Course Code	**:**	**MAIR 34**
Course Title	**:**	**REAL ANALYSIS AND PARTIAL DIFFERENTIAL EQUATIONS**
Number of Credits		**3**
Prerequisites (Course code)	**:**	**NONE**
Course Type	**:**	**GIR**

Course Learning Objectives

- To expose the students to the basics of real analysis and partial differential equations required for their subsequent course work.

Course Content

Properties of real numbers, Numerical sequences. Cauchy sequences. Bolzano-Weierstrass and Heine-Borel properties.

Functions of real variables, Limits, continuity and differentiability, Taylor's formula, Extrema of functions.

Riemann integral, mean value theorems, Differentiation under integral sign, Change-of-variables formula, Sequences and series of functions, Point wise and uniform convergence.

Method of separation of variables-Fourier series solution applications to one dimensional wave equation and one-dimensional heat flow equation.

Laplace and Helmholtz equations, Boundary and initial value problems, Solution by separation of variables and Eigen Function Expansion.

Text Books

1. *Guenther, R.B. &Lee, J.W., "Partial Differential Equations of Mathematical Physics and Integral Equations", Prentice Hall, 1996.*
2. *W.Rudin, "Introduction to Principles of Mathematical Analysis", McGraw-Hill International Editions, Third Edition, 1976.*

Reference Books

1. *Kreyszig.E., "Advanced Engineering Mathematics", John Wiley, 1999.*
2. *S.C. Malik, Savita Arora, "Mathematical Analysis", New Age International Ltd, 4th Edition, 2012.*
3. *G.B.Gustafson&C.H. Wilcox, "Advanced Engineering Mathematics", Springer Verlag, 1998.*

Course outcomes

At the end of the course student will be able

CO1: Develops an understanding for the construction of proofs and an appreciation for deductive logic.

CO2: Explore the already familiar properties of the derivative and the Riemann Integral, set on a more rigorous and formal footing which is central to avoiding inconsistencies in engineering applications.

CO3: Explore new theoretical dimensions of uniform convergence, completeness and important consequences as interchange of limit operations.

CO4: Develop an intuition for analyzing sets of higher dimension (mostly of the R^n type) space.

CO5: Solve the most common PDEs, recurrent in engineering using standard techniques and understanding of an appreciation for the need of numerical techniques.

Course Code	**:**	**ECPC10**
Course Title	**:**	**SIGNALS AND SYSTEMS**
Number of Credits		**4**
Prerequisites (Course code)	**:**	**NONE**
Course Type	**:**	**PC**

Course Learning Objectives

The aim of the course is for

- understanding the fundamental characteristics of signals and systems.
- understanding the concepts of vector space, inner product space and orthogonal series.
- 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.
- development of the mathematical skills to solve problems involving convolution, filtering, modulation and sampling.

Course Content

Vector spaces. Inner Product spaces. Schwartzin equality. Hilbertspaces. Orthogonal expansions. Bessel's inequality and Parseval's relations.

Continuous-time signals, classifications. Periodic signals. Fourier series representation, Hilbert transform and its properties.

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

Sampling and reconstruction of band limited signals. Low pass and band pass sampling theorems. Aliasing. Anti-aliasing filter. Practical Sampling-aperture effect.

Discrete-time signals and systems. Z-transform and its properties. Analysis of LSI systems using Z – transform.

Text Books

1. *A.V.Oppenheim, A. Willsky, S. Hamid Nawab, "Signals and Systems (2/e)", Pearson 200.*
2. *S.Haykin and B.VanVeen "Signals and Systems, Wiley, 1998.*
3. *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, 200.*
2. *K.Huffman&R.Kunz, "Linear Algebra", Prentice- Hall, 1971.*
3. *S.S.Soliman&M.D.Srinath, "Continuous and Discrete Signals and Systems", Prentice- Hall, 1990.*

Course outcomes

At the end of the course student will be able

CO1: apply the knowledge of linear algebra topics like vector space, basis, dimension, inner product, norm and orthogonal basis to signals.

CO2: analyse the spectral characteristics of continuous-time periodic and a periodic signals using Fourier analysis.

CO3: classify systems based on their properties and determine the response of LSI system using convolution.

CO4: analyze system properties based on impulse response and Fourier analysis.

CO5: apply the Laplace transform and Z- transform for analyze of continuous-time and discrete-time signals and systems.

CO6: understand the process of sampling and the effects of under sampling.

Course Code	**:**	**ECPC11**
Course Title	**:**	**NETWORK ANALYSIS AND SYNTHESIS**
Number of Credits		**4**
Prerequisites (Course code)	**:**	**NONE**
Course Type	**:**	**PC**

Course Learning Objectives

- To make the students capable of analyzing any given electrical network.
- To make the students to learn synthesis of an electrical network for a given impedance/ admittance function.

Course Content

Network concept. Elements and sources. Kirchoff's laws. Tellegen's theorem. Network equilibrium equations. Node and Mesh method. Source superposition. Thevenin's and Norton's theorems. Network graphs.

First and second order networks. State equations. Transient response. Network functions. Determination of the natural frequencies and mode vectors from network functions.

Sinusoidal steady-state analysis. Maximum power-transfer theorem. Resonance. Equivalent and dual networks. Design of equalizers.

Two-port network parameters. Interconnection of two port networks. Barlett's bisection theorem. Image and
Iterative parameters. Design of attenuators.

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

Text Books

1. *Hayt W. H., Kemmerly J. E. and Durbin S. M., "Engineering Circuit Analysis", 6th Ed., Tata McGraw-Hill Publishing Company Ltd.,2008.*
2. *F.F. Kuo, "Network analysis and Synthesis", Wiley International Edition ,2008.*

Reference Books

1. *Valkenberg V., “Network Analysis”, 3rd Ed., Prentice Hall International Edition, 2007.*
2. *B.S.Nair and S.R.Deepa, “Network analysis and Synthesis”, Elsevier,2012.*

Course outcomes

At the end of the course student will be able

CO1: analyze the electric circuit using network theorems
CO2: understand and Obtain Transient & Forced response
CO3: determine Sinusoidal steady state response; understand the real time applications of maximum power transfer theorem and equalizer
CO4: understand the two–port network parameters, are able to find out two-port network parameters & overall response for interconnection of two-port networks.
CO5: synthesize one port network using Foster form, Cauer form.

Course Code	**:**	**ECPC12**
Course Title	**:**	**ELECTRODYNAMICS AND ELECTROMAGNETIC WAVES**
Number of Credits		**4**
Prerequisites (Course code)	**:**	**NONE**
Course Type	**:**	**PC**

Course Learning Objectives

- To expose the students to the rudiments of Electromagnetic theory and wave propagation essential for subsequent courses on microwave engineering, antennas and wireless communication

Course Content

Electrostatics. Coulomb’slaw. Gauss’s law and applications. Electric potential. Poisson’s and Laplace equations. Method of images. Multipole Expansion.

Electrostatic fields in matter. Dielectrics and electric polarization. Capacitors with dielectric substrates. Linear dielectrics. Force and energy in dielectric systems.

Magnetostatics. Magnetic fields of steady currents. Biot-Savart’s and Ampere’s laws. Magnetic vector potential. Magnetic properties of matter.

Electrodynamics. Flux rule for motional emf. Faraday’s law. Self and mutual inductances. Maxwell’sEquations. Electromagnetic Boundary conditions. Poynting theorem.

Electromagnetic wave propagation. Uniform plane waves. Wave polarization. Waves in matter. Reflection and transmission at boundaries. Propagation in an ionized medium.

Text Books

1. *D.J.Griffiths, “Introduction to Electrodynamics (3/e)”, PHI, 2001*
2. *E.C. Jordan & G. Balmain, “Electromagnetic Waves and Radiating Systems”, PHI, 1995.*

Reference Books

1. *W.H.Hayt, “Engineering Electromagnetics, (7/e)”, McGraw Hill, 2006.*
2. *D.K.Cheng, “Field and Wave Electromagnetics, (2/e)”, Addison Wesley, 1999.*
3. *M.N.O.Sadiku,”Principles of Electromagnetics, (4/e)”, Oxford University Press, 2011.*
4. *N.NarayanaRao, “Elements of Engineering Electromagnetics, (6/e)”, Pearson, 2006.*
5. *R.E.Collin, “Foundations for Microwave Engineering (2/e)”, McGraw –Hill, 2002.*

6. *R.E.Collin, “Antennas and Radiowave Propagation”, McGraw-Hill, 1985.*

Course outcomes

At the end of the course student will be able

CO1: recognize and classify the basic Electrostatic theorems and laws and to derive them.
CO2: discuss the behavior of Electric fields in matter and Polarization concepts.
CO3: classify the basic Magneto static theorems and laws and infer the magnetic properties of matter.
CO4: summarize the concepts of electrodynamics &to derive and discuss the Maxwell’s equations.
CO5: students are expected to be familiar with Electromagnetic wave propagation and wave polarization.

Course Code	**:**	**ECPC13**
Course Title	**:**	**SEMICONDUCTOR PHYSICS AND DEVICES**
Number of Credits		**3**
Prerequisites (Course code)	**:**	**NONE**
Course Type	**:**	**PC**

Course Learning Objectives

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

Course Content

Semiconductor materials: crystal growth, film formation, lithography, etching and doping. Formation of energy bands in solids, Concept of hole, Intrinsic and extrinsic semiconductors, conductivity, Equilibrium Carrier concentration, Density of states and Fermi level, Carrier transport – Drift and Diffusion, continuity equation,Hall effect and its applications.

P-N junction diodes, Energy band diagram, biasing, V-I characteristics, capacitances. Diode models, Break down Mechanisms, Rectifiers, Limiting and Clamping Circuits, types of diodes.

BJT Physics and Characteristics modes of operation, Ebers-Moll Model, BJT as a switch and Amplifier, breakdown mechanisms, Photo devices.

MOSFET: Ideal I-V characteristics, non-ideal I-V effects, MOS Capacitor, MOSFET as switch, CMOS Logic gate Circuits, Bi-CMOS circuits, CCDs.

Power devices, operation and characteristics. Thyristor family. Power diodes. Power transistors. Display devices, Operation of LCDs, Plasma, LED and HDTV

Text Books

1. *S.M.Sze, Semiconductors Devices, Physics and Technology, (2/e), Wiley, 2002*
2. *A.S.Sedra&K.C.Smith, Microelectronic Circuits (5/e), Oxford, 2004*
3. *L.Macdonald&A.C.Lowe, Display Systems, Wiley, 2003*

Reference Books

1. *Robert Pierret, “Semiconductor Device Fundamentals,” Pearson Education, 2006*
2. *J.Millman and C.C.Halkias : Electronic devices and Circuits, McGraw Hill, 1976.*
3. *B.G.Streetman : Solid state devices, (4/e), PHI, 1995.*

4. *N.H.E.Weste, D. Harris, “CMOS VLSI Design (3/e)”, Pearson, 2005.*

Course outcomes

At the end of the course student will be able

CO1: Apply the knowledge of basic semiconductor material physics and understand fabrication processes.

CO2: Analyze the characteristics of various electronic devices like diode, transistor etc., CO3:Classify and analyze the various circuit configurations of Transistor and MOSFETs.

CO4: Illustrate the qualitative knowledge of Power electronic Devices.

CO5: Become Aware of the latest technological changes in Display Devices.

Course Code	**:**	**ECPC14**
Course Title	**:**	**DIGITAL CIRCUITS AND SYSTEMS**
Number of Credits		**3**
Prerequisites (Course code)	**:**	**NONE**
Course Type	**:**	**PC**

Course Learning Objectives

- To introduce the theoretical and circuit aspects of digital electronics, which is the back bone for the basics of the hardware aspect of digital computers?

Course Content

Review of number systems-representation-conversions, error detection and error correction. Review of Boolean algebra- theorems, sum of product and product of sum simplification, canonical forms-minterm and maxterm, Simplification of Boolean expressions-Karnaugh map, completely and incompletely specified functions, Implementation of Boolean expressions using universal gates.

Combinational logic circuits- adders, subtractors, BCD adder, ripple carry look ahead adders, parity generator, decoders, encoders, multiplexers, demultiplexers, Realization of Boolean expressions- using decoders-using multiplexers. Memories – ROM- organization, expansion. PROMs. Types of RAMs – Basic structure, organization, Static and dynamic RAMs, PLDs, PLAs.

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.

Synchronous circuit analysis and design: structure and operation, analysis-transition equations, state tables and state diagrams, Modelling- Moore machine and Mealy machine- serial binary adder, sequence recogniser, state table reduction, state assignment. Hazard; Overview and comparison of logic families.

Introduction to Verilog HDL, Structural, Dataflow and behavioral modelling of combinational and sequential logic circuits.

Text Books

1. *Wakerly J F, “Digital Design: Principles and Practices, Prentice-Hall”, 2nd Ed., 2002.*
2. *D. D. Givone, “Digital Principles and Design”, Tata Mc-Graw Hill, New Delhi, 2003.*
3. *S.Brown and Z.Vranesic, “Fundamentals of Digital Logic with Verilog Design”, Tata Mc-Graw Hill, 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. *Roth C.H., “Fundamentals of Logic Design”, Jaico Publishers. V Ed., 2009.*
5. *T. L. Floyd and Jain ,”Digital Fundamentals”, 8th ed., Pearson Education, 2003.*

Course outcomes

At the end of the course student will be able

CO1: Apply the knowledge of Boolean algebra and simplification of Boolean expressions to deduce optimal digital networks.

CO2: Study and examine the SSI, MSI and Programmable combinational networks.

CO3: Study and investigate the sequential networks suing counters and shift registers; summarize the performance of logic families with respect to their speed, power consumption, number of ICs and cost.

CO4: Work out SSI and MSI digital networks given a state di agram based on Mealy and Moore configurations.

CO5: Code combinational and sequential networks using Virology HDL.