Dual Degree Programme in Electronics and Communication Engineering

Semester I

	Course Name			
1.	Humanities and Social Sciences-I	2-0-0	2	HS
2.	Environmental Studies	2-0-2	3	BS
3.	Engineering Mathematics-I (Calculus and Transform Based)	4-0-0	4	BS
4.	Engineering Foundation-I (Computer Programming)	2-0-4	4	EF
6.	Introduction to Engineering-I (Lecture/Visit/Demo/Doing)	1-0-2	2	EF
7.	Engineering Drawing & Visualization	0-0-4	2	DI
8.	Principals of Economics	2-0-0	2	HS
9.	English in Practice	2-0-2	Non-credit	
		Total (19)	HS-2, BS-7, EF-6, DI-3	

***Non-credit course: need to pass Basic English course**

Semester II

	Course Name			
1.	Physics-I	3-0-2	4	BS
2.	Chemistry-I	3-0-2	4	BS
3.	Engineering Mathematics-II (Probability and Statistics)	4-0-0	4	BS
4.	Engineering Foundation-II (Data Structure)	3-0-2	4	EF
5.	Introduction to Engineering-II (Engineering Specific)	1-0-2	Non-Credit	EF
6.	Product Realization	0-0-4	2	DI
7.	Humanities and Social Sciences-II	2-0-0	2	HS
		Total (20)	BS-12, EF-4, DI-2, HS-2	

Semester III

	Course Name			
1.	Engineering Foundation-III		4	EF
2	Biology/Chemistry-II/Physics-II	3-0-2	4	BS
3.	Semiconductor Devices and Circuits	4-0-0	4	BC
4.	Digital Electronics and Logic Design	3-0-2	4	BC
5.	Network Analysis and Synthesis	3-0-2	4	BC
6.	Optional Course-I			
		Total (20)	EF-4,BS-4, BC-12	

Semester IV

	Course Name			
1.	Engineering Foundation-1V (Numerical Analysis)		4	EF
2.	Engineering Foundation-V		4	EF
3.	Signals and Systems	4-0-0	4	BC
4.	Analog Electronics	4-0-0	4	BC
5.	Principles of communication	3-0-2	4	BC
6.	Professional Practice & Ethics	1-0-2	2	HS
7	Optional Course-II			
		Total 22	EF-8, BC-12, HS-2	

VI Semester

Semester V

	Course Name			
1.	Digital Communication	4-0-0	4	BC
2.	Computer Architecture	4-0-0	4	BC
3.	Bachelor Elective- I		4	BE
4.	Technical Writing	2-0-0	2	HS
5.	Open-Elective-I	3-0-0	3	OE
6.	Open-Elective-II	3-0-0	3	OE
7	Optional Course-III			
		Total (20)	HS-2, BC-8, BE-4,OE-6	

Semester VI

	Course Name			
1.	Electromagnetic Theory	4-0-0	4	BC
2.	Introduction to VLSI Design	4-0-0	4	BC
3.	Bachelor Elective- II		4	BE
4.	Open-Elective-III		3	OE
5.	Open-Elective-IV		3	OE
6.	Optional Course-IV			
		Total (18)	BC-8, BE-4, OE-6	

Semester VII

	Course Name			
1.	Project (Engineering Specific)		6	BE
2.	Bachelor Elective -III		4	BE
3.	MOS VLSI design		3	MC
4.	VLSI Design Laboratory		3	MC
5.	Master Specialization-I		3	ME
		Total (19)	BE- 10, MC-6, ME-3	

Semester VIII

	Course Name			
1.	Master Specialization –II		3	ME
2.	Master Specialization –III		3	ME
3.	Master Specialization –IV		3	ME
4.	Master Specialization –V		3	ME
5.	Master Specialization –VI		3	ME
		Total (15)	ME-15	

Semester IX

	Course Name			
1.	Master Specialization-VII		3	ME
2.	Master Specialization-VIII		3	ME
3.	Dissertation		9	DS
		Total (15)	ME-6, DS-9	

Semester X

	Course Name			
1.	Dissertation		15	DS
		Total (15)	DS-15	

Core Courses for B. Tech Electronics & Communication Engineering:

S. No.	Course Name
1.	Semiconductor Devices and Circuits
2.	Digital Electronics and Logic Design
3.	Network Analysis and Synthesis
4.	Signals and Systems
5.	Analog Electronics
6.	Principles of communication
7.	Digital Communication
8.	Computer Architecture
9.	Electromagnetic Theory
10.	Introduction to VLSI Design

Elective Courses for B. Tech Electronics & Communication Engineering:

S. No.	Course Name
1.	Minor Project
2.	Self Study
3.	Control Systems
4.	Fiber optics communication
5.	Digital signal processing
6.	Microprocessors
7.	Information Theory & Coding Tech.
8.	Microwave devices and circuits
9.	Biomedical Electronics
10.	Antenna and propagation

Elective Courses for M. Tech in VLSI:

S,No.	**Course Name**
1	Hardware Description Languages
2.	Embedded System Design
3.	ANALOG IC DESIGN
4.	Embedded System Design-II
5.	Low Power VLSI Design
6.	Adaptive Digital Signal Processing
7.	MMICs
8.	RF MEMS
9.	IC Fabrication Technology
10.	Nanolithography & Nanoscale Devices
11.	Introduction to MEMS

Courses for B. Tech in Electronics & Communication Engineering

Semiconductor Devices and Circuits

P-N JUNCTION DIODE: - P-N junction and its V-I characteristics, P-N junction as rectifier, diode as acircuit element, the load line concept, half-wave and full-wave rectifiers, filter circuits. Photoelectric devices& their applications.REGULATED POWER SUPPLIES: - Series and shunt voltage regulators, power supply parameters, threeterminal IC regulators, SMPS. TRANSISTORS: - Review of BJT and its Hybrid model, analysis of a transistor amplifier circuit using hparameters,Emitter follower, Miller's theorem, Frequency response of R-C coupled amplifier, Multistageamplifier, classification of amplifiers, Transistor Biasing; Operating point, Bias stability, Collector to Basebias, Self-bias, emitter bias, bias compensation, Thermistor and sensitor compensation, High frequencylimitations on BJT'S FEEDBACK OSCILLATORS AND POWER AMPLIFIERS: - Feedback in amplifiers: Basic feedbacktopologies. Oscillators: Barkhausen's criterion, sinusoidal oscillators, Phase shift oscillators, Resonantcircuit oscillator, a general form of oscillator, the Wein Bridge oscillator, Crystal oscillator. Introduction topower amplifiers and its various types with applications. FIELD EFFECT TRANSISTORS: - JFET, pinch-off voltage, Volt-ampere characteristics, small signalmodel, MOSFET-Enhancement & Depletion mode, V-MOSFET, JFET & MOSFET amplifiers, Biasing ofJFETS and MOSFETS.

Text/ Reference Books:

- Integrated Electronics: Millman&Halkias; McGraw Hill.
- Electronic circuit analysis and design (Second Edition): D.A. Neamen; TMH
- Electronics Principles: Malvino; McGraw Hill.
- Electronics circuits: Donald L. Schilling & Charles Belove: McGraw Hill.
- Electronics Devices & Circuits: Boylestad&Nashelsky; Pearson.

Digital Electronics and Logic Design

Introduction to Number Systems and Codes.Switching properties of Diodes, BJT and FET, Logic gates, DTL, TTL, ECL, I2L, CMOS Gates and their parameters and comparisons, Applications of switching transistors in bistable, monostable, astable and Schmitt trigger circuits. Boolean algebra, Switching Function, minimization of switching function: Karnaugh map method and Tabulation Method don't care terms and applications w.r.to code converters and Digital Comparators, etc. Gated Flip Flops, Master Slave Flip Flop, Ripple and Parallel Counter, Up-Down Counter, Shift Registers and Ring Counter, designing the combinational circuits of the counters through Excitation Table. Introduction to the circuits for Arithmetic Unit: Serial and parallel Binary Adders, 2's compliment and principle of subtraction, Carry-Look Ahead Adder, and BCD adder: Principles of multiplication, division in ALU Semiconductor memories: ROM, PROM, EPROM, EEPROM, Bipolar RAM, static and dynamic RAM. Encoder and Decoder/Demultiplexer, multiplexer, Designing combinational circuits with multiplexer, ROM and PLA.Introduction to advanced memory concepts.Analog-to-Digital conversion:, dual slope integration method and voltage to frequency conversion, principal of DVM. , counter type, successive approximation type, Flash ADC , D-A converter: weighted resistors type, R-2-R ladder type.

Text/ Reference Books:

- H.Taub & D. Schilling, "Digital Integrated Electronics" (TMH).
- Malvino& Leach, "Digital Principles and Application" (TMH).
- M.Mano, "Digital Electronics And Logic Design" (PHI)
- B.S.Sonde, "Introduction To System Design Using Integrated Circuits" (New Age International).
- Z. Kohavi ,"Switching And Finite Automata Theory" (TMH).
- R. P. Jain, "Modern Digital Electronics" (TMH).
- Gothman, "Digital Electronics" (PHI).

Network Analysis and Synthesis

Review of network elements: Linear versus nonlinear, time-variant and time invariant, passive verses active, causal and non-anticipated, stable and unstable networks, Network theorems: superposition, Thevenin and Norton's maximum power transfer, Wye-Delta transformation. Network graph theory, notations and definitions, incidence matrix, cutsets and fundamental loops, fundamental cutsets matrix, Kirchoff voltage law, Kirchoff current low, interrelation ship between matrices of a graph, Tellegen's theorem and its application. Analysis of linear time invariant networks, transform methods in circuit analysis, Laplace transform of common signals, concept of transformed impedance, network functions, poles and zeros, impulse response, step response, convolution. Two-port network parameters: driving point and transfer functions. conversion, various interconnections, analysis using various two port parameters. State equations for networks.State variable analysis of circuits, formulation of state equations, solution of state equations.Transient Response of RC, RL, RLC Circuits to various excitation signals such as step, ramp, impulse and sinusoidal excitations using Laplace Transform.Steady state sinusoidal analysis. Passive /Active network synthesis, positive real functions, driving point synthesis(RC, RL, LC,) Introduction to passive filter.

Text/ Reference Books:

- M.E. Van Valkenburg, "Network Analysis" Third Edition; Prentice Hall, 1986
- BehrouzPeikari; "Fundamentals of Network Analysis & Synthesis" Jaico Publishing house, 2006.
- F.F.Kuo; "Network Analysis & Synthesis" John Wiley & Sons Inc
- Hyat Jr. &Kemmerly; "Engineering Circuit analysis", McGraw Hill

Signal and Systems

An introduction to signals and systems- Signals and systems as seen in everyday life, and in various branches of engineering and science electrical, mechanical, hydraulic, thermal, biomedical signals and systems as examples. Extracting the common essence and requirements of signal and system analysis from these examples. Formalizing signals- energy and power signals, signal properties: periodicity, absolute integrability, determinism and stochastic character. Some special signals of importance: the unit step, the unit impulse, the sinusoid, the complex exponential, some special time-limited signals; continuous and discrete time signals, continuous and discreteamplitude signals. Formalizing systems- system properties: linearity: additivity and homogeneity, shift-invariance, causality, stability, realizability. Examples. Continuous time and discrete time Linear shift-invariant (LSI)

systems in detailthe impulse response and step response, convolution, input-output behavior with aperiodic convergent inputs, cascade interconnections. Characterization of causality and stability oflinear shift-invariant systems. System representation through differential equations and difference equations. Periodic and semi-periodic inputs to an LSI system, the notion of a frequency response and its relation to the impulse response, Fourier series representation, the Fourier Transform, convolution/multiplication and their effect in the frequency domain, magnitude and phase response, Fourier domain duality. The Discrete-Time Fourier Transform (DTFT) and the Discrete Fourier Transform (DFT). Parseval's Theorem.The idea of signal space and orthogonal bases of signals. The Laplace Transform for continuous time signals and systems- the notion of eigen functions of LSI systems, a basis of eigen functions, region of convergence, system functions, poles and zeros of system functions and signals, Laplace domain analysis, solution to differential equations and system behavior. Generalization of Parseval's Theorem. The z- Transform for discrete time signals and systems- eigen functions, region of convergence, system functions, poles and zeros of systems and sequences, z-domain analysis. Generalization of Parseval's Theorem. System realization through block-diagram representation and system interconnection. State space analysis and multi-input, multi-output representation. The statetransition matrix and its role. The Sampling Theorem and its implications- Spectra of sampled signals. Reconstruction: ideal interpolator, zero-order hold, first-order hold, and so on. Aliasing and its effects. Relation between continuous and discrete time systems. Applications of signal and system theory- modulation for communication, filtering and so on. **Advanced topics:** time-frequency representation and the uncertainty principle, Short-time Fourier Transforms and wavelet transforms.

Text/ Reference Books:

- R.F. Ziemer, W.H. Tranter and D.R. Fannin, "Signals and Systems - Continuous and Discrete", 4th edition, Prentice Hall, 1998.
- A. Papoulis, "Circuits and Systems: A Modern Approach", HRW, 1980.
- B.P. Lathi, "Signal Processing and Linear Systems", Oxford University Press, 1998.
- Douglas K. Lindner, "Introduction to Signals and Systems", Mc-Graw Hill International Edition: 1999.
- Simon Haykin, Barry van Veen, "Signals and Systems", John Wiley and Sons (Asia) Private Limited, 1998.
- M. J. Roberts, "Signals and Systems - Analysis using Transform methods and MATLAB", TMH, 2003.

Analog Electronics

Scope and applications of analog electronic circuits. Amplifier models: Voltage amplifier, current amplifier, trans-conductance amplifier and trans-resistance amplifier. Biasing schemes for BJT and FET amplifiers, bias stability, various configurations (such as CE/CS, CB/CG, CC/CD) and their features, small signal analysis, low frequency transistor models, estimation of voltage gain, input resistance, output resistance etc., design procedure for particular specifications, low frequency analysis of multistage amplifiers. High frequency transistor models, frequency response of single stage and multistage amplifiers, cascode amplifier. Various classes of operation (Class A, B, AB, C etc.), their power efficiency and linearity issues. Feedback topologies: Voltage series, current series, voltage shunt, current shunt, effect of feedback on gain, bandwidth etc., calculation with practical circuits, concept of stability, gain margin and phase margin. Oscillators: Review of the basic concept,

Barkhausen criterion, RC oscillators (phase shift, Wien bridge etc.), LC oscillators (Hartley, Collpit, Clapp etc.), non-sinusoidal oscillators. Current mirror: Basic topology and its variants, V-I characteristics, output resistance and minimum sustainable voltage (VON), maximum usable load. Differential amplifier: Basic structure and principle of operation, calculation of differential gain, common mode gain, CMRR and ICMR. OP-AMP design: design of differential amplifier for a given specification, design of gain stages and output stages, compensation. OP-AMP applications: review of inverting and non-inverting amplifiers, integrator and differentiator, summing amplifier, precision rectifier, Schmitt trigger and its applications. Active filters: Low pass, high pass, band pass and band stop, design guidelines. Digital-to-analog converters (DAC): Weighted resistor, R-2R ladder, resistor string etc. Analog-to-digital converters (ADC): Single slope, dual slope, successive approximation, flash etc. Switched capacitor circuits: Basic concept, practical configurations, application in amplifier, integrator, ADC etc. Semiconductor devices: UJT, SCR, diac, triac etc., device characteristics and application circuits. Case studies: practical circuits of typical electronic systems.

Text/ Reference Books:

- J.V. Wait, L.P. Huelsman and GA Korn, Introduction to Operational Amplifier theory and applications,
- McGraw Hill, 1992.
- J. Millman and A. Grabel, Microelectronics, 2nd edition, McGraw Hill, 1988.
- P. Horowitz and W. Hill, The Art of Electronics, 2nd edition, Cambridge University Press, 1989.
- A.S. Sedra and K.C. Smith, Microelectronic Circuits, Saunder's College Publishing, Edition IV
- Paul R.Gray \& Robert G.Meyer, Analysis and Design of Analog Integrated Circuits, John Wiley, 3rd Edition

Principles of Communication

Review of signals and systems, Frequency domain of signals, Principles of Amplitude Modulation Systems- DSB, SSB and VSB modulations. Angle Modulation., Representation of FM and PM signals. Spectral characteristics of angle modulated signals. Review of probability and random process. Gaussian and white noise characteristics. Noise in amplitude modulation systems. Noise in Frequency modulation systems. Pre-emphasis and De-emphasis. Threshold effect in angle modulation. Pulse modulation. Sampling process. Pulse Amplitude and Pulse code modulation (PCM). Differential pulse code modulation. Delta modulation. Noise considerations in PCM. Time Division multiplexing. Digital Multiplexers.

Text/ Reference Books:

- Haykin S., "Communications Systems", John Wiley and Sons, 2001.
- Proakis J. G. and Salehi M., "Communication Systems Engineering", Pearson Education, 2002.
- Taub H. and Schilling D.L., "Principles of Communication Systems", Tata McGraw Hill, 2001.

Digital Communication