2nd Year 3rd Semester

National Institute of Technology Raipur												
Course of Study and Scheme of Examination							B. Tech. 3rd Semester				Branch: ECE	
S. No.	Subject Code	Subject Name	Periods per Week			TA	Examination Scheme				Total Marks	Credits
							MSE/MTR		ESE/ESVE			
			L	T	P		Theory	Prac.	Theory	Prac.		
1	EC103101EC	Network Analysis and Synthesis	3	1	0	20	30		50		100	4
2	EC103102EC	Microelectronics Devices and Circuits	3	1	0	20	30		50		100	4
3	EC103103EC	Signal and Systems	3	1	0	20	30		50		100	4
4	EC103104EC	Digital Logic Design	3	1	0	20	30		50		100	4
5	EC103105EC	Electronic Measurement and Instruments	3	1	0	20	30		50		100	4
6	MA103001MA	Mathematics III	4	0	0	20	30		50		100	4
7	EC103401EC	Devices & Circuit Laboratory	0	0	2	40		20		40	100	1
8	EC103402EC	Digital Logic Design Laboratory	0	0	2	40		20		40	100	1
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Network Analysis and Synthesis

[3rd Semester, Second Year]

Course Description

Offered by Department	Credits	Status	Code
Electronics & Communication	3-1-0, (4)	CORE	EC103101EC

[Pre-requisites: EL10I022EL-Basic Electrical Engineering]

Course Objectives

1. To analyze the different impedance parameters and study the concepts of different network derivatives and waveform functions.
2. To implement the different network theorems and pole zero concepts of network functions.
3. To analyze different R-L-C networks and synthesize different networks.
4. To study the different two port networks parameters and their power analysis.

Course Content

UNIT I

Introduction: The capacitance parameter, The inductance parameter, The resistance parameter, reference direction for current and voltage, active element convention , the dot convention for coupled circuits, Kirchhoff's laws, the number of network equation, source transformation, example of the formulation of network equation loop variables analysis, node variables analysis, duality network. Dependent sources.

Network graph theory: concept of network graph, terminology used in network graph, relation between Twigs and Links, properties of tree in a graph, formation of incidence

Matrix [Ai], number of trees in a graph, cut-set matrix, tie set matrix, fundamental tie-set matrix, fundamental of cut-set matrix.

UNIT II

Initial Conditions in Networks: Why Study Initial Conditions, Initial Conditions In Element, Geometrical Interpretation Of Derivatives, A Procedure for Evaluating Initial Conditions, initial State of a Network.

Transforms of other signal waveform: The shifted unit steep Function, The ramp- and Impulse functions, Wave forms synthesis, the initial and final value of F(t) from f(s), the convolution integral, and convolution as a summation.

Impedance function and Network theorems: The Concept of complex frequency, Transform Impedance and Transform Circuits, Series and Parallel combination of elements, Superposition and Reciprocating, Thevenin's Theorem and Norton's Theorem.

UNIT III

Network function: Poles and zeros, terminal pairs or ports, network function for one port and two port, the calculation of network function: ladder network, general network, poles and zeros of network function, restrictions on poles and zero location for driving point function, Restriction on poles and zero location for transfer function, time domain behaviour from the pole and zero plot, stability of active network.

Network synthesis: concept of network synthesis, reactive network, driving point immittance of LC network, LC network synthesis using foster and Caurr form, RC and RL network synthesis by Foster and Caurr form.

UNIT IV

Two port parameters: Relation of two port variables, short circuit admittance parameters, the open circuit impedance parameters, Transmission parameters, the hybrid parameters, relation between parameter sets, parallel connection of two port network. Input power, power transfer and insertion loss: energy and power, effective or root mean square values, average power and complex power, problem in optimizing power transfer, insertion loss, Tellegen's theorem.

Course Materials

Required Text: Text Books:

1. Network analysis, M. E. Van Valkenbarg, PHI
2. Network Analysis and Synthesis, Franklin F. Kuo, McGraw Hill Education

Optional Materials: Reference Books

1. Electric Circuit Analysis, Alexender and Sadique, TMH
2. Network Theory, D. Roy Chaudhary, Newage Asian

Microelectronics Devices and Circuits

[3rd Semester, Second Year]

Course Description

Offered by Department	Credits	Status	Code
Electronics & Communication	3-1-0, (4)	CORE	EC103102EC

[Pre-requisites: PH10I006PH-Physics II]

Course Objectives

1. To understand the fundamentals of p-n junction diode, their electrical characteristics, and applications of various types of diodes.
2. To understand different type of configurations and biasing of BJT along with AC and DC small signal analysis and applications as Amplifier.
3. To understand different type of configurations and biasing of MOSFET along with AC and DC small signal analysis and applications as Amplifier.
4. To understand the basic concept of feedback, types of feedback and their applications in amplifiers and oscillator.

Course Content

Unit-I

Energy Bands and Charge Carrier in Semiconductor: Bonding forces and energy bands in solids, Charge Carriers in Semiconductors, Carrier Concentrations, Drift Mechanism, Diffusion of carriers and Einstein relation. Intrinsic Semiconductors Doped Semiconductors, Current Flow in Semiconductors.
Junction Diodes: The PN Junction, the pn Junction with Open-Circuit Terminals (Equilibrium), the pn Junction with Applied Voltage, Capacitive Effects in the pn Junction, The Ideal Diode, Terminal Characteristics of Junction Diodes, Modelling the Diode Forward Characteristic, Operation in the Reverse Breakdown Region—Zener Diodes. Rectifier Circuits, Limiting and Clamping Circuits, Special Diode Types

Unit-II

Bipolar Junction Transistor (BJT): Review of device structure operation and V-I characteristics, BJT circuits at DC, BJT as amplifier and switch, biasing in BJT amplifier circuit, small-signal operation and models, single stage BJT amplifier, BJT internal capacitances and high frequency model, frequency response of CE

Unit-II

MOSFET: Device structure and its operation in equilibrium, V-I characteristics. Circuits at DC, MOSFET as Amplifier and switch, Biasing in MOS amplifier circuits, small-signal operation and models, single stage MOS amplifier, MOSFET internal capacitances and high frequency model, frequency response of CS amplifier

Unit-IV

Feedback: The general feedback structure, properties of negative feedback, the four basic feedback topologies, the series-shunt feedback amplifier, the series-series feedback amplifier, the shunt-shunt and shunt series feedback amplifier. Oscillators: Basic principles of sinusoidal oscillators, op-amp RC oscillator circuits, LC oscillator.

Course Materials

Required Text: Text Books:

1. Microelectronic Circuits, A. S Sedra and K. C. Smith, Oxford University Press.
2. Electronic Devices and Circuits, Millman Jacob, Christos Halkias, Satyabrata Jit, Tata McGraw Hill.

Optional Materials: Reference Books

1. Semiconductor Devices and Circuits, Alok K. Dutta, Oxford University Press.
2. Microelectronics, Jacob Millman and Arvin Grabel, Tata McGraw Hill.

Signal and Systems

[3rd Semester, Second Year]

Course Description

Offered by Department	Credits	Status	Code
Electronics & Communication	3-1-0, (4)	CORE	EC103103EC

[Pre-requisites: PH10I006PH-Physics II]

Course Objectives

1. To understand the signals and systems and their classification.
2. To perform Laplace and Z transform for continuous and discrete time signals.
3. To analyze the signal and system in time and frequency domain using Fourier series, Fourier transform and Hilbert transforms.
4. To analyze discrete time signal and system using DTFS, FTFT, DFT and FFT.

Course Content

Unit-I

Fundamentals of Signals and Systems: Signals and Mutual exclusive classification of signals, Elementary continuous time and discrete time signals, Basic signal operations. System Properties and classification of System, Continuous LTI, Discrete LTI systems, Impulse response in time domain, Convolution in time domain, properties of discrete and continuous LTI systems, systems described by difference and differential equations.

Unit-II

S-Domain and Z-domain Analysis of CT and DT systems: Laplace and Z-transforms, Laplace transforms of common signals, properties of Laplace transforms, inverse Laplace transforms, Z-transforms of common sequences, properties of Z-transforms, inverse Z-transforms, relation between Z and Laplace Transform, analyzing continuous time systems using Laplace and discrete time systems using Z-transforms.

Unit-III:

Frequency Analysis of CT signal and frequency response of CT system: Fourier analysis of continuous time signals and systems, Fourier series representation of periodic systems, Fourier transforms, properties of CTFT, frequency response of continuous time LTI, systems, Fourier transforms of power signals filter characteristics of LTI systems, transmission of signals through LTI systems, filtering, bandwidth, quadrature filter and Hilbert transforms.

Unit-IV

Frequency Analysis of DT signal and frequency response of DT system: Fourier analysis of discrete time signals and systems, discrete Fourier series, DTFS, DTFT properties of DTFT, frequency response of discrete time LTI systems, DFT and Introduction to FFT.

Course Materials

Required Text: Text Books:

1. Signals & Systems, 2nd Edition, Alan Oppenheim, Alan Wilsky, S. Nawab. Prentice Hall, 1997.
2. Signals and Systems, Simon Haykin and Barry Van Veen. Wiley, 1999.

Optional Materials: Reference Books

1. Schaum's Outline of Signals and Systems, H Hsu, TMH.

Digital Logic Design

[3rd Semester, Second Year]

Course Description

Offered by Department	Credits	Status	Code
Electronics & Communication	3-1-0, (4)	CORE	EC103104EC

[Pre-requisites: PH10I006PH-Physics II]

Course Objectives

1. To analyze and design various combination logic design
2. To analyze and design various sequential logic design
3. To work with various logic families.
4. To understand and implement fixed- and floating-point representation.

Course Content

Unit-I

Combinational Circuits: Logic minimization for design in POS and SOP forms, Logic design with universal building blocks: MUX, Decoders, Encoders, Design of Arithmetic circuit, Binary Adder, Subtractor, Look-ahead carry, Comparator, Design of BCD adder/subtractor, multipliers for signed binary numbers.

Unit-II

Sequential circuits: Introduction to Sequential circuits, Latches, Flip-Flops, Master-slave Flip-flop, Triggering, Design of Flip-flop, Series and parallel Registers, Analysis and Design of Sequential circuits, Moore and Mealy state machines, State diagram, State assignment and reduction, Design of sequential adder, Logarithmic state machine (ASM), hardware conversion of ASM.

Unit-III

Implementation Technologies: Basic gates in TTL and ECL. TTL Family Gates: Fan-in, Fan-out and Noise Margin. MOS Family: NMOS And CMOS Logic Gates, Negative Logic System, Tri-state logic, Comparison among various Logic Families. Programmable Logic Devices: Introduction to SPLD, CPLD and FPGA.

Unit-IV

Representation of positive, negative and fractional numbers, shortcomings, Floating point number system, IEEE 754 representation, addition, subtraction multiplication and division of Floating-point numbers.
Memory Devices, RAM (static and dynamic), ROM, EPROM, Flash Memory. Design using SPLD and CPLDs.

Course Materials

Required Text: Text Books:

1. An Engineering Approach to Digital Design, W. Fletcher, PHI Edition.
2. Fundamentals of Digital Logic with Verilog Design, S. Brown and Z. Vranesic, Tata McGraw Hill New Delhi, 2008.
3. Digital System Design using VHDL, C. H. Roth, Thompson Publications, Fourth Edition, 2002.

Optional Materials: Reference Books

1. Digital Logic and Computer Design, Morris Mano, PHI
2. Digital Integrated Electronics, Taub B & Schilling, McGraw Hill

Electronic Measurement and Instruments

[3rd Semester, Second Year]

Course Description

Offered by Department	Credits	Status	Code
Electronics & Communication	3-1-0, (4)	CORE	EC103105EC

[Pre-requisites: NA]

Course Objectives

1. To understand the fundamental Principles of measurements-standards, and errors in measurement
2. To measure current, voltage, resistances, power, energy using different meters
3. To understand DC/AC bridges and their applications in measuring various electrical quantities
4. To understand different electronic test equipment's

Course Content

UNIT-I

FUNDAMENTALS OF MEASUREMENT: Systems and standards; methods of measurement; Characteristics of instruments &measurement systems; Errors in measurement & its analysis.

UNIT-II

ELECTROMECHANICAL INDICATING INSTRUMENTS: AC/DC current and voltage meters, ohmmeter - Series-type and Shunt-type; Loading effect; Measurement of power and energy; Instrument transformers; Measurement of resistance, inductance and capacitance; Thermo-instruments; Watt-hour meters, Power factor meters; Potentiometers.

UNIT-III

DC/AC BRIDGES: DC bridges: Wheatstone bridge and Kelvin bridge. AC bridges and their Applications- Maxwell bridge, Hay bridge, Schering bridge, and Wein bridge, MEASUREMENT OF NON-ELECTRICAL QUANTITIES: Displacement; Strain; Temperature; Pressure; Flow and force, etc.

UNIT-IV

MODERN ELECTRONIC TEST EQUIPMENT: Oscilloscope, DMM, frequency counter, wave/network/harmonic distortion/spectrum analyzers, logic probe and logic analyzer; Programmable logic controller; Virtual instrumentation. Data transmission and telemetry; Data acquisition system.

Course Materials

Required Text: Textbooks:

1. Electrical Measurement and Measuring Instrument, E. W. Golding, F. C. Widdis, Wheeler Publishing, 2003.
2. Modern Electronic Instrumentation and Measurement Techniques, W. D. Cooper, A. D. Helfrick, Pearson Education, 2007.
3. Measurement Systems, Application and Design, E. O. Deobelin, Tata McGraw-Hill, 2004.
4. Electronic Instruments and Instrumentation Technology, M. M. S. Anand, Prentice-Hall of India, 2006.

Optional Materials: Reference Books

1. Electronic Measurements & Instrumentation, Oliver & Cage, McGraw Hill.
2. Electronics & Electrical Measurements and Instrumentation, J B Gupta, Katson Publication.

Mathematics III

[3rd Semester, Second Year]

Course Description

Offered by Department	Credits	Status	Code
Mathematics	4-0-0, (4)	EPR	MA103001MA

[Pre-requisites: MA10I001MA-Mathematics-I, MA10I002MA Mathematics-II]

Course Objectives

To enable the students to apply the knowledge of Mathematics in various fields:

1. Introduce the series solution of differential equations and special functions.
2. Introduce the concepts Laplace Transform and its application in solution of differential equations and improper integral.
3. Able to form and solve the partial differential equation using different analytical techniques with application in solution of wave and Laplace equations.
4. Introduce to Basic concepts of graph theory.

Course Content

UNIT-I

SERIES SOLUTION OF DIFFERENTIAL EQUATIONS AND SPECIAL FUNCTIONS: Series solution of differential equations, The method of Frobenius, Bessel's differential equation, Bessel's function of the First Kind - recurrence relations, generating function, Orthogonality, Legendre's differential equation, Legendre's polynomial - Rodrigue's formula, generating function, recurrence relations, orthogonality.

UNIT-II

LAPLACE TRANSFORM: Definition, Transform of elementary functions, Properties of Laplace transform, Transform of derivatives and integrals, Multiplication by t^n , Division by t, Evaluation of Integrals, Periodic functions, Inverse Laplace transform, Convolution theorem, Application of Laplace transform to solutions of ordinary differential equations.

UNIT-III

COMPLEX ANALYSIS: Complex number, Complex functions, Limit and Continuity, Derivative, Cauchy-Riemann equations, Analytic functions, Harmonic functions, application to flow problems, Complex integration, Cauchy theorem, Cauchy integral formula, Taylor & Laurent series; Singularity, Residue' Theorem, Application in Evaluation of real definite integrals.

UNIT-IV

GRAPH THEORY: Basic concepts of graph theory, types of graphs, subgraphs, path, circuit, directed and undirected graph, Shortest path problem, Matrix representation of graphs, planar graphs, Trees and fundamental circuit, spanning tree, binary trees, Network flows.

Course Materials

Required Text: Text books

1. Higher Engineering Mathematics by B. S. Grewal, Khanna Publishers.
2. Advanced Engineering Mathematics by Erwin Kreyszig, John Wiley & Sons.

Optional Materials: Reference Books

1. Advanced Engg. Mathematics by R. K. Jain and S. R. K. Iyengar, Narosa Publishing House.
2. Discrete Mathematics with Graph Theory and Combinatorics by Veerarajan, Mc Graw Hill Education.

Devices & Circuit Laboratory

[3rd Semester, Second Year]

Course Description

Offered by Department	Credits	Status	Code
Electronics & Communication	0-0-2, (1)	CORE	EC103401EC

Course Objectives

1. To understand the fundamentals of p-n junction diode, their electrical characteristics and applications of various types of diodes.
2. To understand different type of configurations and biasing of BJT along with AC and DC small signal analysis and applications as Amplifier.
3. To understand different type of configurations and biasing of MOSFET along with AC and DC small signal analysis and applications as Amplifier.
4. To understand the basic concept of feedback, types of feedback and their applications in amplifiers and oscillator.

List of Experiments:

1. Identification, Specification and Testing of electronic components like resistor, capacitor and inductor on the basis of color coding.
2. Study the operation of CRO, Multimeter and Function generator.
3. Study of P-N junction diode (V-I characteristics)
4. Study of Zener diode (V-I characteristics)
5. Study of half-wave rectifier
6. Study of center tapped Full-wave rectifier (with and without filter)
7. Study of Bridge rectifier
8. Design and study of output and transfer characteristics of various diode clipper circuits.
9. Design and study of output and transfer characteristics of various diode clamper circuits.
10. Study of input and output characteristics of transistor in Common-Emitter configuration.
11. Study of input and output characteristics of transistor in Common-Base configuration.
12. Study of input and output characteristics of transistor in Common-Collector configuration.
13. Study of output and transfer characteristics of n-channel JFET.
14. Study of output and transfer characteristics of n-channel MOSFET
15. Calculation of h-parameters from static characteristics curve of CE transistor amplifier.
16. Determination of Q-point for potential divider bias circuit.

Course Materials

Required Text: Text books

1. Integrated Electronics, Jacob Millman, Christos Halkias, TMH
2. Electronics Devices and Circuits, Robert L. Boylestad, Louis Nashelsky, Longman Higher Education

Digital Logic Design Laboratory

[3rd Semester, Second Year]

Course Description

Offered by Department	Credits	Status	Code
Electronics & Communication	0-0-2, (1)	CORE	EC103402EC

Course Objectives

1. To analyze and design various combination logic design
2. To analyze and design various sequential logic design
3. To work with various logic families.
4. To understand and implement fixed- and floating-point representation

Course Content

1. Study of pin configuration and verification of logic gates (AND, OR, NOT, NAND, NOR).
2. Design of basic gates using universal Logic Gate (NAND and NOR)
3. Design and Implement Half Adder and Half subtractor using Logic Gates.
4. Design and Implement Full Adder and Full subtractor using Logic Gates.
5. Implement of 4-bit binary Adder/Subtractor with IC 7483.
6. Implementation of BCD Adder using IC 7483.
7. Design and Implement 1-bit Magnitude Comparator using IC 7485.
8. Design and Implement 2-bit Magnitude Comparator using Logic Gates.
9. Design and Implement BCD to Excess-3 code converters using logic gates.
10. Design and Implement Binary to Gray code converters using logic gates.
11. Design and Implement 4:1 Multiplexers and 1:4 Demultiplexer.
12. Design and Implement 8 to 3 Encoder and 3 to 8 decoder using logic gates.
13. Design and Implement 4 bit SISO, SIPO, PISO, PIPO shift register using flip-flop.
14. Design and Implement 3-bit Synchronous UP/Down counter.
15. Design and Implement 3-bit Asynchronous UP/Down counter.
16. Design and Implement ODD/EVEN parity checker/Generator using IC-74180.

Course Materials

Required Text: Text books

1. An Engineering Approach to Digital Design, W. Fletcher, PHI Edition.
2. Digital Logic and Computer Design, Morris Mano, PHI
3. Digital Integrated Electronics, Taub B & Schilling, McGraw Hill