC network consists of resistance of 200 KΩ and the capacitance of 300pf, find its frequency of oscillation.
5. A crystal has the following parameters: L = 0.33 H, C_1= 0.065 pf, C_L 1.0 pf and R = 5.5 KΩ. Find the series resonant frequency and Q factor of the crystal.
6. The open loop gain of an amplifier is -200. A voltage series negative feed back is used with a feed back ratio of -0.02. The input and the output impedance of the amplifier are 2 KΩ and 40 KΩ, respectively in the absence of feedback. Determine the closed loop gain, and the input and the output impedance when the feed back circuit is completed.

Module: 5 Operation Amplifier:

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

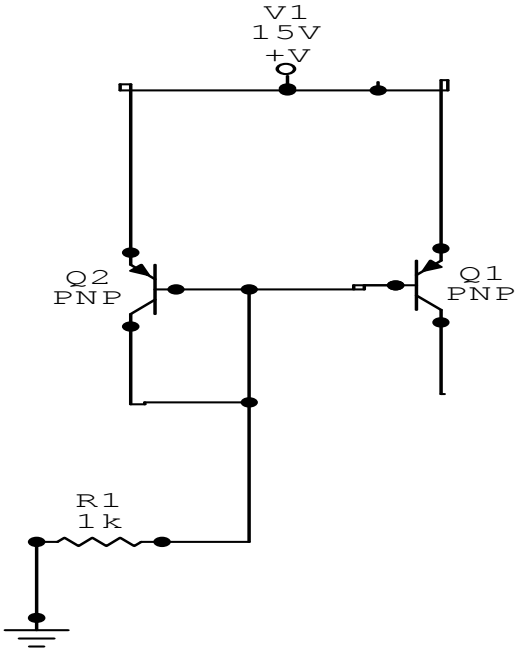
Assignment: (These are typical examples, indicative of the type of problems to be set for tutorials.)

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



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

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

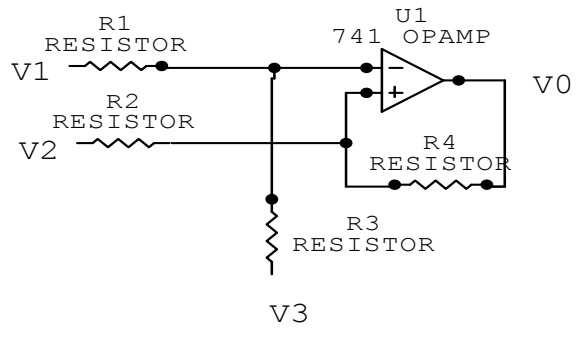


Module:6 Application of operational amplifier

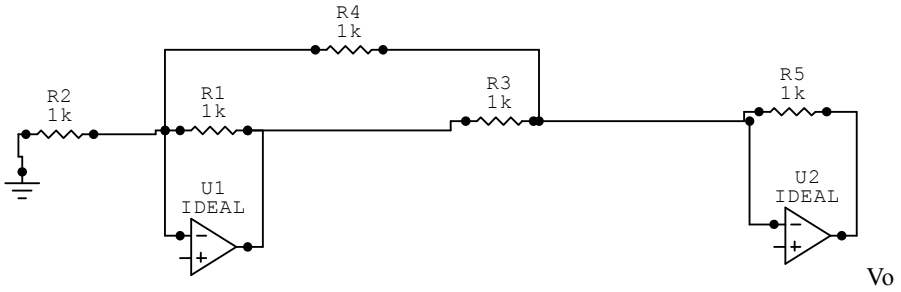
Topic	Reference: book(optional)
Adder.Integrator,differentiator,comparator,schimit trigger, instrumentation amplifier, log& anti log amplifier,Transconductance multiplier, precision rectifier, v to I and I to v converter, free running oscillator	Linear integrated circuits-D Roy choudhury, shail B.Jain

Assignment:

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

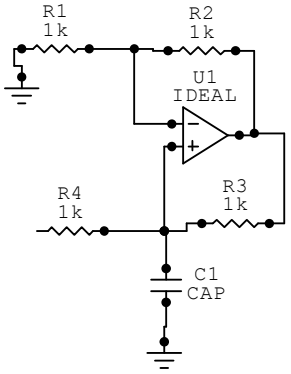


(2) For the instrumentation amplifier shown in figure, verify that Vo= (1+R2/R1+2R2/R1) (V2-V1)



[note- R1=R3, R2=R5]

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



Module: 7 power Amplifier
Assignment:

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

Module: 8 Multivibrator
Assignment:

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

Module: 9 Special Functional Circuit

1. In the VCO, calculate the change in output Frequency if the supply voltage is varied between 9 volt and 11 volt. Assume V_{CC}= 12V, R_T= 6.8 KΩ, C_T= 75$P_{F,}$ and R1= 15 KΩ, and R2= 100 KΩ.
2. Determine the dc control voltage Vc at lock if signal frequency fs=10$KH_{Z,}$ VCO free running frequency is 10.66$KH_{Z,}$ and the voltage to frequency transform coefficient of VCO is 6600H_Z/V.

3. Calculate the output frequency f_o, lock range Δf_L, and capture range Δfc of a 565 PLL if R_T= 10 KΩ, C_T= 0.01μF, and C= 10μF.

Reference Book(optional)

a) Linear Integrated Circuit:---------D.Roy Choudhary
S.B. Jain (Chapter-9)
b) Electronics Devices and Circuit Theory: ---------- Boylestad & Nashelshy.
c) Electronics Devices and Circuits: --------- Salivahanan,N.S.Kumar

Practical Detailed manuals will be uploaded later.

NUMERICAL METHODS
Code : M(CS) 391
Credits :1

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

Circuits and Networks Laboratory
Code: EC391

Contacts: 3P

Credits: 2

1. Characteristics of Series & Parallel Resonant circuits
2. Verification of Network Theorems
3. Transient Response in R-L & R-C Networks ; simulation / hardware
4. Transient Response in RLC Series & Parallel Circuits & Networks ; simulation / hardware
5. Determination of Impedance (Z), and Admittance (Y) parameters of Two-port networks
6. Generation of periodic, exponential, sinusoidal, damped sinusoidal, step, impulse, and ramp signals using MATLAB
7. Representation of Poles and Zeros in s-plane, determination of partial fraction expansion in s-domain and cascade connection of second-order systems using MATLAB
8. Determination of Laplace Transform, different time domain functions, and Inverse Laplace
9. Transformation using MATLAB

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

Solid State Devices Laboratory
Code: EC392

Contacts: 3P

Credits: 2

Perform any four experiments:
Ex 1: Study input characteristics of BJT in common-emitter configuration.

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

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

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

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

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

Module 2:

Perform any two experiments

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

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

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

Signals and Systems Laboratory
Code: 393

Contacts: 3P

Credits: 2

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

Analog Electronic Circuits Laboratory

Code:EC394.

Contacts: 3P

Credits: 2

Any 8 experiments. A College has to design a new design oriented experiment.

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

SEMESTER - IV

Theory

VALUES & ETHICS IN PROFESSION

HU-401
Contracts:3L
Credits- 3

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

Effects of Technological Growth:

Rapid Technological growth and depletion of resources, Reports of the Club of Rome. Limits of growth: sustainable development
Energy Crisis: Renewable Energy Resources
Environmental degradation and pollution. Eco-friendly Technologies. Environmental Regulations, Environmental Ethics
Appropriate Technology Movement of Schumacher; later developments
Technology and developing notions. Problems of Technology transfer, Technology assessment impact analysis.
Human Operator in Engineering projects and industries. Problems of man, machine, interaction, Impact of assembly line and automation. Human centered Technology.

Ethics of Profession:

Engineering profession: Ethical issues in Engineering practice, Conflicts between business demands and professional ideals. Social and ethical responsibilities of Technologists. Codes of professional ethics. Whistle blowing and beyond, Case studies.

Profession and Human Values:

Values Crisis in contemporary society
Nature of values: Value Spectrum of a good life
Psychological values: Integrated personality; mental health
Societal values: The modern search for a good society, justice, democracy, secularism, rule of law, values in Indian Constitution.
Aesthetic values: Perception and enjoyment of beauty, simplicity, clarity
Moral and ethical values: Nature of moral judgements; canons of ethics; ethics of virtue; ethics of duty; ethics of responsibility.

Books:

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

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

Module 1:

Vector Calculus:

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

Module 2 :

Electricity

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

5L

2.2 Dielectrics-concept of polarization, the relation $D=\varepsilon_0 E+P$, 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

Module-1: [10]
Electromagnetic Theory:

Vector calculus – orthogonal Coordinate Systems, Transformations of coordinate systems; Del operator; Gradient, Divergence, Curl – their physical interpretations; Laplacian operator. [4]

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 [6]

Module-2: [8]
Faraday's law & Lenz's law, Displacement Current, J C – J D Relation, Maxwell's equations, Time- harmonic fields, Wave Equation, Boundary Conditions between media interface; Uniform Plane wave; Wave Propagation in Lossy Dielectric, Loss-less Dielectric, Free space. Poynting Theorem, Power flow, Poynting vector. Wave polarizations [8]

Numerical Techniques for Electromagnetic Problems- Moment Methods, Finite Difference Method, Finite Elements Method, Some case studies. (Tutorial)

Transmission Lines: Concept of Lump parameters and Distributed parameters, Line Parameters, Transmission line equations and solutions, Physical significance of the solutions. Propagation constant, Characteristic Impedance;

Module-3: [10]
Wavelength; Velocity of Propagation; Distortion-less Line,
Reflection and Transmission coefficients; Standing Waves, VSWR, Input Impedance, Smith Chart – Applications; Load Matching Techniques [10]

Module-4: [10]
Field Analysis of Waveguides: Rectangular, Circular & Elliptical; Analysis of Resonator — Application [10]

Text Books

1. Principles of Electromagnetics, 4th Edition, Matthew O H Sadiku, Oxford University Press.

2. Electromagnetic Field Theory & Transmission Lines, G.S.N. Raju, Pearson Education

3. Electromagnetic Waves Shevgaonkar, Tata-McGaw-Hillr –R K

Reference Books

1. Engineering Electromagnetics, 2ed Edition - Nathan Ida, Springer India

2. Fields & Waves in Communication Electronics, S. Ramo, J. R. Whinnery & T. Van Duzer, John Wiley

3. Electromagnetic Theory & Applications, A. K. Saxena, Narosa Publishing House Pvt. Ltd.

4. Electromagnetics, 2ed Edition – J A Edminister, Tata-McGraw-Hill.

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

5.
Electromagnetic Waves and Transmission Lines- by G.Prasad, J.Prasad and J.Reddy- Scitech

- **Details will be made after getting feedback on this topic.**

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

Minimum 3 experiments from each Group.

Group-A

1. Measurement of free space wavelength λ, guide wavelength λg and frequency f using X- band waveguide test bench. Plot λ vs. f & λg vs. f curves.
2. Obtain the dispersion curve (ω-β plot) for X- band waveguide and study the phase velocity and group

velocity within waveguide.

3. Measurement of unknown impedance using shift in minima technique.
4. Measurement of reflection co-efficient and transmission co-efficient due to a discontinuity within a waveguide.
5. Determination of Dielectric constant of a
   (i) Solid material
   (ii) Liquid material
   In an X-band test bench.

Group-B

6. Study of the filter characteristics using spectrum analyzer with tracking generator.
7. Simulate Smith Chart on MATLAB platform. Measure VSWR for various values of ZL (load impedance). Find the position of VMAX and VMIN from the chart.
8. Study of Spectrum Analyzer. Measure frequency response of a filter using Spectrum Analyzer with tracking generator.
9. Measure ZO and γ of an X-band waveguide by measuring Z SC and ZOC.

Study the matching techniques (single -stub, double- stub and quarter wave techniques).

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.