Syllabus for B.Tech(ECE) Second Year

Revised & Proposed 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**				**Cr.**
			L	**T**	**P**	**Total**	
1	**M(CS)301**	Numerical Methods	2	0	0	2	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						**20**	**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						**34**	**29**

ECE SECOND YEAR: FOURTH SEMESTER

A. THEORY							
Sl.No.	**Field**	**Theory**	**Contact**				**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 Circuits	3	1	0	4	4
Total of Theory						**18**	**18**
B. PRACTICAL							
6	**HU491**	Communication Skill & Report Writing	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 Circuits Lab	0	0	3	3	2
Total of Practical						**12**	**8**
Total of Semester						**30**	**26**

SEMESTER - III

Theory

NUMERICAL METHODS
Code : M(CS) 301
Contacts : 2L
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, Weddle's rule. (3)

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

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

Numerical solution of ordinary differential equation: Taylor's series method, 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 whole syllabus has been divided into five modules.

Note 2: Structure of the question paper

There will be three groups in the question paper. In Group A, there will be one set of multiple choice type questions spreading the entire syllabus from which 10 questions (each carrying one mark) are to be answered. From Group B, three questions (each carrying 5 marks) are to be answered out of a set of questions covering all the three modules. Three questions (each carrying 15 marks) are to be answered from Group C. Each question of

Group C will have two or three parts covering not more than two modules. Sufficient questions should to be set covering the whole syllabus for alternatives.

Module I

Fourier Series:

Introduction, Periodic functions, Even and odd functions, Special waveforms, Eulers formulae for Fouriers coefficients, Dirichlet's conditions and sum of the Fourier series, Half range Fourier series, Parseval's identity (Statement only).

Fourier Transform: Fourier Transform and its properties, Inverse Fourier Transform (Statement only), Fourier Transform of derivatives (Statement only), Convolution theorem (Statement only). Related problems. (8L)

Module II

Calculus of Complex variable:

Functions, Limit and Continuity, Analytic functions, Cauchy-Riemann equations

(Statement only) and related problems, Analytic continuation, Complex integration and Cauchy's theorem (Statement only), Cauchy's integral formula (Statement only), Taylors and Laurent series, Zeros of an analytic function, Poles, Essential singularities, Residue theorem (Statement only) and its application to evaluation of definite integrals (Elementary cases only), Introduction to Conformal Mapping. (12L)

Module III

Probability:

Axiomatic definition of probability, Conditional probability, Independent events, Related problems, Bayes theorem (Statement only) & its application. One dimensional random variable, Probability distributions-discrete and continuous, Expectation, Binomial, Poisson, Uniform, Exponential and Normal distribution, Problems on Binomial, Poisson and Normal distribution only. (12L)

Module IV

Partial Differential Equations:

Solution of one dimensional wave equation, One dimensional heat-conduction equation, Laplace equation in two dimension by the methods of

1: Separation of variables 2: Integral Transforms (Laplace and Fourier Transforms)

(6L)

Module V

Series solution of Ordinary Differential equation:

Introduction, validity of series solution of an ordinary differential equation, general method to solve equation of the type: $P_o y'' + P_1 y' + P_2 y = 0$, related problems, Bessel's equation, properties of Bessel's function, Recurrence formula for Bessel's function of first kind, Legendre's equation, Legendre function; Recurrence formula for Legendre function ($P_n(x)$); Orthogonality relation. (10L)

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.

CIRCUIT THEORY & NETWORKS

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

Module#	Content	Hrs
1.	**Resonant Circuits:** Series and Parallel Resonance, Impedance and Admittance Characteristics, Quality Factor, Half-Power Points, Bandwidth, Resonant voltage rise, Transform diagrams, Solution of Problems	**4**
2.	**Mesh Current Network Analysis:** Kirchoff's Voltage Law, Formulation of Mesh Equations, Solution of mesh equations by Cramer's rule and matrix method, Driving point impedance, Transfer impedance, Solutions of Problems with DC and AC sources	**6**
3.	**Node Voltage Network Analysis:** Kirchoff's Current Law, Formulation of node equations and solutions, Driving point admittance, Transfer admittance, Solutions of Problems with DC and AC sources	**4**
4.	**Network Theorems:** Definition and implications of Superposition Theorem, Thevenin's Theorem, Norton's Theorem, Reciprocity Theorem, Compensation Theorem, Maximum Power Transfer Theorem, Millman's Theorem, Star-Delta transformations, Solutions and Problems with DC and AC sources	**6**
5.	**Graph of Network:** Concept of Tree Branch, Tree link, junctions, Incident matrix, Tie-set matrix, Cut-set matrix, determination of loop current and node voltages.	**4**
6.	**Coupled Circuits:** Magnetic Coupling, polarity of coils, polarity of induced voltage, concept of self and mutual inductance, coefficient of coupling, Solution of Problems	**2**
7.	**Circuit Transients:** DC Transient in R-L & R-C circuits with and without initial charge, R-L-C circuits, AC transients in sinusoidal R-L, R-C, & R-L-C circuits, solution of problems	**4**
8.	**Laplace Transform:** Concept of complex frequency, transformation of f(t) into F(s), transformation of step, exponential, overdamped surge, critically damped surge, damped sine, undamped sine functions, properties of Laplace Transform, linearity, real-differentiation, real-integration, Initial Value Theorem and Final Value Theorem, Inverse Laplace Transform, applications in circuit analysis, Partial Fractions expansion, Heaviside's Expansion Theorem, solution of problems	**8**
9.	**SPICE:** Introduction, model statement, elementary DC and small-signal analysis.	**2**

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	Contents	Hrs
1.	**Energy Bands and Charge Carriers in Semiconductors-** Energy bands, E-k diagram; carrier charge and concentration; carrier drift, diffusion and recombination, quasi-Fermi energy level, surface effects	**4**
2.	**Transport phenomena in semiconductor junctions**: Basic p-n junction and its fabrication; junction current flow,, small signal model, generation and recombination junctions with non-uniform doping, switching time, metal-semiconductor junctions and hetero-junctions	6
3.	**Rectifier and detector diodes**: Reversed-biased p-n junction, photovoltaic effect-solar cells, zener and tunnel diodes; Varactor, Gunn and Impatt diode.	4
4.	**Bipolar Transistor*:*** Physical mechanism, current gain, minority current distribution; Punch-through and avalanche effect; High voltage and high power transistors; Frequency limitations, high frequency transistors; CE, CB and CC configurations, Input and output characteristics (CE only)	8
5.	**Field Effect Transistors:** JFETS, IJFETS and MOSFETs; V-I characteristics; MOS-capacitors, flat band and threshold voltages; P and N-channel MOSFETS, Semiconductor sensors and detectors. Elements of device fabrications technology.	6
6.	**Opto-electronic Devices:** Optical absorption, photo-detectors, LEDs and LCDs, Laser diode	4

Total: 32 hrs

Text Books :

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

Reference Books :

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

2. Bell-Electronics Devices and Circuits-Oxford
3. Dimitrijev- Semiconductor Devices- Oxford
4. Singh & Singh- Electronics Devices and Integrated Circuits –PHI
5. Bogart, Bisley & Rice- Electronics Devices and Circuits- Pearson
6. Kasap-Principles of Electronic Materials and Devices- TMH
7. Boylestad & Nashelsky- Electronics Devices and Circuit Theory- Pearson
8. Salivahanan, Kumar & Vallavaraj- Electronics Devices and Circuits- TMH
9. Pierret- Semiconductor Device Fundamentals- Pearson
10. Islam- Semiconductor Physics and Devices- Oxford

SIGNALS AND SYSTEMS

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

Module No	Topic	Hrs
1.	**Introduction- Signal Representation**: 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 – properties of discrete time complex exponential unit impulse – unit step impulse functions – Transformation in independent variable of signals: time scaling, time shifting: Discrete Fourier series (DFS), Properties of the DFS, Determination of Fourier series representation of continuous time and discrete time periodic	8
2.	**Continuous Time Signals and Systems** : Discrete Fourier Transform (DFT), Properties of DFT, Two dimensional DFT, Circular Convolution; Analysis of continuous time Fourier Transform with examples; Properties of Fourier Transform , Parseval's relation and convolution in time and frequency domains. Basic properties of continuous time systems: Linearity, Causality, time invariance, stability, magnitude and Phase representations of frequency response of LTI systems -Analysis and characterization of LTI systems: Computation of impulse response and transfer function.	8
3.	**Sampling Theorem**: Representation of continuous time signals by its sample - Sampling theorem – Reconstruction of a Signal from its samples, aliasing – discrete time processing of continuous time signals using Fourier's Transform, sampling of band pass signals using DFT	8
4.	**Z-Transforms:** Basic principles of z-transform - z-transform definition – 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, Relationship between z-transform and Fourier transform.	8

Total: 32 hrs

Text Books:

1. A.V.Oppenheim, A.S.Willsky and S.H.Nawab -Signals & Systems, Pearson
2. S.Haykin & B.V.Veen, Signals and Systems- John Wiley
3. 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 Amhardar, -Analog and Digital Signal Processing- Thomson.

Phillip, Parr & Riskin- Signal, Systems and Transforms- Pe

ANALOG ELECTRONIC CIRCUITS

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

Module	Contents	Hrs
1.	***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
2.	***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
3.	***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
4.	***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
5.	***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
6.	***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
7.	**Power amplifiers** – Class A, B, AB, C, Conversion efficiency, Tuned amplifier	4
8.	**Multivibrator** – Monostable, Bistable, Astable multivibrators; Monostable and astable operation using 555 timer.	2
9.	**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

Practical

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, Matrix inversion, Gauss-Jacobi, and Gauss-Seidel iterations.
4. Assignments on numerical solution of Algebraic Equation by Bisection, Secant, Regular-falsi and Newton Raphson methods.
5. Assignments on ordinary differential equation: Taylor series, Euler's, Runga-Kutta and Finite difference 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 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

1. Study of JFET drain and transfer characteristics.
2. JFET biasing arrangement Graphical method.
3. Build and Test JFET CS amplifier.
   Find performance parameters for JFET amplifier - A_V, R_i, R_O.

4. Simulation of JFET CS amplifier using multisim/spice.
   Find performance parameters for JFET amplifier - A_V, R_i, R_O and compare with theoretical and practical results.
5. Input and Output Characteristics of BJT CE configuration. Find h parameters from characteristics.
6. Build and Test BJT in CE amplifier and find performance parameters - A_V, R_i, R_O, A_I
7. Simulation of BJT CE amplifier using multisim/spice
   Find performance parameters for BJT amplifier - A_V, R_i, R_O, A_I and compare with theoretical and practical results.
8. Comparison of CE, CC, CB configurations in terms of A_V, R_i, R_O, A_I.
9. Study of MOSFET drain and transfer characteristics
10. Frequency response - For BJT/ FET single stage amplifiers - Effect of unbypassed R_E and R_S. Effect of coupling and bypass capacitors on low frequency cut-off.

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

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. Construction of 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. Construction & study of Bistable multivibrator using NE 555.
11. Study of Switched Mode Power Supply & construction of a linear voltage regulator using regulator IC chip.
12. Construction of 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**

Electromagnetic Theory

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

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. [6]

3. Faraday's law & Lenz's law, Displacement Current, $\mathbf{J}_C - \mathbf{J}_D$ 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]

4. Numerical Techniques for Electromagnetic Problems- Moment Methods, Finite Difference Method, Finite Elements Method, Some case studies. [6]

Transmission Lines

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

6. Field Analysis of Waveguides: Rectangular, Circular & Elliptical; Analysis of Resonator—Applications [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.
5. *Engineering Electromagnetics, 7th Edition*-W.H.Hayt & J.A.Buck, Tata-McGraw-Hill
6. *Electromagnetic Waves and Transmission Lines*- by G.Prasad, J.Prasad and J.Reddy- Scitech

DIGITAL ELECTRONICS & INTEGRATED CIRCUITS

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

Module	Contents	Hrs
1.	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
2.	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 and Quine-McClauskey method	6
3.	Combinational circuits- Adder and Subtractor circuits; Applications and circuits of Encoder, Decoder, Comparator, Multiplexer, De-Multiplexer and Parity Generator.	5
4.	Memory Systems: RAM, ROM, EPROM, EEROM	4
5.	Design of combinational circuits-using ROM, Programming logic devices and gate arrays.(PLAs and PLDs)	4
6.	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
7.	Different types of A/D and D/A conversion techniques.	4
8.	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.
4. J.Bignell & R.Donovan-Digital Electronics-5/e- Cenage Learning.
8. Leach & Malvino—Digital Principles & Application, 5/e, Mc Graw Hill
9. Floyed & Jain- Digital Fundamentals-Pearson.
10. P.Raja- Digital Electronics- Scitech Publications
11. S.Aligahanan, S.Aribazhagan, Digital Circuit & Design- Bikas Publishing

Practical

Communication Skill & Report Writing
Code: HU491
Cr-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

3. Kingsler and Frey

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

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

Quantum Physics
1. Eisberg and Resnick
2. A.K. Ghatak and S. Lokenathan
3. S.N. Ghoshal (Introductory Quantum Mechanics)
4. E.E. Anderson (Modern Physics)
5. Haliday, Resnick and Crane (Physics vol.III)
6. 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
1. A.K. Ghatak and Thyagarajan (Laser)
2. Tarasov (Laser)
3. P.K. Chakraborty (Optics)
4. B. Ghosh and K.G. Majumder (Optics)
5. B.B. Laud (Laser and Non-linear Optics)
6. 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
3. Reitz, Milford and Christy

4. David J. Griffith
5. D. Chattopadhyay and P.C. Rakshit
6. Shadowitz (The Electromagnetic Field)

Quantum Mechanics
7. Eisberg and Resnick
8. A.K. Ghatak and S. Lokenathan
9. S.N. Ghoshal (Introductory Quantum Mechanics)
10. E.E. Anderson (Modern Physics)
11. Haliday, Resnick and Crane (Physics vol.III)
12. 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
7. 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 wavelengthλ, guide wavelength λ_g and frequency f using X- band waveguide test bench. Plot λ vs. f & λ_g 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 Z_L (load impedance). Find the position of V_{MAX} and V_{MIN} from the chart.
8. Study of Spectrum Analyzer. Measure frequency response of a filter using Spectrum Analyzer with tracking generator.
9. Measure Z_O and γ of an X-band waveguide by measuring Z_{SC} and Z_{OC}.
10. 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.
9. Realization of Universal Register using multiplexer and flip-flops.
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.