EC – 1841 Electromagnetic Theory

Course Title	Course Code	Credits - 4		
Electromagnetic Theory	EC 1841	L	T	P
		3	1	-

COURSE OBJECTIVES

The objective of this course is to enable the students to make use of maxwell's equation for analyzing wave- formation and wave propagation in various media.

PRE-REQUISITES

- Mathematics I & II
- Fundamentals of Electrical Engineering

COURSE CONTENTS

Unit I: Orthogonal coordinate systems, gradient, divergence and curl. Stokes's theorem, gauss's theorem and divergence theorem. Static electric fields: Electric flux density, permittivity, Columb's law, and electric field intensity, field of distributed charges in free space and line charge, potential function, Laplace's and Poisson's equations, electric dipole, dipole moment, field due to electric dipole, stored electric energy density. Boundary conditions at abrupt discontinuities between two media including conducting boundaries, surface charge distribution, capacitance between two isolated conductors.

Unit-II: Solution of Laplace's equations in systems of dielectric and conducting boundaries, uniqueness theorem, Static current and magnetic fields- current density, mobility, Ohm's law employing mobility. Biot-Savart's law, magnetic field, magnetic field intensity, magnetic flux, and permeability, closed loop currents, Ampere's circuital law in integral and differential vector form, magnetic vector potential. Problems related to straight wire, toroid and cylindrical solenoids. Boundary conditions on magnetic field.

Unit-III: Time varying fields – Faraday's law in integral and differential forms, displacement current concept, Maxwell's equations in differential and integral forms, wave equations in source free region, continuity equation, Poynting vector theorem, complex Poynting vector. Time harmonic fields, Maxwell's equations for TH field, average energy density, duality concept. Helmholtz wave equation, general solution in free space in various coordinates, plane polarized wave in free space, properties of plane waves, wave front, power flow, stored energy density

Unit-IV: Circular and elliptic polarization, resolution in terms of linear polarized waves and vice- versa. Plane waves in lossy medium, low loss dielectric, good conducting and ionized media, loss tangent, skin depth, transmission line analogy, Interference of two plane waves traveling at oblique directions.

Unit-V: Reflection and refraction of plane waves at dielectric media and conducting Surfaces, Brewster's angle, total internal reflection, resultant fields and power flow in both media. Frequency dispersive propagation, phase velocity and group velocity. Magnetic vector potential for sources in free space, retarded potential, radiation principles.

COURSE OUTCOMES:

On successful completion of this course student should:
CO1: Ability to understand vector analysis and static electric field behavior.
CO2: Ability to understand static magnetic field behavior.
CO3: Ability to understand the behavior of time varying electric and magnetic field.
CO4: Ability to understand polarization and interference of waves.
CO5: Ability to understand Reflection and refraction of plane waves and radiation principle.

TEXT BOOKS& REFERENCES:

- Mathew N.O Sadiku: Elements of Electromagnetic, Oxford University Press
- William H. Hayt: Engineering Electromagnetic, TMH.
- John D. Kraus: Electromagnetics, Mc. Graw Hill.
- Jordan Balmian: Electromagnetic wave and Radiating System, PHI.
- David K. Cheng: Electromagnetic Fields and Wave, Addison Wesley.
- Ramo, Whinnerry and VanDuzzer " Fields and waves in communication electronics ",Wiley 1984
- Harrington RF, "Electromagnetic fields" Mc Graw Hill

EC – 1842 Analog and Digital Communication

Course Title	Course Code	Credits - 4		
Analog and Digital Communication	EC 1842	L	T	P
		3	-	2

COURSE OBJECTIVES

This course provides a thorough introduction to the basic principles and techniques used in analog and digital communications. The course will introduce analog and digital modulation techniques, communication receiver and transmitter design, baseband and band pass communication techniques, noise analysis, and multiplexing techniques. The course also introduces analytical techniques to evaluate the performance of communication systems.

PRE-REQUISITES

- Signal & System
- Electronics Devices

COURSE CONTENTS

Unit I: Definition, Necessity of Modulation, Principle of Amplitude Modulation, Generation and detection of AM, Sidebands, Generation and Detection of sidebands, VSB transmission and Applications.Definition and relationship between PM & FM, Frequency spectrum, Bandwidth requirement, Frequency and Phase deviation, Modulation Index, NBFM & WBFM, Generation and Detection of FM, Comparison of various Analog Communication System (AM-FM-PM).

Unit-II: AM Transmitter, Block diagram & working of Low level & High level transmitter, SSB Transmitters. FM Transmitters, Frequency Multiplication. Receiver, Characteristics (Selectivity, fidelity and Sensitivity), AM receiver, RF Receiver, Super-heterodyne Receiver, RF Amplifier, Frequency Mixer, AVC & AFC, Image Signal, FM Receiver.Noise: Classification & sources of Noise, Noise calculations for single & cascade stages (Noise Bandwidth, Noise Figure, Noise Temp.), SNR in different systems.

Unit-III: Analog Signals:- Sampling of Signal, Sampling Theorem for Low Pass and Band Pass Signals, Aliasing, Pulse Amplitude Modulation (PAM), Time Division Multiplexing (TDM), Channel Bandwidth for PAM-TDM Signal, Types of Sampling, Instantaneous, Natural and Flat Top (Mathematical and Spectral Analysis), Aperture Effect, Introduction to Pulse Position and Pulse Duration Modulation.

Unit-IV: Digital Signal:- Quantization, Quantization Error, Pulse Code Modulation (PCM), Signal-to-Noise Ratio in PCM, Companding, Data Rate and Bandwidth of Multiplexed PCM Signal, Differential PCM (DPCM), Delta Modulation (DM), and Adaptive Delta Modulation (ADM), Comparison of various system in terms of Bandwidth and Signal-to-Noise Ratio.

Unit-V: Analysis, Generation and Detection (Block Diagram), Spectrum and Bandwidth of Amplitude Shift Keying (ASK), Binary Phase Shift Keying (BPSK), Differential Phase Shift Keying (DPSK), Offset and Non-offset Quadrature Phase Shift Keying (QPSK), M-ary PSK, Binary Frequency Shift Keying (BFSK), M-ary FSK, Minimum Shift Keying, Quadrature Amplitude Modulation (QAM)

COURSE OUTCOMES

On successful completion of the course students will be able to:

CO1: Conduct analysis of baseband signals in time domain and in frequency domain

CO2: Analyze the performance of modulation and demodulation techniques in various transmission environments

CO3: To analyze error performance of a communication system in presence of noise and other interferences.

TEXT BOOKS& REFERENCES:

- Taub and Schilling: Principles of Communication System, TMH
- Simon Haykins: Communication Systems, 4th Edition, John Wiley.
- Singh and Sapre: Communication System, TMH
- B.P. Lathi: Modern Analog and Digital Communication System, Oxford University Press
- Tomasi: Advanced Electronics Communication Systems, 6th Edition, PHI
- Couch: Digital and Analog Communication, Pearson Education.
- David Smith : Digital Transmission Systems, Springer- Macmillan India Ltd

EC – 1843 Analog Circuits

Course Title	Course Code	Credits - 4		
		L	T	P
DSP Processor	EC 1843	3	-	2

COURSE OBJECTIVES

The objective of course is to familiarize students with concepts of feedback used in amplifier and oscillators ,understand the basic functionality of op amp,and design electronics circuits of practical applications using op – amp. Also students will be familiar with parameters of op amp such as offset voltage and current,CMRR, Slew rate .They will also get insight into design and analysis of different active filters.

PRE-REQUISITES

- Electronic Devices
- Network analysis.

COURSE CONTENTS

Unit I: Feedback Amplifiers & Oscillators: Concept of feedback, positive and negative feedback, voltage and current feedback, series and shunt feedback, effect of feedback on performance characteristics of an amplifier, stability criterion. Condition for sustained oscillation, Barkhausan criterion, R-C phase shift, Hartley, Colpitts, Crystal and Wein bridge Oscillators, Negative resistance Oscillator, Relaxation Oscillator.

Unit-II: Operational Amplifier Fundamentals: Introduction to op-amp, Block diagram representation, pin diagram , characteristics of ideal op – amp, Equivalent circuit, open loop op amp, configuration of differential ,inverting and non-inverting ,Feedback Amplifier analysis Differential amplifier with one op amp ,two op amp and three op amp , current mirror in op amp, op amp parameters - offset voltage and current, bias current ,drift ,CMRR, slew rate and its effect on frequency response, offset nulling methods.

Unit-III: Operational Amplifier and Linear Applications I: DC and AC amplifiers, peak detector, summing, scaling and averaging amplifiers, Instrumentation amplifier, integrator, differentiator and comparator. Square, triangular and sawtooth wave generator, voltage controlled oscillator. Zero crossing detector, window detector, Precision rectifiers.

Unit-IV: Operational Amplifiers Applications-II: Non-linear Op-Amp Circuits: Schmitt trigger and applications, Precision rectifiers,S/Hcircuits, logarithmic amplifiers., phase locked loop, principle and building block of PLL ,Lock and capture ranges ,capture process and application of PLL ,adjustable output voltage regulators introduction to op-amp LM – 317, LM 340

Unit-V: Design of Active Filters: Active filters, characteristics ,frequency response and different types of filters ,order and cut off frequency ,Butterworth Low pass filters , high pass filters ,band pass filter ,band stop filter and all pass filter Timer IC - 555 ,functional diagram Mono stable and Astable modes. Three terminal regulator ICs , basic blocks 78XX and 79XX.

COURSE OUTCOMES

On successful completion of this course student should be able to:
CO1: Understand concept of feedback in amplifiers and oscillators.
CO2: Understand the basics of op amp , its internal architecture,
CO3: Linear and non linearapplications of op amp.
CO4: understand advanced application of op amp such as PLL ,newer generation op amp
CO5:Design active filters and analyze them, also they will understand the fundamentals of special function ICs such as 555 timer and its application such as Monostable and astablemultivibrators..

TEXT BOOKS& REFERENCES:

- OP-Amps their design and applications — Tobbey et all
- OP-Amps and Linear Integrated circuit — R.A. Gayakwad (PHI)
- Linear Integrated Circuits — D.Roychowdhary and Shail B. Jain
- Integrated Electronics — Millman & Halkias

EC – 1844 VLSI Circuit Design

Course Title	Course Code	Credits - 4		
VLSI Circuit Design	EC 1844	L	T	P
		3	-	2

COURSE OBJECTIVES

The **objective of this course is to make student aware of vlsi technology and its components**

PRE-REQUISITES
Electronic Devices
Digital System Design

COURSE CONTENTS

Unit I: INTRODUCTION: Introduction to IC Technology – MOS, PMOS, NMOS, CMOS & Bi-CMOS technologies. CMOS Fabrication and Layout: Fabrication Process, Layout Design rules, Gate Layout, Stick Diagrams. VLSI Design Flow. VLSI Design Consideration, Hierarchy, Concepts of Regularity, Modularity and Locality, VLSI Design Approaches, Methodologies and Classifications, VLSI Design Qualities.

Unit-II: MOS Transistor: The Metal Oxide Semiconductor (MOS) structure, The MOS System under external bias, Structure &Operation of MOS transistor, MOSFET Current-Voltage characteristics, MOSFET scaling & small-geometry effects, MOSFET capacitances. MOS inverter Static characteristics: Introduction, Resistive load Inverter, Inverter with n-type MOSFET load (Enhancement & Depletion type MOSFET load), CMOS Inverter.

Unit-III: MOS inverters Switching characteristics and Interconnect Effects: Introduction, Delay-time definitions, Calculation of Delay times, Inverter design with delay constraints, Estimation of Interconnect Parasitic, Calculation of interconnect delay, Switching Power Dissipation of CMOS Inverters.

Unit-IV: Combinational MOS & Dynamic Logic circuits: Combinational Logic, NAND Gate, NOR Gate, Compound Gates, Transmission Gates, Tristate. Sequential MOS Logic circuits: Introduction, Behavior of Bistable elements, The SR latch circuit, clocked latch & Flip-flop circuit, CMOS D-latch & Edge triggered flip-flop. Dynamic Logic Circuits: Introduction, Basic principles of pass transistor circuits, Voltage Bootstrapping, Synchronous Dynamic Circuit Techniques, CMOS Dynamic Circuit Techniques, High-performance Dynamic CMOS circuits.

Unit-V: HDL based design: Language Fundamentals, Behavioral and RTL style of modeling, Data Flow style of description, Structural style, Test-Bench.

COURSE OUTCOMES:

On successful completion of this course student should be able to:
CO1: Understand CMOS Design Process
CO2: Understand and analysis MOSFET Characteristics
CO3: Use MOS Inverter as switch
CO4: Analyze and use logic circuits
CO5: Design and Simulate LOGIC circuits on FPGA board using HDL

TEXT BOOKS& REFERENCES:

- Neil H.E. Weste, David Harris, Ayan Banerjee: Cmos Vlsi Design, Third Edition,
- Pearson Education.
- Neil H.E. Weste, Kamran Eshraghian: Principle Of Cmos Vlsi Design, Pearson Education.
- J. P. Uyemura: Chip Design For Submicron Vlsi, Cengage Learning.
- Philip E. Allen And Douglas R Holberg: Cmos Analog Circuit Design, Oxford
- Carver Mead And Lynn Conway: Introduction To Vlsi Systems, Bs Publication.
- J. P. Uyemura: Introduction To Vlsi Circuits And Systems, Wiley.
- Vlsi Technology – S.M. Sze, 2nd Edition, Tmh, 2003.
- J. Bhaskar, A Vhdl Primer, Prentice Hall.

LABORATORY EXPERIMENTS:

1. Combinational Design Exercises using VHDL
   a. Design of 2:1 Multiplexer using other Basic gates
   b. Design 2:4 Decoder
   c. Design Half Adder, Full Adder
   d. Design 3: 8 Decoder
   e. Design 8:3 Priority Encoder
2. Sequential Design Exercises using VHDL
   a. Design of 4 Bit Binary to Gray Code Converter
   b. Design of 4 Bit Binary to BCD Converter
   c. Design of 8 Bit Parity Generator
   d. Design of all types of Flip Flop using (if then else) Sequential constructs
3. Design of basic and universal gates using Microwind Simulation Software
   a. NOT Gate
   b. 2 & 3 input OR & NOR Gate
   c. 2 & 3 input AND & NAND Gate2
   d. 2 & 3 input XOR & XNOR Gate

Category of Course	Course Title	Course Code	Credits - 4			Theory Paper
			L	T	P	
Departmental Core	Engineering Mathematics III	EC-1845	3	1	-	Max.Marks-70 Duration-3 Hrs.

Sub. Code	Subject Name & Title	Maximum Marks Allotted					Total Marks
		Theory Paper			Practical		
		End Sem.	Mid Sem.	Quiz, Assignment	End Sem.	Lab Work/ Assignment	
EC-1845	Engineering Mathematics III	70	20	10	-	-	100

Course Description	This course is a study of advanced topics in applied mathematics which will be very much useful to their further study of engineering. Students of all branches of engineering will be benefitted through this course. They will become self sufficient to model an engineering or physical science problem to find out the solution of that problem. Techniques of numerical method will be utmost helpful for them.
Prerequisite Knowledge	Basic knowledge of Mathematics: simultaneous Equations, Differentiation, Integration and Logarithms.
Course Objectives	It aims to equip the students to solve various advanced level of engineering problems as well as real world problems with the use of transformation and numerical techniques.
Course Outcomes	This course primarily contributes to applied mathematics program outcomes that develop students abilities to: 1. Students will learn the expansion of functions and various transformations. 2. It will help them to solve various physical science and engineering with the application of Laplace transform. 3. Interpolation will help them to find the solution of various types of problems like census problems, weather problems etc. 4. It is useful to solve various differentiation and integration problems using numerical techniques. 5. It will be very much useful to solve various boundary value problems.

	Syllabus
Unit-I	**Fourier Series and Fourier Transform :** Fourier Series, Change of Interval, Half Range Sine and Cosine Series, Fourier Transform, Fourier Sine Transform and Fourier Cosine Transform
Unit-II	**Laplace Transform:** Laplace Transform of Elementary Functions, Properties of Laplace Transform, Change of scale of properties, Second shifting theorem, Laplace Transform of derivatives, Inverse Laplace Transform and its properties, Convolutions theorem, Application of Laplace Transform to solve the ordinary differential equations.
Unit-III	**Interpolation :** Finite Differences, Factorial Notations by Newton's Forward Interpolation Formula, Newton's Backward Interpolation Formula, Gauss Forward Interpolation Formula, Gauss Backward Interpolation Formula, Bessel's Formula, Sterling Formula, Newton's Divided Difference Interpolation Formula, Lagrange's Interpolation Formula, Inverse Interpolation Formula.
Unit-IV	**Numerical Differentiation, Numerical Integration and Solution of Simultaneous Equations:** Methods of Numerical Differentiation, Numerical Integration, Quadrature Formula, Trapezoidal Rule, Simpson's One-third Rule, Simpson's Three-Eight Rule and Weddle's Rule. Solution of Simultaneous Algebraic Equations by Gauss elimination, Gauss Jordan, Crout's Methods, Jacobi's and Gauss-Siedel Iterative Method.
Unit-V	**Numerical Solution of Ordinary differential Equations :** Picard's Method, Taylor's Series Method, Euler's Method, Modified Euler's Method, Runge-Kuttta Method of Fourth Order

Text Books:

1 .Engineering Mathematics by B. V. Ramanna, Tata McGraw Hill
2. Higher Engineering Mathematics by B.S. Grewal, Khanna Publishers3. Advance Engineering Mathematics by E. Kreyszig
3 Advanced Engineering Mathematics by Kreyszig
4. Numerical Methods in Engineering and Science by B.S. Grewal, Khanna Publishers

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