**JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY,
HYDERABAD**

B.TECH. ELECTRONICS AND COMMUNICATION ENGINEERING

II Year   **I Semester**
COURSE STRUCTURE

Code	Subject	T	P	C
	Mathematics - III	4+1*	-	4
	Probability Theory and Stochastic Processes	4+1*	-	4
	Environmental Studies	4+1*	-	4
	Signals and Systems	4+1*	-	4
	Electrical Technology	4+1*	-	4
	Electronic Circuit Analysis	4+1*	-	4
	Electronic Circuits Lab.	-	3	2
	Electrical Technology Lab.	-	3	2
		30	6	28

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	4+1*	0	4

MATHEMATICS – III

UNIT – I

Special functions: Gamma and Beta Functions – Their properties – evaluation of improper integrals. Bessel functions – properties – Recurrence relations – Orthogonality. Legendre polynomials – Properties – Rodrigue's formula – Recurrence relations – Orthogonality.

UNIT-II

Functions of a complex variable – Continuity – Differentiability – Analyticity – Properties – Cauchy-Riemann equations in Cartesian and polar coordinates. Harmonic and conjugate harmonic functions – Milne – Thompson method.

UNIT-III

Elementary functions: Exponential, trigonometric, hyperbolic functions and their properties – General power Z^C (c is complex), principal value.

UNIT-IV

Complex integration: Line integral – evaluation along a path and by indefinite integration – Cauchy's integral theorem – Cauchy's integral formula – Generalized integral formula.

UNIT-V

Complex power series: Radius of convergence – Expansion in Taylor's series, Maclaurin's series and Laurent series. Singular point –Isolated singular point – pole of order m – essential singularity.

UNIT-VI

Residue – Evaluation of residue by formula and by Laurent series - Residue theorem.
Evaluation of integrals of the type

(a) Improper real integrals $\int_{-\infty}^{\infty} f(x)dx$ (b) $\int_{c}^{c+2\pi} f(\cos\theta, \sin\theta)d\theta$

(c) $\int_{-\infty}^{\infty} e^{imx} f(x)dx$ (d) Integrals by identation.

UNIT-VII

Argument principle – Rouche's theorem – determination of number of zeros of complex polynomials - Maximum Modulus principle - Fundamental theorem of Algebra, Liouville's Theorem.

UNIT-VIII

Conformal mapping: Transformation by e^z, lnz, z^2, z^n (n positive integer), Sin z, cos z,   z + a/z. Translation, rotation, inversion and bilinear transformation – fixed point – cross ratio – properties – invariance of circles and cross ratio – determination of bilinear transformation mapping 3 given points .

Text Books:

1. A text Book of Engineering Mathematics, Vol-III T. K. V. Iyengar, B. Krishna Gandhi and Others, S. Chand & Company.
2. A text Book of Engineering Mathematics, C. Sankaraiah, V. G. S. Book Links.
3. A text Book of Engineering Mathematics, Shahnaz Bathul, Prentice Hall of India.
4. A text Book of Engineering Mathematics, P. Nageshwara Rao, Y. Narasimhulu & N. Prabhakar Rao, Deepthi Publications.

References:

1. A text Book of Engineering Mathematics, B. V. Raman, Tata Mc Graw Hill.
2. Advanced Engineering Mathematics, Irvin Kreyszig, Wiley India Pvt. Ltd.
3. A text Book of Engineering Mathematics, Thamson Book Collection.

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PROBABILITY THEORY AND STOCHASTIC PROCESSES

UNIT I
PROBABILITY : Probability introduced through Sets and Relative Frequency: Experiments and Sample Spaces, Discrete and Continuous Sample Spaces, Events, Probability Definitions and Axioms, Mathematical Model of Experiments, Probability as a Relative Frequency, Joint Probability, Conditional Probability, Total Probability, Bayes' Theorem, Independent Events:

UNIT II
THE RANDOM VARIABLE : Definition of a Random Variable, Conditions for a Function to be a Random Variable, Discrete and Continuous, Mixed Random Variable, Distribution and Density functions, Properties, Binomial, Poisson, Uniform, Gaussian, Exponential, Rayleigh, Conditional Distribution, Methods of defining Conditioning Event, Conditional Density, Properties.

UNIT III
OPERATION ON ONE RANDOM VARIABLE – EXPECTATIONS : Introduction, Expected Value of a Random Variable, Function of a Random Variable, Moments about the Origin, Central Moments, Variance and Skew, Chebychev's Inequality, Characteristic Function, Moment Generating Function, Transformations of a Random Variable: Monotonic Transformations for a Continuous Random Variable, Nonmonotonic Transformations of Continuous Random Variable, Transformation of a Discrete Random Variable.

UNIT IV
MULTIPLE RANDOM VARIABLES : Vector Random Variables, Joint Distribution Function, Properties of Joint Distribution, Marginal Distribution Functions, Conditional Distribution and Density – Point Conditioning, Conditional Distribution and Density – Interval conditioning, Statistical Independence, Sum of Two Random Variables, Sum of Several Random Variables, Central Limit Theorem, (Proof not expected). Unequal Distribution, Equal Distributions.

UNIT V
OPERATIONS ON MULTIPLE RANDOM VARIABLES : Expected Value of a Function of Random Variables: Joint Moments about the Origin, Joint Central Moments, Joint Characteristic Functions, Jointly Gaussian Random Variables: Two Random Variables case, N Random Variable case, Properties, Transformations of Multiple Random Variables, Linear Transformations of Gaussian Random Variables.

UNIT VI
RANDOM PROCESSES – TEMPORAL CHARACTERISTICS : The Random Process Concept, Classification of Processes, Deterministic and Nondeterministic Processes, Distribution and Density Functions, concept of Stationarity and Statistical Independence. First-Order Stationary Processes, Second-Order and Wide-Sense Stationarity, (N-Order) and Strict-Sense Stationarity, Time Averages and Ergodicity, Mean-Ergodic Processes, Correlation-Ergodic Processes, Autocorrelation Function and Its Properties, Cross-Correlation Function and Its Properties, Covariance Functions, Gaussian Random Processes, Poisson Random Process.

UNIT VII
RANDOM PROCESSES – SPECTRAL CHARACTERISTICS : The Power Spectrum: Properties, Relationship between Power Spectrum and Autocorrelation Function, The Cross-Power Density Spectrum, Properties, Relationship between Cross-Power Spectrum and Cross-Correlation Function.

UNIT VIII
LINEAR SYSTEMS WITH RANDOM INPUTS : Random Signal Response of Linear Systems: System Response – Convolution, Mean and Mean-squared Value of System Response, autocorrelation Function of Response, Cross-Correlation Functions of Input and Output, Spectral Characteristics of System Response: Power Density Spectrum of Response, Cross-Power Density Spectrums of Input and Output, Band pass, Band-Limited and Narrowband Processes, Properties, Modeling of Noise Sources: Resistive (Thermal) Noise Source, Arbitrary Noise Sources, Effective Noise Temperature, Average Noise Figures, Average Noise Figure of cascaded networks.

TEXT BOOKS :

1. Probability, Random Variables & Random Signal Principles - Peyton Z. Peebles, TMH, 4th Edition, 2001.
2. Probability, Random Variables and Stochastic Processes – Athanasios Papoulis and S. Unnikrishna Pillai, PHI, 4th Edition, 2002.

REFERENCES :

1. Communication Systems Analog & Digital – R.P. Singh and S.D. Sapre, TMH, 1995.
2. Probability and Random Processes with Application to Signal Processing – Henry Stark and John W. Woods, Pearson Education, 3rd Edition.
3. Probability Methods of Signal and System Analysis. George R. Cooper, Clave D. MC Gillem, Oxford, 3rd Edition, 1999.
4. Statistical Theory of Communication - S.P. Eugene Xavier, New Age Publications, 2003.
5. Signals, Systems & Communications - B.P. Lathi, B.S. Publications, 2003.

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ENVIRONMENTAL STUDIES

UNIT - I
Multidisciplinary nature of Environmental Studies: Definition, Scope and Importance – Need for Public Awareness.

UNIT - II
Natural Resources : Renewable and non-renewable resources – Natural resources and associated problems – Forest resources – Use and over – exploitation, deforestation, case studies – Timber extraction – Mining, dams and other effects on forest and tribal people – Water resources – Use and over utilization of surface and ground water – Floods, drought, conflicts over water, dams – benefits and problems - Mineral resources: Use and exploitation, environmental effects of extracting and using mineral resources, case studies. - Food res ources: World food problems, changes caused by agriculture and overgrazing, effects of modern agriculture, fertilizer-pesticide problems, water logging, salinity, case studies. – Energy resources: Growing energy needs, renewable and non-renewable energy sources use of alternate energy sources. Case studies. Land resources: Land as a resource, land degradation, man induced landslides, soil erosion and desertification. Role of an individual in conservation of natural resources. Equitable use of resources for sustainable lifestyles.

UNIT - III
Ecosystems : Concept of an ecosystem. - Structure and function of an ecosystem. - Producers, consumers and decomposers. - Energy flow in the ecosystem - Ecological succession. - Food chains, food webs and ecological pyramids. - Introduction, types, characteristic features, structure and function of the following ecosystem:
  a. Forest ecosystem
  b. Grassland ecosystem
  c. Desert ecosystem
  d. Aquatic ecosystems (ponds, streams, lakes, rivers, oceans, estuaries)

UNIT - IV
Biodiversity and its conservation : Introduction - Definition: genetic, species and ecosystem diversity. Bio-geographical classification of India - Value of biodiversity: consumptive use, productive use, social, ethical, aesthetic and option values - . Biodiversity at global, National and local levels. - . India as a megadiversity nation - Hot-sports of biodiversity - Threats to biodiversity: habitat loss, poaching of wildlife, manwildlife conflicts. - Endangered and endemic species of India - Conservation of biodiversity: In-situ and Exsitu conservation of biodiversity.

UNIT - V
Environmental Pollution : Definition, Cause, effects and control measures of :
  a. Air pollution
  b. Water pollution
  c. Soil pollution
  d. Marine pollution
  e. Noise pollution
  f. Thermal pollution
  g. Nuclear hazards

Solid waste Management : Causes, effects and control measures of urban and industrial wastes. – Role of an individual in prevention of pollution. - Pollution case studies. - Disaster management: floods, earthquake, cyclone and landslides.

UNIT - VI
Social Issues and the Environment : From Unsustainable to Sustainable development -Urban problems related to energy -Water conservation, rain water harvesting, watershed management -Resettlement and rehabilitation of people; its problems and concerns. Case Studies -Environmental ethics: Issues and possible solutions. -Climate change, global warming, acid rain, ozone layer depletion, nuclear accidents and holocaust. Case Studies. -Wasteland reclamation. -Consumerism and waste products. –Environment Protection Act. -Air (Prevention and Control of Pollution) Act. -Water (Prevention and control of Pollution) Act -Wildlife Protection Act -Forest Conservation Act -Issues involved in enforcement of environmental legislation. -Public awareness.

UNIT - VII

Human Population and the Environment : Population growth, variation among nations. Population explosion - Family Welfare Programme. -Environment and human health. -Human Rights. -Value Education. -HIV/AIDS. -Women and Child Welfare. -Role of information Technology in Environment and human health. -Case Studies.

UNIT - VIII

Field work : Visit to a local area to document environmental assets River /forest grassland/hill/mountain - Visit to a local polluted site-Urban/Rural/industrial/ Agricultural Study of common plants, insects, birds. - Study of simple ecosystems-pond, river, hill slopes, etc.

TEXT BOOK:
1. Textbook of Environmental Studies for Undergraduate Courses by Erach Bharucha for University Grants Commission.
2. Environmental Studies by R. Rajagopalan, Oxford University Press.

REFERENCE:

1 Textbook of Environmental Sciences and Technology by M. Anji Reddy, BS Publication.

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SIGNALS AND SYSTEMS

UNIT I

SIGNAL ANALYSIS : Analogy between vectors and signals, Orthogonal signal space, Signal approximation using orthogonal functions, Mean square error, Closed or complete set of orthogonal functions, Orthogonality in complex functions, Exponential and sinusoidal signals, Concepts of Impulse function, Unit step function, Signum function.

UNIT II

FOURIER SERIES REPRESENTATION OF PERIODIC SIGNALS : Representation of Fourier series, Continuous time periodic signals, properties of Fourier series, Dirichlet's conditions, Trigonometric Fourier series and Exponential Fourier series, Complex Fourier spectrum

UNIT III

FOURIER TRANSFORMS : Deriving Fourier transform from Fourier series, Fourier transform of arbitrary signal, Fourier transform of standard signals, Fourier transform of periodic signals, properties of Fourier transforms, Fourier transforms involving impulse function and Signum function. Introduction to Hilbert Transform.

UNIT IV

SIGNAL TRANSMISSION THROUGH LINEAR SYSTEMS : Linear system, impulse response, Response of a linear system, Linear time invariant (LTI) system, Linear time variant (LTV) system, Transfer function of a LTI system. Filter characteristics of linear systems. Distortion less transmission through a system, Signal bandwidth, system bandwidth, Ideal LPF, HPF and BPF characteristics, Causality and Poly-Wiener criterion for physical realization, relationship between bandwidth and rise time.

UNIT V

CONVOLUTION AND CORRELATION OF SIGNALS : Concept of convolution in time domain and frequency domain, Graphical representation of convolution, Convolution property of Fourier transforms. Cross correlation and auto correlation of functions, properties of correlation function, Energy density spectrum, Parseval's theorem, Power density spectrum, Relation between auto correlation function and energy/power spectral density function.Relation between convolution and correlation, Detection of periodic signals in the presence of noise by correlation, Extraction of signal from noise by filtering.

UNIT VI

SAMPLING : Sampling theorem – Graphical and analytical proof for Band Limited Signals, impulse sampling, Natural and Flat top Sampling, Reconstruction of signal from its samples, effect of under sampling – Aliasing, Introduction to Band Pass sampling.

UNIT VII

LAPLACE TRANSFORMS : Review of Laplace transforms, Partial fraction expansion, Inverse Laplace transform, Concept of region of convergence (ROC) for Laplace transforms, constraints on ROC for various classes of signals, Properties of L.T's relation between L.T's, and F.T. of a signal. Laplace transform of certain signals using waveform synthesis.

UNIT VIII

Z–TRANSFORMS : Fundamental difference between continuous and discrete time signals, discrete time signal representation using complex exponential and sinusoidal components, Periodicity of discrete time usingcomplex exponential signal, Concept of Z- Transform of a discrete sequence. Distinction between Laplace, Fourier and Z transforms. Region of convergence in Z-Transform, constraints on ROC for various classes of signals, Inverse Z-transform, properties of Z-transforms.

TEXT BOOKS :
1. Signals, Systems & Communications - B.P. Lathi, BS Publications, 2003.
2. Signals and Systems - A.V. Oppenheim, A.S. Willsky and S.H. Nawab, PHI, 2nd Edn.

REFERENCES :
1. Signals & Systems - Simon Haykin and Van Veen,Wiley, 2nd Edition.
2. Network Analysis - M.E. Van Valkenburg, PHI Publications, 3rd Edn., 2000.
3. Fundamentals of Signals and Systems Michel J. Robert, MGH International Edition, 2008.
4. Signals, Systems and Transforms - C. L. Philips, J.M.Parr and Eve A.Riskin, Pearson education.3rd Edition, 2004.

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ELECTRICAL TECHNOLOGY

UNIT I
DC MACHINES : Principle of operation of DC Machines- EMF equation – Types of generators – Magnetization and load characteristics of DC generators

UNIT II
D.C. MOTORS : DC Motors – Types of DC Motors – Characteristics of DC motors – 3-point starters for DC shunt motor – Losses and efficiency – Swinburne's test – Speed control of DC shunt motor – Flux and Armature voltage control methods.

UNIT III
TRANSFORMERS : Principle of operation of single phase transformer – types – Constructional features – Phasor diagram on No Load and Load – Equivalent circuit

UNIT IV
PERFORMANCE OF TRANSFORMERS : Losses and Efficiency of transformer and Regulation – OC and SC tests – Predetermination of efficiency and regulation (Simple Problems).

UNIT V
THREE PHASE INDUCTION MOTOR : Principle of operation of three-phase induction motors –Slip ring and Squirrel cage motors – Slip-Torque characteristics – Efficiency calculation – Starting methods.

UNIT VI
ALTERNATORS : Alternators – Constructional features – Principle of operation – Types - EMF Equation – Distribution and Coil span factors – Predetermination of regulation by Synchronous Impedance Method – OC and SC tests.

UNIT VII
SINGLE PHASE INDUCTION MOTORS : Principle of operation - Shaded pole motors – Capacitor motors, AC servomotor, AC tachometers, Synchros, Stepper Motors – Characteristics.

UNIT VIII
ELECTRICAL INSTRUMENTS : Basic Principles of indicating instruments – Moving Coil and Moving iron Instruments (Ammeters and Voltmeters)

TEXT BOOKS :
1. Introduction to Electrical Engineering – M.S Naidu and S. Kamakshaiah, TMH Publ.
2. Basic Electrical Engineering - T.K. Nagasarkar and M.S.Sukhija, Oxford University Press, 2005

REFERENCES :
1. Principles of Electrical Engineering - V.K Mehta, S.Chand Publications.
2. Theory and Problems of basic electrical engineering - I.J. Nagarath amd D.P Kothari, PHI Publications
3. Essentials of Electrical and Computer Engineering - David V. Kerns, JR. J. David Irwin

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ELECTRONIC CIRCUITS ANALYSIS

UNIT I : SINGLE STAGE AMPLIFIERS : Review, Small Signal Analysis of Junction Transistor, Frequency response of Common Emitter Amplifier, Common Base Amplifier, Common Collector Amplifier, JFET Amplifiers, Common Drain (CD) Amplifier, Common Gate Amplifier, Gain Band Width Product.

UNIT II : MULTI STAGE AMPLIFIERS : Multi Stage Amplifiers Methods of Inter Stage Coupling, n – Stage Cascaded Amplifier, Equivalent Circuits, Miller's Theorem, Frequency Effects, Amplifier Analysis, High Input Resistance Transistor Circuits. Cascode – Transistor Configuration, CE-CC Amplifiers, Two Stage RC Coupled JFET amplifier (in Common Source (CS) configuration), Difference Amplifier.

UNIT III : HIGH FREQUENCY TRANSISTOR CIRCUTS : Transistor at High Frequencies, Hybrid- Common Emitter Tranconductance Model, Determination of Hybrid- Conductances, Variation of Hybrid Parameters with |IC|, |VCE| and Temperature. The Parameters ¦t, expression for ¦b, Current Gain with Resistance Load, CE Short Circuit Current Gain, Hybrid– pi) Parameters, Measurement of ¦t, Variation of Hybrid – Parameters with Voltage, Current and Temperature, Design of High frequency Amplifier.

UNIT IV : POWER AMPLIFIERS : Class A Power Amplifier, Maximum Value of Efficiency of Class A Amplifier, Transformer Coupled Amplifier, Transformer Coupled Audio Amplifier, Push Pull Amplifier, Complimentary Symmetry Circuits (Transformer Less Class B Power Amplifier), Phase Inverters, Class D Operation, Class S Operation, Heat Sinks.

UNIT V : TUNED AMPLIFIERS - I : Single Tuned Capacitive Coupled Amplifier, Tapped Single Tuned Capacitance Coupled Amplifier, Single Tuned Transformer Coupled or Inductively Coupled Amplifier, CE Double Tuned Amplifier, Application of Tuned Amplifiers.

UNIT VI : TUNED AMPLIFIERS - II : Stagger Tuning, Stability Considerations, Tuned Class B and Class C Amplifiers, Wideband Amplifiers, Tuned Amplifiers.

UNIT VII : VOLTAGE REGULATORS : Terminology, Basic Regulator Circuit, Short Circuit Protection, Current Limiting, Specifications of Voltage Regulator Circuits, Voltage Multipliers.

UNIT VIII : SWITCHING AND IC VOLTAGE REGULATORS : IC 723 Voltage Regulators and Three Terminal IC regulators, DC to DC Converter, Switching Regulators, Voltage Multipliers, UPS, SMPS.

TEXT BOOKS :
1. Integrated Electronics – J. Millman and C.C. Halkias, Mc Graw-Hill, 1972.
2. Electronic Devices and Circuits, Theodore F. Bogart Jr., J.S. Beasley and G. Rico, Pearson Edition, 6th Edition, 2004.

REFERENCES :
1. Electronic Devices and Circuits Theory – Robert L. Boylestad and Louis Nashelsky, Pearson/Prentice Hall,9th Edition,2006.
2. Micro Electronic Circuits – Sedra A.S. and K.C. Smith, Oxford University Press, 5th ed.
3. Micro Electronic Circuits: Analysis and Design – M.H. Rashid, Thomson PWS Publ., 1999.
4. Principles of Electronic Circuits – S.G.Burns and P.R.Bond, Galgotia Publications, 2nd Edn.., 1998.
5. Electronic Circuit Analysis and Design – Donald A. Neaman, Mc Graw Hill.
6. Electronic Circuit Analysis – K. Lal Kishore, BS Publications, 2004.

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ELECTRONIC CIRCUITS LAB

List of Experiments (Twelve experiments to be done) :
I) Design and Simulation in Simulation Laboratory using Multisim OR Pspice OR Equivalent
Simulation Software. (Any Six):
　1. Common Emitter and Common Source amplifier
　2. Two Stage RC Coupled Amplifier
　3. Current shunt and Feedback Amplifier
　4. Cascade Amplifier
　5. Wien Bridge Oscillator using Transistors
　6. RC Phase Shift Oscillator using Transistors
　7. Class A Power Amplifier (Transformer less)
　8. Class B Complementary Symmetry Amplifier
　9. High Frequency Common base (BJT) / Common gate(JFET) Amplifier.
II) Testing in the Hardware Laboratory (Six Experiments : 3 + 3) :
　A) Any Three circuits simulated in Simulation laboratory
　B) Any Three of the following
　　　1. Class A Power Amplifier (with transformer load)
　　　2. Class B Power Amplifier
　　　3. Single Tuned Voltage Amplifier
　　　4. Series Voltage Regulator
　　　5. Shunt Voltage Regulator

Equipments required for Laborataries:
　1.　For software simultation of Electronic circuits
　　　　　i)　　　　Computer Systems with latest specifications
　　　　　ii)　　　Connected in Lan (Optional)
　　　　　iii)　　　Operating system (Windows XP)
　　　　　iv)　　　Simulations software (Multisim/TINAPRO) Package

　2.　For Hardware simulations of Electronic Circuits
　　　　　i)　　　　RPSs
　　　　　ii)　　　CROs
　　　　　iii)　　　Functions Generators
　　　　　iv)　　　Multimeters
　　　　　v)　　　Components

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ELECTRICAL TECHNOLOGY LAB

PART – A

1. Serial and Parallel Resonance – Timing, Resonant frequency, Bandwidth and Q-factor determination for RLC network.
2. Time response of first order RC/RL network for periodic non-sinusoidal inputs – time constant and steady state error determination.
3. Two port network parameters – Z-Y Parameters, chain matrix and analytical verification.
4. Verification of Superposition and Reciprocity theorems.
5. Verification of maximum power transfer theorem. Verification on DC, verification on AC with Resistive and Reactive loads.
6. Experimental determination of Thevenin's and Norton's equivalent circuits and verification by direct test.

PART – B

1. Magnetization characteristics of D.C. Shunt generator. Determination of critical field resistance.
2. Swinburne's Test on DC shunt machine (Predetermination of efficiency of a given DC Shunt machine working as motor and generator).
3. Brake test on DC shunt motor. Determination of performance characteristics.
4. OC & SC tests on Single-phase transformer (Predetermination of efficiency and regulation at given power factors and determination of equivalent circuit).
5. Brake test on 3-phase Induction motor (performance characteristics).
6. Regulation of alternator by synchronous impedance method.

Note: Any **TEN** of the above experiments are to be conducted