COURSE INFORMATION SHEET
Electronic Devices

Course code: EC201
Course title: Electronic Devices
Pre-requisite(s): EC101 Basics of Electronics & Communication Engineering Co-requisite(s):
Credits: L: 3 T: 0 P: 0 C: 3 **Class schedule per week: 03 Class: B. Tech.**
Semester / Level: III/02
Branch: ECE
Name of Teacher:

Course Objectives

This course envisions to impact to students to:

1.	Understand Atoms, Electrons, Energy Bands and Charge Carriers in Semiconductors.
2.	Grasp the impact of Excess Carriers in Semiconductors, Optical Absorption, Carrier Lifetime, Photoconductivity and Diffusion of Carriers and apply the obtained knowledge.
3.	Appraise and analyse the characteristics of PN Junction and Junction Diodes.
4.	Evaluate the characteristics of Bipolar Junction Transistor (BJT).
5.	Comprehend the characteristics of Field-Effect Transistors and create their structures.

Course Outcomes

After the completion of this course, a student will be able to:

CO1	Describe and illustrate the Atoms, Electrons, Energy Bands and Charge Carriers in Semiconductors.
CO2	Sketch and explain the Carrier Transport Phenomena in semiconductor.
CO3	Illustrate with the sketch of the structure of PN Junction and Junction Diodes diagram their characteristics and analyse them.
CO4	Appraise the principle of operation BJTs, schematize their characteristics, assess and summarize their features.
CO5	Schematize the structure and design Field Effect Transistors. Schematize their characteristics and prepare an inference.

SYLLABUS

MODULE	(NO. OF LECTURE HOURS)
Module – I **Atoms, Electrons, Energy Bands and Charge Carriers in Semiconductors:** Quantum Mechanics, Bonding Forces and Energy Bands in Solids, Direct and Indirect Semiconductors, **LED**, Variation of Energy Bands with Alloy Composition, Effective Mass, Electrons and Holes in Quantum Wells, **Gunn Diode,** Temperature Dependence of Carrier Concentrations, Conductivity and Mobility, High-Field Effects, The Hall Effect.	**8**
Module – II **Excess Carriers in Semiconductors:** Optical Absorption, Luminescence, Carrier Lifetime and Photoconductivity, Solar Cells; Diffusion of Carriers: Diffusion Processes, Diffusion and Drift of Carriers; Built-in Fields, Diffusion and Recombination; The Continuity Equation, Steady State Carrier Injection; Diffusion Length, The Haynes–Shockley Experiment.	**8**
Module – III **PN Junction and Junction Diodes:** Charge at Junction, Contact Potential, Capacitance of p-n Junctions, Reverse-Bias Breakdown, **Zener diode, Varactor Diode,** Effects of Contact Potential on Carrier Injection, Recombination and Generation in Transition Region, Metal–Semiconductor Junctions, PIN diodes, Step Recovery Diodes, IMPATT diodes, Tunnel Diode.	**8**
Module – IV **Bipolar Junction Transistor (BJT):** Fundamentals of BJT Operation, Amplification with BJTs, Minority Carrier Distributions and Terminal Currents, Drift in the Base Region, Base Narrowing, Avalanche Breakdown, Gummel–Poon Model, Kirk Effect; Frequency Limitations of Transistors, High-Frequency Transistors, Heterojunction Bipolar Transistors.	**8**
Module – V **Field-Effect Transistors:** Junction FET, GaAs MESFET, High Electron Mobility Transistor (HEMT); Metal–Insulator–Semiconductor FET, MOSFET: Output Characteristics, Transfer Characteristics, Mobility Models, Short Channel MOSFET I–V Characteristics, Threshold Voltage Expression, Substrate Bias Effects, Subthreshold Characteristics, Equivalent Circuit for the MOSFET, CMOS processes.	**8**

COURSE INFORMATION SHEET
Digital System Design

Course code: EC203 R1
Course title: Digital System Design
Pre-requisite(s): EC101 Basics of Electronics & Communication Engineering
Co- requisite(s):
Credits: L: 3 T:0 P:0 C:3
Class schedule per week: 3x1
Class: B. Tech
Semester / Level: III/02
Branch: ECE
Name of Teacher:

Course Objectives
This course enables the students to:

1.	Understand the basics of digital electronics.
2.	Apply the knowledge of digital electronics to construct various digital circuits.
3.	Analyze the characteristics and explain the outputs of digital circuits.
4.	Evaluate and asses the application of the digital circuits.
5.	To realize various Multivibrators using transistors, op-amp and other discrete components.

Course Outcomes
After the completion of this course, students will be able to:

CO1	Explain the concept of digital electronics.
CO2	Apply the knowledge to produce digital electronics circuits.
CO3	Analyse and categorize digital circuits.
CO4	Justify the uses of different digital circuits.
CO5	Demonstrate the Bistable, Monostable and Astable Multivibrators using discrete components.

SYLLABUS

MODULE	(NO. OF LECTURE HOURS)
Module – I Basics of Digital Electronics: Review of number systems and codes used in digital system. Review of arithmetic used in digital system. Logic gates associated postulates and laws. Logic Families: TTL, ECL, and CMOS Logic Circuits, Logic levels, voltages and currents, fan-in, fan-out, speed, power dissipation. Comparison of logic families. Introduction to VHDL and Verilog, VHDL Models	**8**
Module – II Simplification of Boolean functions: Boolean Algebra, Basic theorems and Properties, De Morgan's theorem, Canonical & Standard forms, Simplification of a Boolean function using Karnaugh map, POS & SOP simplification, Prime implicant, NAND and NOR implementation.	**8**
Module – III **Design of Combinational Circuits:** Analysis and design procedure, Parity Generators and Checkers, Adders, Subtractors, Look ahead carry, Adder, 4-bit BCD adder/subtractor, Magnitude comparator, Decoders, Encoders, Multiplexers, De-multiplexers, Design of 1-bit ALU for basic logic and arithmetic operations.	**8**
Module – IV **Design of Sequential Circuits and Memories:** Basic Latch, Flip-Flops (SR, D, JK, T and Master-Slave), Triggering of Flip Flops, Synchronous and asynchronous counters, Registers, Shift Registers. Design of sequential circuit using state diagrams.	**8**
Module – V Memories and Programmable Logic design, Types of memories, Memory Expansion and its decoding, Programmable Logic Arrays (PLA), Programmable Array Logic (PAL). Switching Circuits and Multivibrators: Astable, Monostable and Bistable Multivibrators using BJTs, Schmitt trigger circuit, Multivibrators using op-amp and IC 555 timer.	**8**

Books recommended:

Textbooks:

1. "Digital Design", Morris Mano and Michael D. Ciletti ,5th edition PHI
2. "Digital System Design using VHDL", Charles H Roth, Thomson Learning

Reference books:

1. Digital computer Electronics AP Malvino, 3rd Edition Mc Graw Hill

COURSE INFORMATION SHEET
Electronic Measurements

Course code: EC207
Course title: Electronic Measurements
Pre-requisite(s): EC101 Basics of Electronics & Communication Engineering **Co-requisite(s):**
Credits: L: 3 T: 0 P: 0 C: 3
Class schedule per week: 3
Class: B. Tech
Semester / Level: III/03 *In-depth Specialization/Programme Elective*

Branch: ECE
Name of Teacher:

Course Objectives
This course enables the students to:

1.	Understand the need and concept of measurement, calibration, standards, errors, static and dynamic performance characteristics of measuring instruments.
2.	Demonstrate the operating principles of different analog and digital instruments.
3.	Experiment and analyze various a.c. and d.c. bridges for the measurement.
4.	Explain the operation and construction of analog and digital CRO used for different parameter measurement in the department laboratory.
5.	Solve the problems of measuring non electrical parameters using different transducers.

Course Outcomes
After the completion of this course, students will be able to:

CO1	Find and investigate errors and explain the static and dynamic characteristics of instruments.
CO2	Explain the working of different analog instruments (PMMC, Moving iron) and use them to design multi-range voltage, current and resistance measuring instruments.
CO3	Demonstrate the process of balancing different bridge networks to find the value of unknown arm components.
CO4	Summarize the working of analog and digital CRO.
CO5	Schematize the measurement of non-electrical parameters using different transducers.

SYLLABUS

MODULE	(NO. OF LECTURE HOURS)
Module – I Introduction of measurements and measurement systems: Significance of measurements, different methods of measurements, Instruments used in measurements, Electronic Instruments and its classification, Elements of a Generalized Measurement System. Characteristics of instruments, Static characteristics, Errors in measurements, scale, range, and scale span, calibration, Reproducibility and drift, Noise, Accuracy and precision, Significant figures, Linearity, Hysteresis, Threshold, Dead time, Dead zone, Resolution and Loading Effects.	**8**
Module – II Analogue Instruments: Classification and Principles of Operation, Working Details Moving Coil (PMMC) and Moving Iron Instruments Construction, DC Ammeter, DC Voltmeter, Series and Shunt type Ohmmeter. Analogue Electronic voltmeter, DC Voltmeter with chopper type DC amplifier.	**8**
Module – III Introduction of DC and AC Bridges: Wheatstone Bridge, Kelvin Double Bridge, Maxwell's Bridge, and Hay's Bridge, Anderson's Bridge, Schering's Bridge, Wien's Bridge, Sources of errors in Bridges and their elimination by shielding and grounding, Q meter. Oscilloscopes: CRT, Construction, Basic CRO circuits, Block diagram of a modern oscilloscope, Y-amplifiers, X-amplifiers, Triggering, Oscilloscopic measurement. Special CRO's: Dual trace, Dual beam.	**8**
Module – IV Digital Instruments and D/A and A/D converters**:** Sample-and-hold circuit, D/A converters: Weighted-resistor D/A Converter, R-2R Ladder type D/A converter, Specifications for D/A Converters, A/D Converters: Parallel-comparator type A/D converter, Successive approximation type A/D converter, Counter type A/D converter, Dual slope converter, Comparison of converter types, Digital Voltmeters, Digital Multimeters, Digital frequency Meter, Sampling oscilloscope, Storage CROs.	**8**
Module – V Transducers: Definition, Classification, Principle of Analogue transducer: Resistive (Strain Gauge, POT, Thermistor and RTD), Capacitive, Piezoelectric, Thermocouple and Inductive (LVDT) and RVDT) transducer, Working principle of Digital Transducer and Optical transducer. Application of above transducers to be discussed on the basis of Pressure, Displacement, Level, Flow and Temperature measurements.	**8**

COURSE INFORMATION SHEET
NETWORK THEORY

Course code: EC209
Course title: NETWORK THEORY
Pre-requisite(s): Basics of Electrical Engineering
Co- requisite(s): Mathematics
Credits: 3 L:3 T:0 P:0
Class schedule per week: 03
Class: B. Tech
Semester / Level: 02
Branch: ECE **Name of Teacher:**

Course Objectives:
This course enables the students to:

A. list the Properties and discuss the concepts of graph theory
B. solve problems related to network theorems
C. illustrate and outline the Multi-terminal network in engineering
D. select and design of filters

Course Outcomes:
After the completion of this course, students will:

1. be able to solve problems related to DC and AC circuits
2. become adept at interpreting network analysis techniques
3. be able to determine response of circuits consisting of dependent sources
4. analyse linear and non-linear circuits
5. be able to design the filters with help of electrical element

Syllabus:

Module – I

Network Topology: Definition and properties, Matrices of Graph, Network Equations &Solutions: Node and Mesh transformation; Generalized element; Source transformation; Formulation of network equations; Network with controlled sources; Transform networks; Properties of network matrices; Solution of equations; Linear timeinvariant networks; Evaluation of initial conditions; Frequency and impedance scaling.

Module – II

Network Theorem: Substitution theorem, Tellegen's theorem, Reciprocity theorem; State space concept and State variable modelling.

Module – III
Multi-terminal Networks: Network function, transform networks, natural frequency (OCNF and SCNF); Two-port parameters, Equivalent networks.

Module – IV

Elements of Network Synthesis: Positive real function, Reactance functions, RC functions, RL Network, Two-port functions, Minimum phase networks.

Module – V

Approximation: Filter specifications; Butterworth approximation; Chebyshev approximation; Frequency transformation; High pass; Band pass; all pass and notch filter approximation.

Text Books:

1. V.K. Aatre, Network Theory & Filter Design, New Age International Pvt. Ltd., New Delhi. (T1)
2. M.S. Sukhija, T.K.Nagsarkar, Circuits and Networks, Oxford University Press, 2nd ed., New Delhi.(T2)

Reference Books:

1. M.E. Van Valkenberg, Introduction to Modern Network Synthesis, John Wiley & Sons (1 January 1966) (R1)
2. Balabanian, N. and T.A. Bickart, "Electric Network Theory", John Wiley & Sons, New York, 1969. (R2) 3. C. L. Wadhwa, Network Analysis and Synthesis, New Age International Pvt. Ltd., New Delhi(R2)

Gaps in the syllabus (to meet Industry/Profession requirements):

i. Practical aspects and demonstration of electrical and non-electrical systems

POs met through Gaps in the Syllabus:

a) Demonstrate appropriate inter-personal skills to function effectively as an individual, as a member or as a leader of a team and in a multi-disciplinary setting (POi)
b) Be able to comprehend and write effective reports and design documentations; give and receive clear instructions; make effective presentations and communicate effectively and convincingly on complex engineering issues with engineering community and with society at large. (POj)
c) Be conscious of financial aspects of all professional activities and shall be able to undertake projects with appropriate management control and control on cost and time. (POk)
d) Recognize the need for continuous learning and will prepare himself/ herself appropriately for his/her allround development throughout the professional career. (POl)

Topics beyond syllabus/Advanced topics/Design:

i. Design of filter using operational amplifier

POs met through Topics beyond syllabus/Advanced topics/Design:

Course Delivery methods
Lecture by use of boards/LCD projectors/OHP projectors
Tutorials/Assignments
Seminars
Mini projects/Projects
Laboratory experiments/teaching aids
Industrial/guest lectures
Industrial visits/in-plant training

COURSE INFORMATION SHEET
Probability and Random Processes

Course code: **EC251**
Course title: **Probability and Random Processes**
Pre-requisite(s): EC205 Signals and Systems
Co- requisite(s):NA
Credits: L: 3 T: 0 P: 0 C: 3
Class schedule per week: 03 Class: B. Tech.
Semester / Level: IV/02
Branch: ECE
Name of Teacher:
Course Objectives:
This course enables the students:

1.	To explain the random phenomena and impart knowledge on the mathematical modelling of the random experiment.
2.	To develop an ability to describe random vectors and their characterization.
3.	To develop an ability to understand the concept of random processes or stochastic processes.
4.	To develop an ability to analyze the stochastic processes with the help of probability models and its characterization
5.	To develop an ability to evaluate different emerging techniques to improve real-time estimation and detection of random parameters.

Course Outcomes:

After the completion of this course, students will be able to:

CO1	Demonstrate an understanding of the mathematical modelling of the random experiment or random phenomena.
CO2	Describe random vectors and their characterization.
CO3	Demonstrate an understanding of the concept of random processes or stochastic processes.
CO4	Analyze the stochastic processes with the help of probability models and their characterization.
CO5	Evaluate the different emerging techniques to improve real-time estimation and detection of random parameters.

SYLLABUS

MODULE	(NO. OF LECTURE HOURS)
Module – I **Randomness, Uncertainty and its Description** Random experiments/phenomenon, outcomes of the random experiment, Sample Space, Events, Probability of an event, Concepts of sets and probability theory to explain Random experiments, Probability space; Conditional probability, Independence and Bayes theorem; Combinatorial probability and sampling models.	**8**
Module – II **Random Variable and its characterization:** Continuous random variables: distribution function, probability density function, Conditional Densities and Distributions, an example of distributions, Gaussian, Rayleigh, and Rician; exponential, chi-squared; gamma. Discrete random variables: distribution function, probability mass function, Example of random variables and distributions (Bernoulli, binomial, Poisson, geometric, negative binomial, etc.), Expectations, Variance, MGF and Characteristics Function of Random Variable, moments of Random Variable.	**9**
Module – III **Random vector and its characterization:** Joint Events, Joint CDF and PDF, Properties of Joint CDF and PDF, Bivariate Gaussian Distributions, Joint Moments, Random Vectors, Vector Gaussian Random Variables, Moments of Random Vectors, Independence of two random vectors	**9**
Module – IV **Inequalities, Convergences, and Limit Theorems**: Random sequences Markov, Chebyshev and Chernoff bounds; modes of convergence (everywhere, almost everywhere, probability, distribution and mean square); Stochastic convergence, the law of large numbers, central limit theorem, Limit theorems; Strong and weak laws of large numbers.	**8**
Module – V **Random Processes and Linear Systems:** Random Data/Signals, stationarity; mean, correlation, and covariance functions, WSS random process; autocorrelation and cross-correlation functions; transmission of a random process through a linear System; power spectral density; white random process; Gaussian process; Poisson process, Application of Probability and Random Processes to understand important domain like digital communication, estimation and information theory.	**6**

COURSE INFORMATION SHEET
Analog Circuits

Course code: EC253 R1
Course title: Analog Circuits
Pre-requisite(s): EC101 Basics of Electronics & Communication Engineering
Co-requisite(s): None
Credits: L: 3 T: 0 P: 0 C: 3.0
Class schedule per week: 03
Class: B. Tech
Semester / Level: 04
Branch: ECE
Name of Teacher:

Course Objectives

This course enables the students:

1.	To help them understand the operation of Transistors for low frequency applications and power amplifiers
2.	To know the operation of multistage amplifiers and transistors for high frequency applications and tuned amplifiers
3.	To help them understand the operation of feedback amplifiers and oscillators
4.	To help them realize the non-linear applications of op-amp and filters
5.	To help them understand sweep circuits and time base generators.

Course Outcomes
After the completion of this course, students will be able to:

CO1	Understand the concept of amplifiers, oscillators and active filter circuits.
CO2	Demonstrate the working of amplifiers, oscillators and active filter circuits.
CO3	Analyze amplifiers, filters at low and high frequency.
CO4	Evaluate amplifiers, oscillator, filters circuits.
CO5	Designing sweep circuits and time base generators.

Syllabus

MODULE	(NO. OF LECTURE HOURS)
Module – I Wave shaping circuits: RC low pass and high pass circuits and their response to sinusoidal, step, pulse, and square wave inputs, clipping and clamping circuits. Review of hybrid and simplified models of CE, CB, CC configurations of BJT. CE amplifier with emitter resistance, Emitter follower, Darlington Circuit, Cascode Amplifier.	**10**
Module – II Transistor Power Amplifiers: Class A, Class B, Class C and Push-Pull Configurations. Multistage amplifiers: Frequency response of an amplifier, Bandpass of cascaded stages, Low frequency response of RC coupled amplifier. Transistors at High Frequencies: Hybrid model and parameters; high frequency response of CE transistor amplifier, Gain-Bandwidth product, Emitter follower at high frequencies, FET (CS & CD) at high frequencies, Single-tuned amplifier.	**10**
Module – III Feedback Amplifiers: Classification of amplifiers, feedback concept, transfer gain with feedback, characteristics of negative-feedback amplifier, method of analysis of feedback amplifiers, voltage-series feedback, current-series feedback, current-shunt feedback, voltage-shunt feedback. Concept of stability, gain margin and phase margin. Oscillators: RC phase shift oscillator, Wien bridge oscillator, crystal oscillator. Current mirror circuits.	**10**
Module – IV Emitter-coupled differential amplifier, transfer characteristics of differential amplifier, IC of operational amplifier: gain stages and output stages, Electronic analog computation using op-amp, Non-linear applications of OP-AMP: zero-crossing detector, precision rectifier, peak detector, logarithmic amplifier, Schmitt trigger. Active filters: Low pass, high pass, band pass and band stop, design guidelines.	**7**
Module – V Negative resistance switching devices and circuits: Tunnel diode, UJT, Voltage controlled and Current controlled negative resistance circuits, Negative–Resistance Characteristics, Monostable, Bistable, and Astable operations, Applications using Tunnel diode and UJT. Sweep circuits: Time base Signal, Miller and Bootstrap Time base Generators-Basic Principles, Transistor Miller Time Base generator, Transistor Bootstrap Time Base Generator, Transistor Current Time Base Generators, Methods of Linearity improvement.	**8**