SEMESTER III

Code	Course of Study	L	T	P	C
MA201	Mathematics – III	3	1	0	4
EC201	Signals and Systems	3	1	0	4
EC203	Network Theory	3	1	0	4
EC205	Engineering Electromagnetics	3	0	0	3
EC207	Semiconductor Physics and Devices	3	0	0	3
EC209	Digital Circuits and Systems	3	0	0	3
EC211	Devices and Networks Laboratory	0	0	3	2
EC213	Digital Electronics Laboratory	0	0	3	2
	TOTAL	**18**	**0**	**6**	**25**

SEMESTER III

MA201 Mathematics-III (3-0-0)3

Pre-Requisite: None

Objectives:

The objective of this subject is to expose student to understand the importance of transform techniques and complex variables to solve real world problems. It also focuses the partial differential equations and its applications in science and engineering.

Topics Covered:

Fourier series: Expansion of a function in Fourier series for a given range - Half range sine and cosine expansions.

Fourier Transforms: Complex form of Fourier series- Fourier transformation sine and cosine transformations - simple illustrations.

Partial Differential Equations: Solutions of Wave equation, Heat equation and Laplace's equation by the method of separation of variables and their use in problems of vibrating string, one dimensional unsteady heat flow and two dimensional steady state heat flow.

Complex Variables: Analytic function - Cauchy Riemann equations - Harmonic functions - Conjugate functions - complex integration - line integrals in complex plane - Cauchy's theorem (without proof), Cauchy's integral formula.

Taylor's and Laurent's series expansions - zeros and singularities - Residues - residue theorem, evaluation of real integrals using residue theorem, Bilinear transformations, conformal mapping.

Course Outcomes:

Apply mathematics and science for solving / troubleshooting electrical and electronics engineering problems.

Text Books:

1. ErwynKreyszig, "Advanced Engineering Mathematics", John Wiley and Sons, 10^{th} Edition, 2011.

Reference Books:

1. Grewal.B.S, "Higher Engineering Mathematics", Khanna Publications, 42^{nd} Edition, 2013.

EC201 SIGNALS AND SYSTEMS (3-0-0)3

Pre-Requisite: None

Objectives:

The aim of the course is for:

1. Understanding the fundamental characteristics of signals and systems.
2. Understanding the concepts of vector space, inner product space and orthogonal series.
3. Understanding signals and systems in terms of both the time and transform domains, taking advantage of the complementary insights and tools that these different perspectives provide.
4. Development of the mathematical skills to solve problems involving convolution, filtering, modulation and sampling.

Topics Covered:

Unit-1: Mathematical Preliminaries
Vector spaces - Inner Product spaces - Schwartz inequality - Hilbert spaces - Orthogonal expansions - Bessel's inequality and Parseval's relations

Unit-2: Signals
Continuous-time signals, classifications - Periodic signals - Fourier series representation -Hilbert transform and its properties

Unit-3: Laplace and Fourier transforms
Continuous - time systems - LTI system analysis using Laplace and Fourier transforms

Unit-4: Sampling and Filters
Sampling and reconstruction of band limited signals - Low pass and band pass sampling theorems - Aliasing, Anti-aliasing filter - Practical Sampling-aperture effect

Unit-5: Z-transform
Discrete-time signals and systems - Z-transform and its properties - Analysis of LSI systems using Z - transform.

Course Outcomes:

Students will be able to

1. Apply the knowledge of linear algebra topics like vector space, basis, dimension, inner product, norm and orthogonal basis to signals.
2. Analyse the spectral characteristics of continuous-time periodic and a periodic signals using Fourier analysis.
3. Classify systems based on their properties and determine the response of LSI system using convolution.
4. Analyze system properties based on impulse response and Fourier analysis.

5. Apply the Laplace transform and Z- transform for analyze of continuous-time and discrete-time signals and systems.

6. Understand the process of sampling and the effects of under sampling.

Text Books:

1. *A.V. Oppenheim et al, Signals and Systems (2/e), Pearson 2003.*
2. *M. Mandal and A. Asif, "Continuous and Discrete Time Signals and Systems, Cambridge, 2007.*

Reference Books:

1. *D.C. Lay, Linear Algebra and its Applications (2/e), Pearson, 2000.*
2. *K. Huffman & R. Kunz, Linear Algebra (2/e), Pearson, 1971.*
3. *S.S. Soliman& M.D. Srinath, Continuous and Discrete Signals and Systems, Prentice- Hall, 1990.*

EC203 NETWORK THEORY(3-0-0)3

Pre-Requisite: None

Objectives:

1. To make the students capable of analysing any given electrical network.
2. To make the students learn how to synthesize an electrical network from a given impedance/admittance function.
3. To make the student learn to apply network theorems.

Topics Covered:

Unit -1:Introduction
Network concept-Elements and sources.Kirchoff'slaws.Tellegen'stheorem.Network equilibrium equations.Node and Mesh method.Sourcesuperposition.Thevenin's and Norton's theorems.

Unit -2:Network Theorems
First and second order networks-State equations-Transient response. Network functions. Determination of the natural frequencies and mode vectors from network functions. Millman Theorem.

Unit -3:Steady state analysis
Sinusoidal steady-state analysis.Maximum power-transfer theorem.Resonance.Equivalent and dual networks.Design of equalizers,Substitution Theorem.

Unit -4:Two port networks
Two-port network parameters.Interconnection of two port networks.Barlett's bisection theorem.Image and Iterative parameters.Design of attenuators.Network graph theory, Tree, Cutset, Incident Matrix.

Unit -5:RLC Networks
Two-terminal network synthesis.Properties of Hurwitz polynomial and Positive real function.Synthesis of LC, RC and RL Networks, Foster Forms and Cauer Forms.

Course Outcomes:

1. Able to analyze and synthesize electrical circuits
2. Understand the concept of Resonance phenomena.
3. Implement networks in various forms.

Text Book:

1. *Hayt W. H., Kemmerly J. E. and Durbin S. M., "Engineering Circuit Analysis", 6th Ed., Tata McGraw-Hill Publishing Company Ltd.,2008.*

Reference Books:

1.*Valkenberg V., "Network Analysis", 3rd Ed., Prentice Hall International Edition., 2007.*
2.*Kuo F. F., "Network Analysis and Synthesis", 2nd Ed., Wiley India., 2008.*

EC205ENGINEERING ELECTROMAGNETICS (3-0-0)3

Pre-Requisite: None

Objective:

To impart core concepts of Electromagnetics and wave propagationwhich is essential for subsequent courses on transmission line and waveguides, antennas and wireless communication, microwave engineering.

Topics Covered:

Unit -1: Electrostatics
Review of Vectors - Co-ordinatesystem – Integrals - Operations on Delta - Greens Theorem - Stokes Theorem - Divergence Theorem - Coulomb's law – Vector Form - Electric Field Intensity - flux Density - Gauss's law and applications - Helmholtz Theorem - Uniqueness Theorem - Electrostatic potential - Poisson's and Laplace equations - Method of images.

Unit -2: Electrostatic fields in matter
Dielectrics and dielectric polarization - Capacitors with dielectric substrates - Boundary conditions for electric fields – Electric current – Current density – point form of ohm's law – continuity equation for current - Force and energy in dielectric systems - Inductance of loops and solenoids - Magnetic boundary conditions.

Unit-3: Magnetostatics
Magnetic fields of steady currents -Biot-Savart's and Ampere's lawsandsimple applications - Magnetic fluxdensity- TheLorentz force equation foramovingchargeandapplications – Magnetic moment – Magnetic vector potential - Magnetic properties of matter.

Unit-4: Electrodynamics
Flux rule for motional emf - Faraday's law - Self and mutual inductances - Maxwell's equations in integral form and differential form - Poynting theorem -Poynting Vector

Unit-5: Electromagnetic wave propagation
Wave Equation -Uniform plane waves - Reflection and refraction - Wave polarization –types - Dependence on Polarization - Brewster angle - Propagation in an ionized medium - Effect of a biasing magnetic field - Faraday rotation.

Course Outcomes:

Students are able to

1. Understand basic Electrostatic theorems and laws and to derive them.
2. Discuss the behavior of Electric fields in matter and Polarization concepts.
3. Understand the basic Magnetostatic theorems and laws and to derive them, to infer the magnetic properties of matter.
4. To derive and discuss the Maxwell's equations.
5. Familiar with Electromagnetic wave propagation and wave polarization.

Text Books:

1. Hayt,WH.andBuck,J.A.,"EngineeringElectromagnetics",7thEdition,TMH, 2009.

2. D.J.Griffiths, Introduction to Electrodynamics (4/e), Addison-Wesley, 2012

References:

- R.E.Collin, "Foundations for Microwave Engineering", 2^{nd} edition, Mc Graw–Hill, 2009.
- R.E.Collin, "Antennas and Radiowave Propagation", Mc Graw-Hill, 1985.
- E.C. Jordan & K.G. Balmain "Electromagnetic Waves and Radiating Systems" PHI Learning, 2^{nd}edition 2011.
- MathewN.O.Sadiku,"ElementsofEngineeringElectromagnetics",5^{th}Edition, Oxford University Press, 2009.
- Narayana Rao, N., "Elements of Engineering Electromagnetics", 6^{th} Edition, Pearson Education, 2009.

EC207 SEMICONDUCTOR PHYSICS AND DEVICES(3-0-0)3

Pre-Requisite: None

Objectives:

1. To make the students understand the fundamentals of electronic devices.
2. To train them to apply these devices in mostly used and important applications.

Topics Covered:

Unit-1: Semiconductors
Semiconductor materials- crystal growth- film formation- lithography- etching and doping- Conductivity- charge densities -E-K relation- Fermi level- Continuity equation- Hall Effect and its applications.

Unit-2: Semiconductor Diodes
P-N junction diodes- biasing-V-I characteristics- Capacitances-Diode model-Various types of diodes.

Unit-3: Bipolar Junction Transistor
BJT- modes of operation-BJT models- BJT switch- Breakdown mechanisms- Photo devices.

Unit-4: Field Effect Transistor
MOSFET- operation- V-I characteristics- MOSFET as amplifier and switch- Capacitance-equivalent model-CMOS circuits.-CMOS circuits.

Unit-5:Power devices
Operation and characteristics-Thyristor family-Power diodes-Power transistors-GTOs and IGBTs.

Course Outcomes:

Students are able to

1. Apply the knowledge of basic semiconductor material physics and understand fabrication processes.
2. Analyze the characteristics of various electronic devices like diode, transistor etc.
3. Classify and analyze the various circuit configurations of Transistor and MOSFETs.
4. Illustrate the qualitative knowledge of Power electronic Devices.

Text Books:

1. J. Millman and C.C. Halkias: Electronic devices and Circuits, McGraw Hill, 1976.
2. S.M. Sze, Semiconductors Devices, Physics and Technology, (2/e), Wiley, 2002.
3. A.S. Sedra& K.C. Smith, Microelectronic Circuits (6/e), Oxford, 2010.

Reference Books:

1. Adir Bar-Lev: Semiconductors and Electronic Devices, (3/e), Prentice Hall, 1993.
2. B.G. Streetman, S.K. Banerjee: Solid state Electronic devices, (6/e), PHI, 2010.

EC209 DIGITAL CIRCUITS AND SYSTEMS (3 - 0 - 0) 3

Pre-Requisite: None

Objectives:

Modern electronics is based on digital logic design, in this course basics of digital logic designing are covered which includes Boolean algebra, propositions, truth tables, minimization of combinational circuits. Karnaugh maps and tabulation procedure, implementation of sum of product and product of sum in hardware.

Topics Covered:

Unit-1: Boolean algebra
Review of number systems- representation- conversions, error detection and error correction. Review of Boolean algebra- theorems, sum of product and product of sum simplification, Simplification of Boolean expressions- Implementation of Boolean expressions using universal gates.

Unit-2: Combinational logic circuits
Adders, subtractors, parity generator, decoders, encoders, multiplexers, demultiplexers, Realisation of boolean expressions- using decoders-using multiplexers. Memories – ROM- Types of RAMs – Basic structure, organization, Static and dynamic RAMs, PLDs, PLAs.

Unit-3: Sequential circuits
Latches, flip flops, edge triggering, asynchronous inputs. Shift registers, Universal shift register, applications. Binary counters – Synchronous and asynchronous up/down counters, mod-N counter, Counters for random sequence.

Unit-4:Synchronous circuit analysis and design:Synchronous circuit analysis and design: structure and operation, analysis-transition equations, state tables and state diagrams, Modelling- Moore machine and Mealy machine

Unit-5:Logic families:
Introduction to TTL and ECL logic families: Basic working of a TTL NAND gate- characteristics of a TTL NAND gate- important specifications – Basic working of ECL gate- –DTL- RTL- CMOS and ECL family of logic circuits.

Course Outcomes:

The expected outcome after learning this course are that a student must be able to design a digital circuit, understand the differences between combinational and sequential circuits and will be able to implement the circuit.

Text Books:

1. Wakerly J F, Digital Design: Principles and Practices, Prentice-Hall, 4thEd.
2. R P Jain, Modern Digital Electronics 4th Edition, Tata Mcgraw Hill Education Private Limited
3. D. D. Givone, Digital Principles and Design, Tata Mc-Graw Hill, New Delhi, 2008.

Reference Books:

1. D.P. Leach, A. P. Malvino, GoutamGuha, Digital Principles and Applications, Tata Mc-Graw Hill, New Delhi, 2011
2. M. M. Mano, Digital Design, 3rd ed., Pearson Education, Delhi, 2003
3. R.J.Tocci and N.S.Widner, Digital Systems - Principles& Applications, PHI, 10th Ed., 2007
4. T. L. Floyd and Jain ,Digital Fundamentals, 8th ed., Pearson Education, 2003

EC211DEVICES AND NETWORKS LABORATORY (0 - 0 - 3 - 2)

List of Experiments:

1. Study Experiment
2. PN Junction Diode and zener diode Characteristics
3. Characteristics study of Bipolar Junction Transistor (BJT)
4. Characteristics study of JFET
5. Thevnin, Norton,Superposition theorem
6. Frequency Response study of Series RLC
7. Constant K High pass Filter
8. Attenuators
9. Equalizers
10. Clippers and Clampers

EC213 DIGITAL ELECTRONICS LABORATORY (0-0-3-2)

List of Experiments:

1. Study of logic gates and verification of Boolean Laws.
2. Design and implementation of adders and subtractors
3. Design and implementation of code converters.
4. Design and implementation of Multiplexers and De-multiplexers
5. Design and implementation of Encoder and Decoder.
6. Design and implementation of parity generator and checker.
7. Design and implementation of 2-bit , 4 bit and 8-bit magnitude comparators.
8. Study of flip-flops.
9. Design and implementation of synchronous counters using flip-flops.
10. Design and implementation of asynchronous counters using flip-flops.
11. Design and implementation of ring and Johnson counter using flip-flops.
12. Design and implementation of shift registers.
13. Simulation of combinational logic circuits using Verilog.
14. Simulation of sequential logic circuits using Verilog