N.B.K.R. INSTITUTE OF SCIENCE & TECHNOLOGY

(AUTONOMOUS)

COLLEGE WITH POTENTIAL FOR EXCELLENCE (CPE)
Affiliated to JNTUA, Anantapuramu
Re-Accredited by NAAC with 'A' Grade
B.Tech. Courses Accredited by NBA under TIER-I

SYLLABUS

B.TECH. DEGREE COURSE

II B.TECH
I & II Semesters

ELECTRONICS AND COMMUNICATION ENGINEERING

(With effect from the batch admitted in the academic year 2023-2024)

VIDYANAGAR - 524413
SPSR Nellore-Dist. Andhra Pradesh
www.nbkrist.org

NBKR INSTITUTE OF SCIENCE & TECHNOLOGY: VIDYANAGAR
(AUTONOMOUS)
(AFFILIATED TO JNTU ANANTAPUR: ANANTHAPURAMU)
SPSR NELLORE DIST
II YEAR OF FOUR YEAR B.TECH DEGREE COURSE – I SEMESTER
ELECTRONICS AND COMMUNICATION ENGINEERING

SCHEME OF INSTRUCTION AND EVALUATION
(With effect from the academic year 2024-2025)
(For the batch admitted in the academic year 2024-2025)

S.No	Course Code	Course Title	Instruction Hours/Week			Credits	Evaluation									
							Sessional-I Marks			Sessional-II Marks			Total Sessional Marks(40)	End Semester Examination		Maximum Total Marks
		THEORY	L	T	D/P		Test[$]-I	A[#]-I	Max. Marks	Test[$]-II	A[#]-II	Max. Marks		Duration In Hours	Max. Marks	100
1	H&S	Probability and Complex Variables	3	0	-	3	25	5	30	25	5	30	0.8*Best of two+0.2* least of two	3	70	100
2	23EC2101	Signals, Systems and Stochastic Processes	3	0	-	3	25	5	30	25	5	30		3	70	100
3	23EC2102	Electronic Devices and Circuits	3	0	-	3	25	5	30	25	5	30		3	70	100
4	23EC2103	Digital Circuits Design	3	0	-	3	25	5	30	25	5	30		3	70	100
		PRACTICALS											Day to Day Evaluation and a test (30 Marks)			
5	23EC21P1	Electronic Devices and Circuits Lab	-	-	3	1.5	-	-	-	-	-	30		3	70	100
6	23EC21P2	Digital Circuits& Signal Simulation Lab	-	-	3	1.5	-	-	-	-	-	30		3	70	100
		SOFT SKILLS														
8	CSE	Python Programming	-	1	2	2	-	-	-	-	-	30		3	70	100
9	Audit Course	Environmental Science	2	-	-	-	25	5	30	25	5	30		3	70	100
		MANDATORY											0.8*Best of two+0.2* least of two			
9	H&S	Universal Human Values– Understanding Harmony and Ethical Human Conduct	2	1	-	3	25	5	30	25	5	30		3	70	100
		TOTAL	16	2	8	20	-	-	-	-	-	270	-	-	-	900

A for Assignment (Continuous Evaluation), $ Test (Descriptive & Short Answers) duration = 2 Hours

23EC2101-SIGNALS, SYSTEMS AND STOCHASTIC PROCESSES

<table>
<tr><td>Course Category:</td><td colspan="2">Professional Core</td><td>Credits:</td><td>3</td></tr>
<tr><td>Course Type:</td><td colspan="2">Theory</td><td>Lecture-Tutorial-Practical:</td><td>3-0-0</td></tr>
<tr><td>Prerequisite:</td><td colspan="2">Basic Mathematics, Transform Techniques, and random variables</td><td>Sessional Evaluation:
Univ. Exam Evaluation:
Total Marks:</td><td>30
70
100</td></tr>
<tr><td>Course Objectives</td><td colspan="4">1. Understanding the basics of signals and systems required for ECE courses.
2. To teach concepts of signals and systems and their analysis using different transform techniques.
3. To provide a basic understanding of random processes which is essential for the random signals and systems encountered in communications and signal processing areas.</td></tr>
<tr><td rowspan="6">Course Outcomes</td><td colspan="4">Upon successful completion of the course, the students will be able to:</td></tr>
<tr><td>CO1</td><td colspan="3">Understand the mathematical description and representation of continuous-time and discrete-time signals and systems, Also, understand the concepts of various transform techniques and Random Processes (L2)</td></tr>
<tr><td>CO2</td><td colspan="3">Apply sampling theorem to convert continuous-time signals to discrete-time signals and reconstruct back, different transform techniques to solve signals and system-related problems. (L3)</td></tr>
<tr><td>CO3</td><td colspan="3">Formulate and solve engineering problems involving random processes. (L3)</td></tr>
<tr><td>CO4</td><td colspan="3">Analyze the frequency spectra of various continuous-time signals using different transform methods. (L4)</td></tr>
<tr><td>CO5</td><td colspan="3">Classify the systems based on their properties and determine the response of them. (L4)</td></tr>
<tr><td>Course Content</td><td colspan="4">UNIT-I
Signals & Systems: Basic definitions and classification of Signals and Systems (Continuous time and discrete time), operations on signals, Concepts of Convolution and Correlation of signals, Analogy between vectors and signals-Orthogonality, Mean square error.
Fourier series: Trigonometric & Exponential forms of Fourier series, Properties, Concept of discrete spectrum, Illustrative problems.

UNIT-II
Fourier Transform: Definition, Computation and properties of Fourier transform for different types of signals and systems, Inverse Fourier transform. Sampling: Sampling theorem – Graphical and analytical proof for Band Limited Signals, Reconstruction of signal from its samples, Effect of under sampling – Aliasing. Illustrative problems.
Laplace Transform: Definition, ROC, Properties, Inverse Laplace transforms, the s-plane and BIBO stability, Transfer functions, System Response to standard signals, Solution of differential equations with initial conditions, Illustrative problems.</td></tr>
</table>

	UNIT-III **Signal Transmission through Linear Systems:** Linear system, impulse response, Response of a linear system for different input signals, 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 Paley-Wiener criterion for physical realization, Relationship between bandwidth and rise time, Energy and Power spectral densities, Illustrative problems. **UNIT-IV** **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, Autocorrelation Function and Its Properties, Cross-Correlation Function and Its Properties, Covariance Functions, Gaussian Random Processes, Poisson Random Process. Random Signal, Mean and Mean-squared Value of System Response, autocorrelation Function of Response, Cross-Correlation Functions of Input and Output. **UNIT-V** **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. Spectral Characteristics of System Response: Power Density Spectrum of Response, Cross-Power Density Spectrums of Input and Output.
Text Books & Reference Books	**TEXT BOOKS:** 1. Peyton Z. Peebles, "Probability, Random Variables & Random Signal Principles", 4thEdition, TMH, 2002. 2. A.V. Oppenheim, A.S. Willsky and S.H. Nawab, "Signals and Systems", 2nd Edition,PHI, 2009. **REFERENCE BOOKS:** 1. Signals, Systems & Communications - B.P. Lathi, 2013, BSP. 2. Athanasios Papoulis and S. Unnikrishna Pillai, "Probability, Random Variables andStochastic Processes", 4th Edition, PHI, 2002 3. Simon Haykin and Van Veen, "Signals & Systems", 2nd Edition, Wiley, 2005. 4. Matthew Sadiku and Warsame H. Ali, "Signals and Systems A primer withMATLAB", CRC Press, 2016. 5. Hwei Hsu, "Schaum's Outline of Signals and Systems", 4th edition, TMH, 2019.

23EC2102- ELECTRONIC DEVICES & CIRCUITS

<table>
<tr><td>Course Category:</td><td colspan="2">Professional Core</td><td>Credits:</td><td>3</td></tr>
<tr><td>Course Type:</td><td colspan="2">Theory</td><td>Lecture-Tutorial-Practical:</td><td>3-0-0</td></tr>
<tr><td>Prerequisite:</td><td colspan="2">Semiconductor Physics, Network Theory, Fourier Series</td><td>Sessional Evaluation:
Univ. Exam Evaluation:
Total Marks:</td><td>30
70
100</td></tr>
<tr><td>Course Objectives</td><td colspan="4">1. Students will be able to understand the basic principles of all semiconductor devices.
2. Able to analyze diode circuits, various biasing, and small signal equivalent circuits of amplifiers, compare the performance of BJTs and MOSFETs
3. Able to design rectifier circuits and various amplifier circuits using BJTs andMOSFETs.</td></tr>
<tr><td rowspan="6">Course Outcomes</td><td colspan="4">Upon successful completion of the course, the students will be able to:</td></tr>
<tr><td>CO1</td><td colspan="3">Understand the principle of operation, characteristics and applications of semiconductordiodes, special diodes, BJTs, JFET and MOSFETs. (L2)</td></tr>
<tr><td>CO2</td><td colspan="3">Applying the basic principles of solving the problems related to Semiconductor diodes,BJTs, and MOSFETs. (L3)</td></tr>
<tr><td>CO3</td><td colspan="3">Analyze diode circuits for different applications such as rectifiers, clippers andclampers also analyze biasing circuits of BJTs, and MOSFETs. (L4)</td></tr>
<tr><td>CO4</td><td colspan="3">Design of diode circuits and amplifiers using BJTs, and MOSFETs. (L4)</td></tr>
<tr><td>CO5</td><td colspan="3">Compare the performance of various semiconductor devices. (L4)</td></tr>
<tr><td>Course Content</td><td colspan="4">UNIT-I
PN junction diode: Review, Diode current equation, Diode resistance, Transition and Diffusion Capacitance, Effect of temperature on PN junction diode, Quantitative analysis of Half-wave, Full-wave and Bridge Rectifiers with and without Filters, Ripple Factor and Regulation Characteristics, Clipping and Clamping circuits, Illustrative problems.
Special Diodes: Construction, operation and VI characteristics of Tunnel Diode, Varactor Diode, LED, LCD, Photo Diode, SCR and UJT.
UNIT-II
Review of Bipolar Junction Transistors, Characteristics, Transistor as an Amplifier and as a Switch, BJT Configurations, Limits of Operation, BJT specification.
Biasing and Stabilization: Operating Point, DC and AC Load Lines, Importance of Biasing, Fixed Bias, Collector to Base Bias, Self-Bias, Bias Stability, Thermal Runaway, Thermal Stability, Illustrative problems.

UNIT-III
BJT Small Signal Operation and Models- the transconductance, input resistance at the base, input resistance at the emitter, Voltage gain, separating the Signal and the DC Quantities, The Hybrid π Model, the T Model. Single Stage BJT Amplifiers - Common-Emitter (CE) amplifier without and with emitter resistance, Common-Base (CB) amplifier, Common-Collector (CC) amplifier or Emitter Follower, Problem solving.</td></tr>
</table>

	UNIT-IV **Junction Field Effect Transistor (FET):** Construction, Principle of Operation, V–I Characteristics, Comparison of BJT and FET, FET as Voltage Variable Resistor. FET biasing. **MOS Field Effect Transistors:** Introduction, Device Structure and Physical Operation, CMOS, V - I Characteristics, MOSFET Circuits at DC, MOSFET as an Amplifier and as a Switch. Biasing in MOS Amplifier circuits - biasing by fixing VGS with and without source resistance, biasing using drain to gate feedback resistor, biasing using constant current source, body effect, Problem solving. **UNIT-V** MOSFET Small Signal Operation Models– the DC bias, separating the DC analysis and the signal analysis, Small signal equivalent circuit models, the transconductance, the T equivalent circuit model, Single stage MOS Amplifiers – common source (CS) amplifier without and with source resistance, common gate (CG) amplifier, source follower, Problem solving.
Text Books & Reference Books	**TEXTBOOKS:** 1. Adel S. Sedra and Kenneth C. Smith, “Microelectronic Circuits – Theory andApplications”, 6th Edition, Oxford Press, 2013. 2. J. Milliman and C Halkias, “Integrated electronics”, 2nd Edition, Tata McGraw Hill,1991. **REFERENCE BOOKS:** 1. Donald A. Neamen, “Electronic Circuits – analysis and design”, 3rd Edition, McGrawHill (India), 2019. 2. Behzad Razavi, “Microelectronics”, Second edition, Wiley, 2013. 3. R.L. Boylestad and Louis Nashelsky, “Electronic Devices and Circuits,” 9th Edition,Pearson, 2006. 4. Jimmie J Cathey, “Electronic Devices and Circuits,” Schaum’s outlines series, 3rd edition, McGraw-Hill (India), 2010.

23EC2103 – DIGITAL CIRCUITS DESIGN

<table>
<tr><td>Course Category:</td><td colspan="2">Professional Core</td><td>Credits:</td><td>3</td></tr>
<tr><td>Course Type:</td><td colspan="2">Theory</td><td>Lecture-Tutorial-Practical:</td><td>3-0-0</td></tr>
<tr><td>Prerequisite:</td><td colspan="2">Number systems, Boolean Algebra.</td><td>Sessional Evaluation:
Univ. Exam Evaluation:
Total Marks:</td><td>30
70
100</td></tr>
<tr><td>Course Objectives</td><td colspan="4">• Understand the properties of Boolean algebra, logic operations, and minimization ofBoolean functions.
• Analyze combinational and analyze sequential logic circuits.
• Understand the concepts of FSM and compare various Programmable logic devices.
• Model combinational and sequential circuits using HDLs.</td></tr>
<tr><td rowspan="6">Course Outcomes</td><td colspan="4">Upon successful completion of the course, the students will be able to:</td></tr>
<tr><td>CO1</td><td colspan="3">Understand the properties of Boolean algebra, logic operations, concepts of FSM (L2)</td></tr>
<tr><td>CO2</td><td colspan="3">Apply techniques for minimization of Boolean functions (L3)</td></tr>
<tr><td>CO3</td><td colspan="3">Analyze combinational and Sequential logic circuits. (L4)</td></tr>
<tr><td>CO4</td><td colspan="3">Compare various Programmable logic devices. (L4)</td></tr>
<tr><td>CO5</td><td colspan="3">Design and Model combinational and sequential circuits using HDLs. (L5, L6)</td></tr>
<tr><td>Course Content</td><td colspan="4">UNIT-I
Boolean algebra, logic operations, and minimization of Boolean functions, Review of Number Systems and Codes, Representation of unsigned and signed integers, Floating Point representation of real numbers, Laws of Boolean Algebra, Theorems of Boolean Algebra, Realization of functions using logic gates, Canonical forms of BooleanFunctions, Minimization of Functions using Karnaugh Maps.

UNIT-II
Combinational Logic Circuits: Combinational circuits, Design with basic logic gates, design procedure, adders, subtractors, 4-bit binary adder/ subtractor circuit, BCD adder, carry look- a-head adder, binary multiplier, magnitude comparator, data selectors, priority encoders, decoders, multiplexers, demultiplexers.

UNIT-III
Hardware Description Language: Introduction to Verilog - structural specification of logic circuits, behavioral specification of logic circuits, hierarchical Verilog Code, Verilog for combinational circuits - conditional operator, if-else statement, case statement, for loop using sequential circuits with CAD tools.

UNIT-IV
Sequential Logic Circuits: Basic architectural distinction between combinational and sequential circuits, Design procedure, latches, flip-flops, truth tables and excitation tables, timing and triggering consideration, conversion of flip- flops, design of counters, ripple counters, synchronous counters, ring counter, Johnson counter, registers, shift</td></tr>
</table>

	registers, universal shift register. Verilog constructs for sequential circuits, flip-flop with clear capability, using Verilog constructs for registers and counters. **UNIT-V** **Finite State Machines and Programmable Logic Devices:** Types of FSM, capabilities and limitations of FSM, state assignment, realization of FSM using flip-flops, Mealy to Moore conversion and vice-versa, reduction of state tables using partition technique, Design of sequence detector. Types of PLD's: PROM, PAL, PLA, basic structure of CPLD and FPGA, advantages of FPGAs.
Text Books & Reference Books	**TEXT BOOKS:** 1. M. Morris Mano, "Digital Design", 3rd Edition, PHI. (Unit I to IV) 2. Stephen Brown and Zvonko Vranesic, "Fundamentals of Digital Logic with VerilogDesign", 3rd Edition, McGraw-Hill (Unit V) **REFERENCE BOOKS:** 1. Charles H. Roth, Jr, "Fundamentals of Logic Design", 4th Edition, Jaico Publishers. 2. ZviKohavi and NirajK.Jha, "Switching and Finite Automata Theory, 3rd Edition,Cambridge University Press, 2010. 3. Samir Palnitkar, "Verilog HDL: A Guide to Digital Design and Synthesis", 2ndEdition,Prentice Hall PTR. 4. D.P. Leach, A.P. Malvino, "Digital Principles and Applications", TMH, 7th Edition.

23EC21P1 - ELECTRONIC DEVICES & CIRCUITS LAB

<table>
<tr><td>Course Category:</td><td colspan="2">Professional Core</td><td>Credits:</td><td>1.5</td></tr>
<tr><td>Course Type:</td><td colspan="2">Practical</td><td>Lecture-Tutorial-Practical:</td><td>0-0-3</td></tr>
<tr><td>Prerequisite:</td><td colspan="2">Electronic Devices & Circuits</td><td>Sessional Evaluation:
Univ. Exam Evaluation:
Total Marks:</td><td>30
70
100</td></tr>
<tr><td>Course Objectives</td><td colspan="4">• Verify the theoretical concepts practically from all the experiments.
• Analyse the characteristics of Diodes, BJT, MOSFET, UJT.
• Design the amplifier circuits from the given specifications.
• Model the electronic circuits using tools such as PSPICE/Multisim.</td></tr>
<tr><td rowspan="6">Course Outcomes</td><td colspan="4">Upon successful completion of the course, the students will be able to:</td></tr>
<tr><td>CO1</td><td colspan="3">Understand the characteristics and applications of basic electronic devices. (L2)</td></tr>
<tr><td>CO2</td><td colspan="3">Plot the characteristics of electronic devices. (L3)</td></tr>
<tr><td>CO3</td><td colspan="3">Analyze various biasing circuits and electronic circuits as amplifiers (L4).</td></tr>
<tr><td>CO4</td><td colspan="3">Design MOSFET / BJT based amplifiers for the given specifications. (L5)</td></tr>
<tr><td>CO5</td><td colspan="3">Simulate all circuits in PSPICE /Multisim. (L5).</td></tr>
<tr><td>Course Content</td><td colspan="4">LIST OF EXPERIMENTS: (Implement / Execute any 10 experiments).
1. Verify various clipping and clamper circuits using PN junction diode and draw the suitable graphs.
2. Study and draw the Volt Ampere characteristics of UJT and determine η, I_P, Iv, V_P, & Vv from the experiment.
3. Verification of the input and output characteristics of BJT in Common Emitter configuration experimentally and find required parameters from the graphs.
4. Study and draw the input and output characteristics of BJT in Common Base configuration experimentally and determine required parameters from the graphs.
5. Verification of the input and output characteristics of BJT in Common Collector configuration experimentally and find required parameters from the graphs. Study and draw the V- I characteristics of JFET experimentally.
6. Study and draw the output and transfer characteristics of MOSFET (Enhance mode) in Common Source Configuration experimentally. Find Threshold voltage (VT), gm, & K from the graphs.
7. Study and draw the output and transfer characteristics of MOSFET (Depletion mode) or JFET in Common Source Configuration experimentally. Find I_{DSS}, gm, & V_P from the graphs.
8. Design and analysis of voltage- divider bias/self-bias circuit using BJT.
9. Design and analysis of self-bias circuit using MOSFET.
10. Design a suitable circuit for switch using MOSFET/BJT.
11. Design a small signal amplifier using MOSFET (common source) for the given specifications. Draw the frequency response and find the bandwidth.</td></tr>
</table>

	12. Design a small signal amplifier using BJT (common emitter) for the givenspecifications. Draw the frequency response and find the bandwidth. **Note:** Software Tools like Multisim/ Pspice or Equivalent, DC Power supplies, Multi meters, DC Ammeters, DC Voltmeters, AC Voltmeters, CROs, and all the required active devices.

23EC21P2 - DIGITAL DESIGN & SIGNAL SIMULATION LAB

<table>
<tr><td>Course Category:</td><td colspan="2">Professional Core</td><td>Credits:</td><td>1.5</td></tr>
<tr><td>Course Type:</td><td colspan="2">Practical</td><td>Lecture-Tutorial-Practical:</td><td>0-0-3</td></tr>
<tr><td>Prerequisite:</td><td colspan="2">Digital Circuit Design, Signals & Systems, Stochastic Processes.</td><td>Sessional Evaluation:
Univ. Exam Evaluation:
Total Marks:</td><td>30
70
100</td></tr>
<tr><td>Course Objectives</td><td colspan="4">1. Verify the truth tables of various logic circuits.
2. Design sequential/combinational circuit using Hardware Description Language andverify their functionality.
3. Simulate various Signals and Systems through MATLAB
4. Analyze the output of a system when it is excited by different types of deterministicand random signals.</td></tr>
<tr><td rowspan="6">Course Outcomes</td><td colspan="4">Upon successful completion of the course, the students will be able to:</td></tr>
<tr><td>CO1</td><td colspan="3">Verify the truth tables of various logic circuits. (L2)</td></tr>
<tr><td>CO2</td><td colspan="3">Understand how to simulate different types of signals and system response. (L2)</td></tr>
<tr><td>CO3</td><td colspan="3">Design sequential and combinational logic circuits and verify their functionality. (L3,L4)</td></tr>
<tr><td>CO4</td><td colspan="3">Analyze the response of different systems when they are excited by different signalsand plot power spectral density of signals. (L4)</td></tr>
<tr><td>CO5</td><td colspan="3">Generate different random signals for the given specifications. (L5)</td></tr>
<tr><td>Course Content</td><td colspan="4">PART A
1. Design a simple combinational circuit with four variables and obtain minimal SOP expression and verify the truth table using Digital Trainer Kit.
2. Verification of functional table of 3 to 8-line Decoder /De-multiplexer
3. 4 variable logic function verification using 8 to1 multiplexer.
4. Design full adder circuit and verify its functional table.
5. Design a four-bit ring counter using D Flip–Flops/JK Flip Flop and verify output.
6. Design a four-bit Johnson’s counter using D Flip-Flops/JK Flip Flops and verify output
7. Verify the operation of 4-bit Universal Shift Register for different Modes ofoperation.
8. Draw the circuit diagram of MOD-8 ripple counter and construct a circuit using T-Flip- Flops and Test it with a low-frequency clock and sketch the output waveforms.
9. Design MOD–8 synchronous counter using T Flip-Flop and verify the result and sketchthe output waveforms.
10. (a) Draw the circuit diagram of a single bit comparator and test the output
(b) Construct 7 Segment Display Circuit Using Decoder and 7 Segment LED and test it.</td></tr>
</table>

PART B

1. Write a program to generate various Signals and Sequences: Periodic and Aperiodic, Unit Impulse, Unit Step, Square, Saw tooth, Triangular, Sinusoidal, Ramp, Sinc function.
2. Perform operations on Signals and Sequences: Addition, Multiplication, Scaling, Shifting, Folding, Computation of Energy and Average Power.
3. Write a program to find the trigonometric & exponential Fourier series coefficients of a rectangular periodic signal. Reconstruct the signal by combining the Fourier series coefficients with appropriate weightings- Plot the discrete spectrum of the signal.
4. Write a program to find Fourier transform of a given signal. Plot its amplitude and phase spectrum.
5. Write a program to convolve two discrete time sequences. Plot all the sequences.
6. Write a program to find autocorrelation and cross correlation of given sequences.
7. Write a program to verify Linearity and Time Invariance properties of a given Continuous System.
8. Write a program to generate discrete time sequence by sampling a continuous time signal. Show that with sampling rates less than Nyquist rate, aliasing occurs while reconstructing the signal.
9. Write a program to find magnitude and phase response of first order low pass and high pass filter. Plot the responses in logarithmic scale.
10. Write a program to generate Complex Gaussian noise and find its mean, variance, Probability Density Function (PDF) and Power Spectral Density (PSD).
11. Generate a Random data (with bipolar) for a given data rate (say 10kbps). Plot the same for a time period of 0.2 sec.
12. To plot pole-zero diagram in S-plane of given signal/sequence and verify its stability.

References Books:

1. M. Morris Mano, “Digital Design”, 3rd Edition, PHI
2. Stephen J. Chapman, “MATLAB Programming for Engineers”, Cengage, November 2012.

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SPSR NELLORE DIST
II YEAR OF FOUR YEAR B.TECH DEGREE COURSE – II SEMESTER
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SCHEME OF INSTRUCTION AND EVALUATION
(With effect from the academic year 2024-2025)
(For the batch admitted in the academic year 2024-2025)

S.No	Course Code	Course Title	Instruction Hours/Week			Credits	Evaluation									
							Sessional-I Marks			Sessional-II Marks			Total Sessional Marks(40)	End Semester Examination		Maximum Total Marks
		THEORY	L	T	D/P		Test[$]-I	A[#]-I	Max. Marks	Test[$]-II	A[#]-II	Max. Marks		Duration In Hours	Max. Marks	100
1	H&S	Business Environment	2	0	-	2	25	5	30	25	5	30	0.8*Best of two+0.2* least of two	3	70	100
2	EEE	Linear Control Systems	3	0	-	3	25	5	30	25	5	30		3	70	100
3	23EC2201	EM Waves and Transmission Lines	3	0	-	3	25	5	30	25	5	30		3	70	100
4	23EC2202	Electronic Circuits Analysis	3	0	-	3	25	5	30	25	5	30		3	70	100
5	23EC2203	Analog and Digital Communications	3	0	-	3	25	5	30	25	5	30		3	70	100
		PRACTICALS											Day to Day Evaluation and a test (30 Marks)			
6	23EC22P1	Electronic Circuits Analysis Lab	-	-	3	1.5	-	-	-	-	-	30		3	70	100
7	23EC22P2	Analog and Digital Communications Lab	-	-	3	1.5	-	-	-	-	-	30		3	70	100
		SKILLS														
8	H&S	Soft Skills	-	1	2	2	-	-	-	-	-	30		3	70	100
9	H&S	Design Thinking and Innovation	1	-	2	2	-	-	-	-	-	30		3	70	100
		TOTAL	15	1	10	21	-	-	-	-	-	270	-	-	-	900
Mandatory Community Service Project Internship of 08 weeks duration during summer vacation																

A for Assignment (Continuous Evaluation), $ Test (Descriptive & Short Answers) duration = 2 Hours

23EC2201-EM WAVES AND TRANSMISSION LINES

Course Category:	Program Core	**Credits:**	3
Course Type:	Theory	**Lecture-Tutorial-Practical:**	3-0-0
Prerequisite:	Random Signals and Stochastic Processes, Signals & Systems	**Sessional Evaluation:** **External Evaluation:** **Total Marks:**	30 70 100

Course Objectives	Students undergoing this course are expected: 1. To understand and analyze different laws and theorems of electrostatic fields. 2. To study and analyze different laws and theorems of magnetostatic fields. 3. To Analyze Maxwell’s equations in different forms. 4. To learn the concepts of wave theory and its propagation through various mediums. 5. To get exposure to the properties of transmission lines.

Course Outcomes

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

CO1	Learn the concepts of wave theory and its propagation through various mediums. (L2)
CO2	Understand the properties of transmission lines and their applications. (L2)
CO3	Apply the laws & theorems of electrostatic fields to solve the related problems (L3)
CO4	Gain proficiency in the analysis and application of magnetostatic laws and theorems(L4).
CO5	Analyze Maxwell’s equations in different forms. (L4)

Course Content

UNIT I

Review of Co-ordinate Systems, Electrostatics: Coulomb’s Law, Electric Field Intensity, Electric Flux Density, Gauss Law and Applications, Electric Potential, Maxwell’s Two Equations for Electrostatic Fields, Energy Density, Illustrative Problems. Convection and Conduction Currents, Dielectric Constant, Poisson’s and Laplace’s Equations; Capacitance – Parallel Plate, Coaxial Capacitors, Illustrative Problems.

UNIT II

Magnetostatics: Biot-Savart Law, Ampere’s Circuital Law and Applications, Magnetic Flux Density, Maxwell’s Two Equations for Magnetostatic Fields, Magnetic Scalar and Vector Potentials, Forces due to Magnetic Fields, Ampere’s Force Law, Inductances and Magnetic Energy, Illustrative Problems.

Maxwell’s Equations (Time Varying Fields): Faraday’s Law and Transformer EMF, Inconsistency of Ampere’s Law and Displacement Current Density, Maxwell’s Equations in Different Final Forms and Word Statements, Conditions at a Boundary Surface, Illustrative Problems.

UNIT III

EM Wave Characteristics: Wave Equations for Conducting and Perfect Dielectric Media, Uniform Plane Waves – Definition, All Relations Between E & H, Sinusoidal Variations, Wave Propagation in Lossy dielectrics, lossless dielectrics, free space, wave propagation in good conductors, skin depth, Polarization & Types, Illustrative Problems. Reflection and Refraction of Plane Waves – Normal and Oblique Incidences, for both Perfect Conductor and Perfect Dielectrics, Brewster Angle, Critical Angle and Total Internal Reflection, Surface Impedance, Poynting Vector and Poynting Theorem,

Course Content	IllustrativeProblems. **UNIT IV** **Transmission Lines - I** : Types, Parameters, T & π Equivalent Circuits, Transmission Line Equations, Primary & Secondary Constants, Expressions for Characteristic Impedance, Propagation Constant, Phase and Group Velocities, Infinite Line, Lossless lines, distortion less lines, Illustrative Problems. **UNIT V** **Transmission Lines – II:** Input Impedance Relations, Reflection Coefficient, VSWR, Average Power, Shorted Lines, Open Circuited Lines, and Matched Lines, Low loss radio frequency and UHF Transmission lines, UHF Lines as Circuit Elements, Smith Chart – Construction and Applications, Quarter wave transformer, Single Stub Matching, Illustrative Problems.
Text Books and Reference Books	**Textbooks:** 1. Elements of Electromagnetics, Matthew N.O. Sadiku, 4th Edition, Oxford UniversityPress, 2008. 2. Electromagnetic Waves and Radiating Systems, E.C. Jordan and K.G. Balmain, 2ndEdition, PHI, 2000. **References:** 1. Electromagnetic Field Theory and Transmission Lines, G. S. N. Raju, 2nd Edition, Pearson Education, 2013. 2. Engineering Electromagnetics, William H. Hayt Jr. and John A. Buck, 7th Edition, TataMcGraw Hill, 2006. 3. Electromagnetics, John D. Krauss, 3rd Edition, McGraw Hill, 1988. 4. Networks, Lines, and Fields, John D. Ryder,2nd Edition, PHI publications, 2012.

23EC2202- ELECTRONIC CIRCUITS ANALYSIS

<table>
<tr><td>Course Category:</td><td colspan="2">Program Core</td><td>Credits:</td><td>3</td></tr>
<tr><td>Course Type:</td><td colspan="2">Theory</td><td>Lecture-Tutorial-Practical:</td><td>3-0-0</td></tr>
<tr><td>Prerequisite:</td><td colspan="2">Electronic Devices and Circuits</td><td>Sessional Evaluation:
External Evaluation:
Total Marks:</td><td>30
70
100</td></tr>
<tr><td rowspan="2">Course Objectives</td><td colspan="4">Students undergoing this course are expected to:</td></tr>
<tr><td colspan="4">1. Understand the characteristics of Differential amplifiers, feedback and power amplifiers.
2. Analyze the response of tuned amplifiers
3. Categorize different oscillator circuits based on the application
4. Design the electronic circuits for the given specifications and for a given application.</td></tr>
<tr><td rowspan="6">Course Outcomes</td><td colspan="4">At the end of this course the student will be able to:</td></tr>
<tr><td>CO1</td><td colspan="3">Understand the characteristics of differential amplifiers, feedback and power amplifiers. (L2)</td></tr>
<tr><td>CO2</td><td colspan="3">Examine the frequency response of multistage and differential amplifier circuits usingBJT & MOSFETs at low and high frequencies. (L3)</td></tr>
<tr><td>CO3</td><td colspan="3">Investigate different feedback and power amplifier circuits based on the application.(L4)</td></tr>
<tr><td>CO4</td><td colspan="3">Derive the expressions for frequency of oscillation and condition for oscillation of RCand LC oscillator circuits. (L4)</td></tr>
<tr><td>CO5</td><td colspan="3">Evaluate the performance of different tuned amplifiers (L5)</td></tr>
<tr><td>Course Content</td><td colspan="4">UNIT I

Multistage & Differential Amplifiers: Introduction, Classification of Amplifiers, Distortion inamplifiers, Coupling Schemes, RC Coupled Amplifier using BJT, Cascaded RC Coupled BJT Amplifiers, Cascode amplifier, Darlington pair, the MOS Differential Pair, Small-Signal Operation of the MOS Differential Pair, The BJT Differential Pair, and other Non-ideal Characteristics of the Differential Amplifier.

UNIT II

Frequency Response: Low-Frequency Response of the CS and CE Amplifiers, Internal Capacitive Effects and the High-Frequency Model of the MOSFET and the BJT, High-Frequency Response of the CE, Emitter follower, CS, CD, f_β, f_T and gain bandwidth product.

UNIT III

Feedback Amplifiers: Introduction, The General Feedback Structure, Some Properties of Negative Feedback, The Four Basic Feedback Topologies, Series-Shunt, Series-Series, Shunt-Shunt, Shunt-Series.
Oscillators: General Considerations, Phase Shift Oscillator, Wien-Bridge Oscillator, LC Oscillators, Relaxation Oscillator, Crystal Oscillators, Illustrative Problems.</td></tr>
</table>

	UNIT IV **Power Amplifiers:** Introduction, Class A amplifiers (Series fed, Transformer coupled, Push pull), Second Harmonic distortion, Class B amplifiers (Push pull, Complementary symmetry), Crossover distortion and Class AB operation, Class C amplifiers, Power BJTs, MOS power transistors. **UNIT V** **Tuned Amplifiers**: Introduction, single Tuned Amplifiers – Q-factor, frequency response, Double Tuned Amplifiers – Q-factor, frequency response, Concept of stagger tuning and synchronous tuning. **Multivibrators:** Analysis and Design of Bi-stable, Mono-stable, Astable Multivibrators and Schmitt trigger using Transistors.
Text Books and Reference Books	**Textbooks:** 1. Adel. S. Sedra and Kenneth C. Smith, "Micro Electronic Circuits," 6th Edition, Oxford University Press, 2011. 2. J. Millman, H. Taub and Mothiki S. Prakash Rao - Pulse, Digital and SwitchingWaveforms - 2nd Ed., TMH, 2008. 3. Millman, C Chalkias, "Integrated Electronics", 4thEdition, McGraw Hill Education (India) Private Ltd., 2015. **References:** 1. Behzad Razavi, "Fundamentals of Micro Electronics", Wiley, 2010. 2. Donald A Neamen, "Electronic Circuits – Analysis and Design," 3rdEdition, McGrawHill (India), 2019. 3. Robert L. Boylestad and Louis Nashelsky, "Electronic Devices and Circuits Theory", 9th Edition, Pearson/Prentice Hall, 2006.

23EC2203- ANALOG AND DIGITAL COMMUNICATIONS

<table>
<tr><td>Course Category:</td><td colspan="2">Program Core</td><td>Credits:</td><td>3</td></tr>
<tr><td>Course Type:</td><td colspan="2">Theory</td><td>Lecture-Tutorial-Practical:</td><td>3-0-0</td></tr>
<tr><td>Prerequisite:</td><td colspan="2">Signals & Systems</td><td>Sessional Evaluation:
External Evaluation:
Total Marks:</td><td>30
70
100</td></tr>
<tr><td rowspan="2">Course Objectives</td><td colspan="4">Students undergoing this course are expected to:</td></tr>
<tr><td colspan="4">1. Introduce various modulation and demodulation techniques of analog and digital communication systems.
2. Analyze different parameters of analog and digital communication techniques.
3. Understand function of various stages of AM, FM transmitters and Know characteristics of AM &FM receivers.
4. Analyze the performance of various digital modulation techniques in the presence of AWGN.</td></tr>
<tr><td rowspan="6">Course Outcomes</td><td colspan="4">At the end of this course the student will be able to:</td></tr>
<tr><td>CO1</td><td colspan="3">Recognize the basic terminology used in analog and digital communication technique for transmission of information/data. (L1)</td></tr>
<tr><td>CO2</td><td colspan="3">Explain the basic operation of different analog and digital communication systems at baseband and passband level. (L2)</td></tr>
<tr><td>CO3</td><td colspan="3">Compute various parameters of baseband and passband transmission schemes by applying basic engineering knowledge. (L3)</td></tr>
<tr><td>CO4</td><td colspan="3">Analyze the performance of different modulation & demodulation techniques to solvecomplex problems in the presence of noise. (L4)</td></tr>
<tr><td>CO5</td><td colspan="3">Evaluate the performance of all analog and digital modulation techniques to know the merits and demerits of each one of them in terms of bandwidth and power efficiency. (L5)</td></tr>
<tr><td>Course Content</td><td colspan="4">UNIT I
Amplitude Modulation: Need for modulation, Amplitude Modulation - Time and frequency domain description, single tone modulation, power relations in AM waves, Generation of AM waves - Switching modulator, Detection of AM Waves - Envelope detector, DSBSC modulation - time and frequency domain description, Generation of DSBSC Waves - Balanced Modulators, Coherent detection of DSB-SC Modulated waves, COSTAS Loop, SSB modulation - time and frequency domain description, frequency discrimination and Phase discrimination methods for generating SSB, Demodulation of SSB Waves, principle of Vestigial side band modulation.
UNIT II
Angle Modulation: Basic concepts of Phase Modulation, Frequency Modulation: Single tone frequency modulation, Spectrum Analysis of Sinusoidal FM Wave using Bessel functions, Narrow band FM, Wide band FM, Constant Average Power, Transmission bandwidth of FM Wave - Generation of FM Signal- Armstrong Method, Detection of FM Signal: Balanced slope detector, Phase locked loop, Comparison of FM and AM., Concept of Pre-emphasis andde-emphasis
UNIT III
Transmitters: Classification of Transmitters, AM Transmitters, FM Transmitters
Receivers: Radio Receiver - Receiver Types - Tuned radio frequency receiver, Super heterodyne receiver, RF section and Characteristics - Frequency changing and tracking, Intermediate frequency, Image frequency, AGC, Amplitude limiting, FM</td></tr>
</table>

Course Content	Receiver,Comparison of AM and FM Receivers. **UNIT IV** **Introduction to Noise:** Types of Noise, Receiver Model, Noise in AM, DSB, SSB, and FM Receivers. **Pulse Modulation:** Types of Pulse modulation- PAM, PWM and PPM. Comparison of FDM and TDM. Pulse Code Modulation: PCM Generation and Reconstruction, Quantization Noise, Non-Uniform Quantization and Companding, Delta Modulation, DPCM, Noise in PCM and DM. **UNIT V** **Digital Modulation Techniques:** Coherent Digital Modulation Schemes – ASK, BPSK, BFSK, QPSK, Non-coherent BFSK, DPSK. M-ary Modulation Techniques, Power Spectra, Bandwidth Efficiency. **Baseband Transmission and Optimal Reception of Digital Signal:** A Baseband Signal Receiver, Probability of Error, Optimum Receiver, Coherent Reception, ISI, Eye Diagrams.
Text Books and Reference Books	**Textbooks:** 1. Simon Haykin, “Communication Systems”, John Wiley& Sons, 4th Edition, 2004. 2. Wayne Tomasi - Electronics Communication Systems- Fundamentals through Advanced,5thEd., PHI, 2009 3. B. P. Lathi, Zhi Ding “Modern Digital and Analog Communication Systems”, Oxfordpress, 2011. **References:** 1. Sam Shanmugam, “Digital and Analog Communication Systems”, John Wiley & Sons, 1999. 2. Bernard Sklar, F.J.Harris “Digital Communications: Fundamentals and Applications”,Pearson Publications, 2020. 3. Taub and Schilling, “Principles of Communication Systems”, Tata McGraw Hill, 2007.

23EC22P1- ELECTRONIC CIRCUITS ANALYSIS LAB

Course Category:	Program Core	**Credits:**	1.5
Course Type:	Theory	**Lecture-Tutorial-Practical:**	0-0-3
Prerequisite:	Electronic Devices and Circuits	**Sessional Evaluation:** **External Evaluation:** **Total Marks:**	30 70 100

Course Objectives	Students undergoing this course are expected to:	
	1. Plot the characteristics of Differential amplifiers, feedback and power amplifiers. 2. Analyze the response of tuned amplifiers and multivibrators. 3. Categorize different oscillator circuits based on the application. 4. Design the electronic circuits for the given specifications and for a given application.	
Course Outcomes	At the end of this course the student will be able to:	
	CO1	Know about the usage of equipment/components/software tools used to conduct experiments in analog circuits. (L2)
	CO2	Conduct the experiment based on the knowledge acquired in the theory about various analog circuits using BJT/MOSFETs to find the important parameters of the circuit experimentally. (L3)
	CO3	Analyze the given analog circuit to find required important metrics of it theoretically. (L4)
	CO4	Compare the experimental results with that of theoretical ones and infer the conclusions. (L4)
	CO5	Design the circuit for the given specifications. (L6)
Course Content	**List of Experiments:** 1. Design and Analysis of Darlington pair. 2. Frequency response of CE – CC multistage Amplifier 3. Design and Analysis of Cascode Amplifier. 4. Frequency Response of Differential Amplifier 5. Design and Analysis of any two topologies of feedback amplifies and find thefrequency response of it. 6. Design and Analysis of Class A power amplifier. 7. Design and Analysis of Class AB amplifier. 8. Design and Analysis of RC phase shift oscillator. 9. Design and Analysis of LC Oscillator 10. Frequency Response of Single Tuned amplifier 11. Design a Bistable Multivibrator and analyze the effect of commutating capacitorsand draw the wave forms at base and collector of transistors. 12. Design an Astable Multivibrator and draw the wave forms at base and collectorof transistors. 13. Design a Mono-stable Multivibrator and draw the input and output waveforms. 14. Draw the response of Schmitt trigger for gain of greater than and less than one. **Note:** At least 12 experiments shall be performed. Faculty members who are handling the laboratory shall see that students are given design specifications for a given circuit appropriately and monitor the design and analysis aspects of the circuit.	

23EC22P2- ANALOG AND DIGITAL COMMUNICATIONS LAB

<table>
<tr><td>Course Category:</td><td colspan="2">Program Core</td><td>Credits:</td><td>1.5</td></tr>
<tr><td>Course Type:</td><td colspan="2">Theory</td><td>Lecture-Tutorial-Practical:</td><td>0-0-3</td></tr>
<tr><td>Prerequisite:</td><td colspan="2">Signals & Systems</td><td>Sessional Evaluation:
External Evaluation:
Total Marks:</td><td>30
70
100</td></tr>
<tr><td rowspan="2">Course Objectives</td><td colspan="4">Students undergoing this course are expected to:</td></tr>
<tr><td colspan="4">1. Understand the basics of analog and digital modulation techniques.
2. Integrate theory with experiments so that the students appreciate the knowledge gained from the theory course.
3. Design and implement different modulation and demodulation techniques and their applications.
4. Develop cognitive and behavioral skills for performance analysis of various modulation techniques.</td></tr>
<tr><td rowspan="5">Course Outcomes</td><td colspan="4">At the end of this course the student will be able to:</td></tr>
<tr><td>CO1</td><td colspan="3">Know about the usage of equipment/components/software tools used to conduct experiments in analog and digital modulation techniques. (L2)</td></tr>
<tr><td>CO2</td><td colspan="3">Conduct the experiment based on the knowledge acquired in the theory about modulation and demodulation schemes to find the important metrics of the communication system experimentally. (L3)</td></tr>
<tr><td>CO3</td><td colspan="3">Analyze the performance of a given modulation scheme to find the important metrics of the system theoretically. (L4)</td></tr>
<tr><td>CO4</td><td colspan="3">Compare the experimental results with that of theoretical ones and infer the conclusions. (L4)</td></tr>
<tr><td>Course Content</td><td colspan="4">List of Experiments:
Design the circuits and verify the following experiments taking minimum of six from eachsection shown below.
Section-A
1. AM Modulation and Demodulation
2. DSB-SC Modulation and Demodulation
3. Frequency Division Multiplexing
4. FM Modulation and Demodulation
5. Radio receiver measurements
6. PAM Modulation and Demodulation
7. PWM Modulation and Demodulation
8. PPM Modulation and Demodulation
Section-B
1. Sampling Theorem.
2. Time Division Multiplexing
3. Delta Modulation and Demodulation
4. PCM Modulation and Demodulation
5. BPSK Modulation and Demodulation
6. BFSK Modulation and Demodulation
7. QPSK Modulation and Demodulation
8. DPSK Modulation and Demodulation
Note: Faculty members (who are handling the laboratory) are requested to instruct the students not to use readymade kits for conducting the experiments. They are advised to</td></tr>
</table>

	make the students work in the laboratory by constructing the circuits and analyzing them during thelab sessions.