Scheme for B.Tech. Engineering with Minor in Electronics and Communication Engineering

Department of Electronics and Communication Engineering

The student has to do 6 courses. The (*) indicates one subject can be chosen in each of the VII and VIII semesters.

S.No.	Semester	Course Code	Course Name	Cate gory	Type	Credit	L-T-P
1	V		Analog Communication		Theory	3	3-0-0
2	V		Digital Logic Design		Theory	3	3-0-0
3	VI		Signals and Systems		Theory	3	3-0-0
4	VI		Electronic Devices and Circuits		Theory	3	3-0-0
5	VII*		Linear Integrated Circuits		Theory	3	3-0-0
6	VII*		Wireless and 5G Communication		Theory	3	3-0-0
7	VIII*		Digital Communication Systems		Theory	3	3-0-0
8	VIII*		Embedded Systems		Theory	3	3-0-0

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Course Name : Analog Communication
Course Code :
Credits : 3 (L-T-P : 3-0-0)

Syllabus:

- Amplitude Modulation: AM, Double Side Band Suppressed Carrier modulation, Single Side Band modulation, Vestigial Side Band modulation, AM receivers, Noise in AM receivers using envelope detection, SNR for coherent reception with SSB and DSBSC modulations, Frequency Division Multiplexing.
- Angle modulation: Frequency modulated & Phase modulated signals, NBFM/WBFM, Multitone FM, De-emphasis in FM, Noise in FM reception.
- Pulse Analog Modulation: Pulse Amplitude Modulation, Pulse time Modulation, Time Division multiplexing, Elements of Pulse Code modulation , Differential PCM, Delta Modulation, Adaptive Delta Modulation.
- Probability Theory & Random Variables : Self, joint & conditional probabilities, Statistically dependent & independent events, Discrete and continuous Random Variables (RV's) , their CDF's and PDF's, Functions of random variables, Joint RVs, Mean values and moments of some pdf's (Binomial, Poisson, Gaussian, Rayleigh, Maxwell), Correlation function and their properties, Random processes.
- Noise Analysis of Communication Systems.

Course Outcomes:

CO1-To familiarize the students about different analog modulation and demodulation schemes
CO2- To understand analog-digital conversion techniques.
CO3- To analyze the performance of different modulation techniques under noise.
CO4- To apply the concept of probability and random processes in analysis of communication systems.
CO5- To perform noise analysis of communication systems

References:

1. Haykin S.: Communication Systems, 2/e, Student Edition, Wiley India, 2007.
2. Oppenheim A.V., Willsky A.S. and Nawab S.H..: Signals and Systems, 2/e, Prentice Hall of India, 1997
3. Tan: Digital Signal Processing; Fundamentals and application, Elsevier
4. B.P. Lathi, Modern Digital and Analog. Communication Systems, 3rd ed., Oxford. University Press, 1998
5. Proakis and M. Salehi, Communication Systems Engineering, 2nd Edition

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Course Name : Digital Logic Design
Course Code :
Credits : 3 (L-T-P : 3-0-0)

Syllabus:

Number System and Codes: Weighted Codes/Non Weighted codes, Error Correction/Detection Codes, BCD codes, Fixed point & floating point Number System

Boolean Algebra and Logic Gates: SOP and POS for Truth Table, K'Maps, Tabular method, NAND/NOR Universal Gates, Introduction to logic families

Combination Circuits: Adders, Subtractors, Magnitude comparators, Encoder/Decoders, Muxes/DeMuxes, BCD Adder, Logic Implementation using combinational blocks

Sequential Circuits: FlipFlops, Master-Slave FlipFlop, Type of Counters (Synchronous/Asynchronous), Types Registers, FSM concept, Examples of FSM

PLD Concept and Implementation: Basics of HDL (VHDL/Verilog) , Syntax and Semantics of HDL, Design Style using HDL, Basics of PAL,PLA, PROM, CPLD, FPGA

Course Outcomes:

At the end of the course the student will be able to:

CO1: Understand the concept and design of combinational and sequential (synchronous and asynchronous) digital logic circuits (knowledge)

CO2: Understand the concept of Testing and Testability of digital circuits (Knowledge)

CO3: Design and Implement Algorithmic State Machines (skills)

CO4 : Understand Symmetric and Iterative Circuits (Knowledge)

References:

1. Digital Design by Morris Mano
2. Switching Theory and Finite Automata by Zvi Kohvi

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Course Name : Signals & Systems
Course Code :
Credits : 3 (L-T-P : 3-0-0)

Syllabus:

- Representation of Signals and Systems: Continuous & discrete time signals, LTI systems and their classification, System modelling using differential and difference equations
- Convolution, Transmission of signals through linear systems
- Analysis of signals: Fourier series, Fourier transforms and their properties
- Fourier Analysis for DTS: Discrete time Fourier series, Discrete time Fourier transform and their properties, DFT and its properties, Fast Fourier Transform
- Laplace transforms, Z-transforms & its properties, ROC, Inversion of Z-transform, application to System Analysis.

Course Outcomes :

CO1. Understand the handling of signals in different domains- time and frequency -through Fourier transforms. Analysis and synthesis of different basic signals to be used in the communication systems.
CO2. Acquire the basic mathematical understanding of the probability theory; methods of converting these results of the probability theory into different form of expressions-distribution and density functions, so as to be useful in the analysis of signals.
CO3. Extend the concepts of probability theory to random processes. Learn to evaluate the different type of estimates generated through the probabilistic methods for use in the analysis of noise.
CO4. After undergoing this course, the student will be able to analyze the different type of signals and noises in communication systems.

References:

1. Oppenheim A.V., Willsky A.S. and Nawab S.H..: Signals and Systems, 2/e, Prentice Hall of India, 1997
2.B.P. Lathi, Modern Digital and Analog. Communication Systems, 3rd ed., Oxford. University Press, 1998

Course Name : Electronic Devices & Circuits
Course Code :
Credits : 3 (L-T-P : 3-0-0)

Syllabus:

Transistor at low frequencies: Graphical Analysis of the CE configuration, Two-Port devices and the hybrid Model, Transistor hybrid model, The h-parameter, Conversion formulas for the parameters of the three transistor Configuration, Analysis of a transistor Amplifier Circuit using h parameters, The Emitter follower, Comparison of transistor amplifier configurations, Linear Analysis of a Transistor Circuit, Cascading Transistor Amplifiers, Simplified Common-Emitter Hybrid Model, Simplified calculations for the Common Collector Configuration, The Common-Emitter Amplifier with an emitter resistance, High input resistance transistor circuits, Multistage amplifier analysis.
Field Effect Transistors: The FET and MOSFET Small-Signal model, The Low-Frequency Common-Source and Common-Drain Amplifiers, The FET as a Voltage-variable Resistor (VVR). High frequency model of BJT: High frequency hybrid-π model of BJT, Common emitter and common collector configurations, Cascade configuration.
Feedback Amplifiers: General Feedback structure, Properties of negative Feedback, Four basic Feedback Topologies, Voltage series, Voltage shunt, Current series, Current Shunt, Effect of Feedback connection on various parameters. Analysis of above topology for BJT and FET. **Oscillators:** Basic principle of sinusoidal oscillator (phase shift, wein bridge), Hartley & Colpitts, Crystal Oscillator, nonlinear/pulse oscillator.

Course Outcomes:
CO1-Understand the modelling of bipolar junction transistors (BJTs), analyse the different amplifier configurations using these transistors models, learn to simplify these models and analyse the different transistor configurations.
CO2-Acquire the basic understanding of the Field effect transistor (FET) and its small signal model, analyse the low frequency configurations of the amplifier using FET. (I/3)
CO3-Understand the high frequency model of the bipolar junction transistors (BJTs) for the different configurations.
CO4-Learn the concept of feedback to stabilize the amplifiers, analyse the different topologies and synthesise the same using BJTs and FETs (II/3)
CO5-Learn the principles of sinusoidal oscillators. (III/3)

References:
1) Electronic principles, Bolysted.
2) Millman, Halkias, Integrated Electronics- Analog & digital circuits, TMH.
3) Millman, Halkias & S. Jit. Electronics Devices & Circuits, TMH, 2009.
4) Microelectronic Circuits, Sedra Smith, Oxford press, India.
5) Electronic Devices and Circuits, David-A-Bell, Oxford Univ. Press 2008.

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Course Name : Linear Integrated Circuits
Course Code :
Credits : 3 (L-T-P : 3-0-0)

Syllabus:

Operational Amplifiers and its applications: Op-amp and its parameters, Applications of Op-amps as integrator, differentiator, comparator, oscillators, digital-to-analog, analog-to-digital converter, log and antilog, rectifiers etc.

Active Filters: High pass filter, low pass filter, band pass filter, band stop filter, notch filter.

Waveform Generators: Astable Multivibrator, Monostable Multivibrator, Bistable Multivibrator, Schmitt trigger.

Power Amplifiers: Power Amplifier Circuits: Class A, Class B and Class AB output stages, Class A, Class B Push pull amplifiers with and without Transformers.

PLL and 555 Timer: Phase locked loop (PLL): Block diagram, working and its various applications; 555 Timer: Block diagram, working principle and its applications as Bistable, Monostable, and Astable mode.

Course Outcomes:
At the end of the course the student will be able to:
CO1: Understanding different modes of Schmitt trigger
CO2: Implementing circuits with Operational amplifier
CO3: Understanding different types of power amplifiers
CO4: Applying the voltage regulator in different configuration
CO5: Understanding PLL and its usage

References:

1. Sedra/Smith, Microelectronic Circuits, Oxford University Press.
2. L. Schilling and C. Belove, Electronic Circuits, McGraw-Hill.
3. S. Soclof, Applications & Design with analog IC's PH1
4. Jacob-Applications & Design with analog IC's, PH1
5. Coughlin Driscol-Operational Amplifiers & Linear IC's Pearson Education.
6. Millman, Halkias & Parikh. Integrated Electronics- Analog & digital circuits, TMH, 2009.
7. Current literature from reputed journals

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Course Name : Wireless and 5G Communication
Course Code :
Credits : 3 (L-T-P : 3-0-0)

Syllabus:

Introduction to 5G: Fundamentals of Wireless Communication, Evolution from 1G to 5G, 5G spectrum, Wireless Standards: Overview of 2G 3G, 4G and 5G, Key capabilities of 5G, System Architecture, Performance measures- Outage, average snr, average symbol/bit error rate. System examples- GSM, EDGE, GPRS, IS-95, CDMA 2000 and WCDMA, 3G, 4G and 5G mobile communications.

Cellular System Design Fundamentals: Components of Mobile Cellular Systems: Cell structure, frequency reuse, cell splitting, Call origination & Termination. Cellular concepts- Signal propagation-Propagation mechanism, reflection, refraction, diffraction and scattering, large scale signal propagation and lognormal shadowing. Interference & System Capacity: Improving Capacity in Cellular Systems, Co-Channel Interference, Channel Assignment Strategies, Handoff Strategies.

Channel Fading and Diversity: Multipath Measurements, Parameters of Mobile Multipath Channels, Types of Fading: Multipath and small-scale fading- Doppler shift, power delay profile, average and rms delay spread, coherence bandwidth and coherence time, flat and frequency selective fading, slow and fast fading, average fade duration and level crossing rate. Impulse Response Model of a Multipath Channel, Channel State Information. Receiver structure- Diversity receivers- selection and MRC receivers, RAKE receiver, equalization: linear-ZFE and adaptive, DFE. Transmit diversity Altamonte scheme

5G Radio Standard: Orthogonal frequency division multiplexing (OFDM), Modulation schemes-BPSK, QPSK and variants, QAM, MSK and GMSK, multicarrier modulation, OFDM, MIMO and space time signal processing, spatial multiplexing, diversity/multiplexing tradeoff.

5G Enabling Technologies: Concept of 5G Communication, Multi-carrier with filtering, Filter-bank based multi-carrier, Non-orthogonal multiple access (NOMA). Principle and Spectrum Allocation, Power Control Mechanism in NOMA Techniques, 5G Applications.

Course Outcomes :

CO1- Appreciate and familiarize the world of mobile communications.

CO2- Develop requisite mathematical background for mobile systems using teletraffic theory, probability theory and stochastic processes as well as linear algebra.

CO3- Design parts of mobile communication system using mathematical models.

CO4- Develop proficiency in the subject by working on individual term papers and presenting their study to the entire class (Presentation Sessions).

References:

1) Wireless Communications: Principles & Practices by Theodore S. Rapport.
2) Mobile Cellular Telecomm. B y William C. Y. Lee.
3) Mobile Communication by Schiller, (Pearson Education India.
4) Osseiran, Afif, Jose F. Monserrat, and Patrick Marsch, eds. *5G mobile and wireless communications technology*. Cambridge University Press, 2016.
5) Rodriguez, Jonathan. *Fundamentals of 5G mobile networks*. John Wiley & Sons, 2015.

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Course Name :: Digital Communication Systems
Course Code :
Credits : 3 (L-T-P : 3-0-0)

Syllabus:

Line Codes: On-Off (RZ), Polar (RZ), Bipolar (RZ), on-off (NRZ),-Polar (NRZ) & their Power spectrum density (PSD), HDB coding, B8ZS signaling.
Baseband Pulse transmission: Inter-symbol Interference (ISI) & its Reduction. Techniques, Nyquist criterion for distortionless baseband binary transmission, correlative coding, eye pattern.
Digital Passband transmission: BPSK, BFSK, QPSK, QAM, MSK and M-ary, PSK, M-ary FSK transmitter and receiving systems and their detection , Probability of error, Power spectra, Matched filter. Introduction to Link Budget Analysis.
Spread spectrum Techniques: Spread Spectrum Overview, PN Sequences, DS-spread spectrum & Frequency- hop spread spectrum systems and their analysis, Introduction to W-CDMA and multiuser detection.

Course Outcomes:
Co1- Understanding of different types of modulation and demodulation techniques for digital communication
Co2- To learn the ISI and equalization techniques.
Co3-To analyse different types of channel coding schemes.
Co4-Understanding the performance of different digital communication systems

References:

1) Modern Digital & Analog Comm. systems 3/e B.P. Lathi; Oxford
2) Principles of Comm. Systems., Taub & Schilling, McGraw Hill publications.
3) Digital Comm.- By Proakis (TATA McGraw Hill) publications.
4) Digital Comm.-By Sklar (Pearson Education)
5) Comm. System 3/e Simon Haykin, Wiley Eastern Ltd.

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Course Name : Embedded Systems
Course Code :
Credits : 3 (L-T-P : 3-0-0)
Syllabus:

Syllabus:

Embedded Computing- Microprocessors, embedded design process, system description formalisms. Instruction sets- CISC and RISC;
MBeD platform; ARM architectures and programming- Cortex M0 etc;

CPU fundamentals- programming I/Os, co-processors, supervisor mode, exceptions, memory management units and address translation, pipelining, superscalar execution, caching, CPU power consumption.

Embedded platform- CPU bus, memory devices, I/O devices, interfacing, debugging techniques. Realtime OS, timer & pulse width modulation, Serial and parallel communication, digital I/O, Analog I/O, interrupts, low power techniques

Hardware accelerators- CPUs and accelerators, accelerator system design. Networks- distributed embedded architectures, networks for embedded systems, network-based design, Internet-enabled systems.

Course Outcomes:

CO1- Appreciate difference between embedded and other types of computing and their specific hardware requirements.

CO2- Identify and interface embedded platform components.

CO3- ARM family processor architectures and their specific uses.

CO4- Program analysis and optimization

CO5- Able to compile programs,, download and run them on hardware

References:

1) Wolf, W. Computers as components- Principles of embedded computing system design. Academic Press (Indian edition available from Harcourt India Pvt. Ltd., 27M Block market, Greater Kailash II, New Delhi-110 048.)
2) Vahid and T. Givargis. Embedded System Design: A Unified Hardware/Software Introduction , Wiley, 2002.
3) Furber, ARM System-on-Chip Architecture, Pearson
4) ARM reference manuals for cortex M0+ .