4th Semester

Course No.	Subject	Teaching Periods		Credits
		L	T	
BSCMTH41	**Engineering Mathematics – IV**	2	1	3

Section	Course contents	Hours
1.	Analytical Functions, C-R Equations	4
2.	Complex Integration	3
3.	Cauchy's Fundamental Theorem, Cauchy's Integral Theorem	3
4.	Cauchy's Inequality and Liouville's theorem on Integral Function	2
5.	Taylor's and Laurent's Expansions	3
6.	Zeroes and Poles of Analytic Functions	2
7.	Residues and Contour Integration	3
8.	Solution of Series	2
9.	Legendre's Functions, Rodrigues's Formula	3
10.	Generating Functions for Legendre's Polynomials and Recurrence Formulae	3
11.	Bessel's Functions	3
12.	Recurrence Formulae and Bessel's Functions of Integral Order.	3
13.	Continuous Wavelet Transform, Basic Properties of Wavelet Transform	3
14.	Discrete Wavelet Transform, Orthonormal Wavelets	3
15.	Multi Resolution Analysis	2
16.	Construction of Orthonormal Wavelets	2
17.	Daubchie's Wavelets and Algorithms	3
18.	Band limited wavelets, Balian low theorem	3
TOTAL HOURS FOR THE COURSE		**50**

References

1. Complex Variables & Applications by R. V. Churchill
2. Theory of Functions of Complex Variables by E. I. Copson

Course No.	Subject	Teaching Periods		Credits
		L	T	
PCCECE42	**Analog Electronic Circuits – II**	3	1	4

Section	Course Contents	Hours
1	***Differential Amplifiers*:** MOS and BJT differential pair, large signal analysis and small signal analysis of differential pairs, common mode rejection, DC offset, differential amplifiers with active loads	8
2	***Operational Amplifiers*:** Ideal Op Amp, differential and common mode signals, inverting and non-inverting configuration, open loop and closed loop gain, input and output resistance, Applications of Op Amp: integrator, differentiator, weighted summer, voltage follower, instrumentation amplifier, effect of bandwidth on circuit performance, large signal operation of Op Amps, ADC and DAC using Op Amps	8
3	***Sinusoidal Oscillators*:** Basic principle of sinusoidal oscillators, oscillation criterion, analysis of oscillator circuits using BJT, FET and Op-Amps (ring, LC, phase shift, Wein Bridge), brief discussion on crystal oscillators. Design of practical Oscillator circuits	8
4	***Waveform Shaping Circuits*:** *Bistable Multivibrators*: Feedback loop, transfer characteristics, triggering, Bistable circuit as a memory element, application as a comparator. *Astable Multivibrators*: Operation, generation of square and triangular waveforms. *Monostable Multivibrators:* Generation of a standardized pulse, 555 IC timer, Implementation of monostable bistable and astable multivibrator using 555 IC	8
5	***Output Stages and Power Amplifiers*:** Classification of output stages, Class A, Class B, Class AB and Class D output stages; circuit operation. Transfer characteristics, power conversion efficiency and power dissipation of each output stage. Power supplies and IC regulators	7
TOTAL HOURS FOR THE COURSE		**39**

References

1. Sedra A.S. and Smith K.C., Microelectronic Circuits, *Oxford University Press.*
2. Razavi B., Fundamentals of Microelectronics, *John Wiley & Sons.*
3. R. Gayakward, Operational Amplifiers, *Pearson Education*
4. Boylestad R. and Nashelsky L., Electronic Devices and Circuits, *Prentice Hall*
5. J. Millman and C. Halkias, Integrated Electronics, *McGraw Hill Publications*
6. Neamen D. A., Microelectronics: Circuit Analysis and Design, *McGraw Hill Publications*

Course No.	Subject	Teaching Periods		Credits
		L	T	
PCCECE43	**Digital System Design – II**	2	1	3

Section	Course contents	Hours
1.	**Review to Sequential logic:** Flip flop and Timing circuit : set-reset latches, D-flip-flop, R-S flip-flop, J-K Flip-flop, Master slave Flip flop, edge triggered flip-flop, T flip-flop. Registers & Counters: Synchronous/Asynchronous counter operation, Up/down synchronous counter, application of counter, Serial in/Serial out shift register, Serial in/parallel out shift register, parallel in/ parallel out shift register, parallel in/Serial out shift register, Bi-directional register.	8
2.	Introduction to state equations and state diagrams, design with state equation state diagram, mealy Sequential circuit design, Moore Sequential circuit design, Equivalent states and reduction of state tables, sequential circuit timing, Tri-state logic and buses.	7
3.	**Data-conversion circuits:** Digital –to-analogue converters, D/A converters specifications, Types of D/A converters, D/A converters application, Integrated circuits D/A, A/D converters, A/D converters specifications, Types of A/D converters, , Integrated circuits A/D converters, A/D converters applications.	6
4.	Memory organization, Classification, and characteristics of memories, Sequential memories, ROMs, R/W memories, Content Addressable memories, CCD memory, PLA, PAL and Gate Array, introduction to CPLD and FPGA.FPGA Architecture.	6
5.	**Introduction to VHDL**: Computer-aided design, Hardware Description Languages, VHDL description of combinational circuits, VHDL modules, VHDL models for multiplexers, Modeling combinational circuits using VHDL Processes, Variables, signals and constants, Arrays and loops in VHDL, VHDL data-types and operators, , VHDL libraries and Packages, IEEE Standard logic, Compilation, Simulation of VHDL Code.	10
6.	**VHDL for Sequential Logic:** Modeling Flip-flops using VHDL Processes, Modeling Registers and counters using VHDL Processes, Modeling a sequential machine, Synthesis of VHDL code, More about Processes and sequential statements.	8
7.	**VHDL for digital system design:** VHDL code for BCD to seven-segment decoder, VHDL code for BCD adder, VHDL code for serial adder, VHDL code for binary multiplier, VHDL code for 4x4 array multiplier, VHDL code for binary divider.	7
TOTAL HOURS FOR THE COURSE		**52**

References

1. Anil K. Maini, “Digital Electronics”, Wiley.
2. Charles H. Roth, “Digital System Design using VHDL”, Thomson
3. Mano M. Morris, “Digital Design”, Pearson Education, Third Edition,(2006)
4. Tocci Ronald J, “Digital Systems- Principles and Applications” Prentice Hall of India, New Delhi
5. Charles H. Roth, “Fundamentals of logic design”, CENGAGE Learning

Course No.	Subject	Teaching Periods		Credits
		L	T	
PCCECE44	**Signals and Systems**	2	1	3

Section	Course contents	Hours
1	**Introduction to signals and Systems Representation:** Classification of signals and systems: Introduction to signals and systems, Continuous time and discrete time signals.	3
2	Classification of CT and DT signals -periodic and non-periodic, Even and Odd, Power and Energy, Invertible and Non-invertible, Deterministic and Random.	4
3	Elementary signals - exponential, sine, step, impulse and its properties, ramp, rectangular, sine, triangular, signum, Operations on signals: Amplitude scaling, addition, multiplication, differentiation, integration(Accumulator for DT), time scaling, time shifting and folding.	5
4	System viewed as interconnection of of operations, properties of systems, sampling theorem, graphical and analytical proof of band limited signals.	4
5	System: definition, classification – Linear and Non-Linear, Time Variant and Time Invariant, Causal and Non-causal, Stable and Unstable (BIBO stability), Static and Dynamic.	4
6	**Fourier Analysis:** Analysis of continuous time signals: Definition and necessity of CT and DT Fourier series and Fourier transforms.	4
7	Fourier series representation of continuous time and discrete time periodic signals - properties of continuous time and discrete time Fourier series.	4
8	Continuous Time Fourier Transform (CTFT), amplitude and phase spectra of CT signals, Properties of CTFT, convolution and multiplication property of CTFT, systems characterized by Linear Constant Coefficient Differential Equations, Limitations of FT and need of LT and ZT.	4
9	Laplace Transform – ROC, poles and zeros, Properties of Laplace Transform, inverse Laplace transform, relation between Laplace transform and Fourier transform.	3
10	**Analysis of Continuous time LTI Systems:** Laplace Transform: Linear time invariant –continuous time systems: Differential equation and Block diagram representation of LTI systems, Impulse response and properties of LTI systems.	3
11	Convolution integral, properties of convolution, frequency response, State variable equations and matrix representation of systems, Analysis and characterization of LTI systems using Fourier and Laplace transform.	3
12	Computation of impulse response, transfer function, causality and stability using Laplace Transform, Unilateral Laplace transform & its applications to solve differential equations.	5
13	**Analysis of Discrete Time Systems:** Introduction Z-Transform: Analysis of discrete time signals and systems: Sampling of CT signals and aliasing, DTFT and properties, Unilateral Z-Transform & its applications to LTI Systems described by difference equations.	5
TOTAL HOURS FOR THECOURSE		**50**

References

1. Oppenheim A. V., Wilsky A. S. and Nawab S. H., Signals and Systems, *Pearson Education*
2. Haykin S. and Veen B. V., Signals and Systems, *John Wiley and Sons*
3. Roberts M. J., Signals and Systems: Analysis Using Transform Method and MATLAB, *Tata McGraw Hill*

Course No.	Subject	Teaching Periods		Credits
		L	T	
PCCECE45	**Electromagnetic Fields and Waves**	2	1	3

Section	Course contents	Hours
1.	Review of Electric Field Coulombs law, Electric field due to a point charge, surface charge and volume charge, divergence and curl of E, Electric potential	6
2.	Review of Magnetic Field, Lorentz law, Biot-Savarts law, B due to line current, Surface current and volume current densities, Divergence and curl of B, Magnetic Potential	6
3.	Maxwell's Equations, Maxwell's equations in Electrostatics and magneto-statics, in medium, Maxwell's equation	6
4.	Potential functions, Boundary conditions	4
5.	Wave equation and its solution	4
6.	Electromagnetic Waves, Poynting Theorem	4
7.	Phase and group velocity	4
8.	Plane waves in lossless and lossy media,	4
9.	Wave propagation in Ferrites-Faraday Rotation and Bire frigerence.	4
10.	Normal and oblique incidence at plane conducting boundary	4
11.	Normal and oblique incidence at plane dielectric boundary	4
TOTAL HOURS FOR THE COURSE		**50**

References

1. Jordan E and Balman K: Electromagnetic Waves & Radiating Systems, PHI
2. David K. Cheng: Field and Wave Electromagnetics, Addison Wesley
3. Krauss: Electromagnetics, Mc Graw Hill.
4. Griffiths: Introduction to Electrodynamics, PHI

Course No.	Subject	Teaching Periods		Credits
		L	P	
ESCECE46	**OOPS with Java**	2	2	3

Section	Course Content	Hours
1.	**Introduction to Java** Definition, History of Java, The Internet and Java's Place of IT, Applications and Applets, Java Virtual Machine, Byte Code- Procedure Oriented vs. Object-Oriented Programming, Compiling and Running a Simple Program, Setting up your Computer for Java Environment, Writing a program, Compiling, Interpreting and Running the Program, Handling Common Errors.	4
2.	**Tokens, Expressions and Control Structures** Primitive Data Types,User Defined Data Types, Declarations, Constants, Identifiers, Literals, Type Conversion and Casting, Variables: Arrays of Primitive Data Types, Comment Syntax, Garbage Collection, Expressions, Using Operators: Using Control Statements	5
3.	**Object Oriented Programming Concepts** Fundamentals of Classes: A Simple Class, Creating Class Instances, Adding methods to a class, Calling Functions/Methods, Abstraction, Encapsulation, Using 'this' Keyword, Constructors, Default constructors, More on methods: Passing by Value,by Reference, Access Control, Methods that Return Values, Polymorphism and Method Overloading, Recursion; Nested and Inner Classes	8
4.	**Inheritance & Packaging** Inheritance: Using 'extends' keyword, Subclasses and Superclasses, 'super' keyword usage. Overriding Methods, Dynamic Method Dispatch; The Object class, Abstract and Final Classes, Package: Access Control; Interfaces: Defining an Interface, Implementing and applying interfaces.	4
5.	**Handling Error / Exceptions** Basic Exceptions, Proper use of exceptions, User defined Exceptions, Catching Exception: try, catch; Throwing and re-throwing: throw, throws; Cleaning up using the finally clause.	2
6.	**. Handling Strings** Creation, Concatenation and Conversion of a String, Changing Case, Character Extraction, String Comparison, Searching Strings, Modifying Strings, String Buffer.	2
7.	**Threads** Create/Instantiate/Start New Threads: Extending java.lang.Thread, Implementing java.lang.Runnable Interface; Understand Thread Execution, Thread Priorities, Synchronization, Inter-Thread Communication, Deadlock.	7
8.	**I/O and Streams**java.io package, Files and directories, Streams and Character Streams; Reading/Writing Console Input/Output, Reading and Writing files, The Serialization Interface, Serialization & Deserialization	2
9.	**Understanding Core Packages** Using java.lang Package: java.lang.Math, Wrapper classes and associated methods (Number, Double, Float; Integer, Byte; Short, Long; Character, Boolean); Using java.util package: Core classes (Vector, Stack, Dictionary, Hashtable, Enumerations, Random Number Generation).	3
10.	**Holding Collection of Data** Arrays And Collection Classes/Interfaces, Map/List/Set Implementations: Map Interface, List Interface, Set Interface, Collection Classes: Array List, Linked List, Hash Set and Tree Set, Accessing Collections/Use of An Iterator, Comparator.	3

11.	**Java Applications** About AWT & Swing, About JFrame (a top level window in Swing), Event Handling in Swing Applications, Layout Management using FlowLayout, Border Layout, Grid Layout, Using JPanel, Choice components like JCheck Box, JRadio Button, Borders components, JCombo Box & its events, JList& its events with MVC patterns,	8
12	**Introduction to Java Applets** Definition, Applet lifecycle methods, Build a simple applet, Using Applet Viewer, Adding Controls: Animation Concepts.	1
13	**Database Programming using JDBC** Using Connection, Statement & Result Set Interfaces for Manipulating Data with the Databases.	2

Books

1. The Java Tutorial: A Short Course on the Basics (The Java Series) 6th Edition by Raymond Gallardo , Scott Hommel, Sowmya Kannan, Joni Gordon, Sharon Biocca Zakh
2. Thinking in Java 4th Edition by Bruce Eckel
3. Java the Complete Reference latest edition Herbert Schildt
4. Head First Java by Kathy Sierra O'Reilly publication

Course No.	Subject	Teaching Periods	Credits
		P	
PCCECE42L	Analog Electronic Circuits Lab – II	2	1

List of Experiments

1) To assemble current series feedback amplifier and study its performance.
2) To assemble a voltage shunt feedback amplifier and study its performance.
3) To design RC phase shift oscillator using OPAMP/BJT.
4) To assemble a differential amplifier and obtain its CMRR.
5) To study different applications of OP AMPS.
    a. OP-AMP as voltage comparator
    b. OP-Amp as Zero Crossing Detector
    c. OP-AMP as an inverting amplifier.
    d. OP AMP as a non -inverting amplifier
    e. OP AMP as an integrator
    f. OP AMP as a differentiator
6) To measure the following parameters of a typical OP-AMP.
    a. I/P Impedance
    b. O/P Impedance
    c. Slew rate
    d. CMRR
7) Obtain frequency response of an OP-AMP & hence find its bandwidth.
8) Study performance of multivibrator circuits using 555 chip in following modes:
    a. Bistable
    b. Astable
    c. Monostable
    d. Use of 555 Chip as a timer circuit.
9) To assemble a Schmitt trigger Circuit and to obtain its characteristics and to use it as squaring circuit.

Course No.	Subject	Teaching Periods	Credits
		P	
PCCECE43L	**Digital System Design Lab – II**	2	1

List of Experiments

Experiments on Design using VHDL and Implementation using Xilinx/Spartan Kits: Combinational Design & Implementation Exercises:

1. Design and implementation of basic Gates: AND, OR, NOT.
2. Design and implementation of universal gates.
3. Design and implementation of 2:1 Mux using other basic gates.
4. Design and implementation of 2 to 4 Decoder.
5. Design and implementation of Half-Adder, Full Adder, Half Subtractor, Full Subtractor.
6. Design and implementation of 3:8 Decoder.
7. Design and implementation of 8:3 Priority Encoder.
8. Design and implementation of 4-Bit Binary to Grey code Converter.
9. Design and implementation of 4-Bit Binary to BCD Converter using sequential statement.
10. Design an 8-Bit parity generator (with for loop and Generic statements).
11. Design and implementation of 2's Complementary for 8-bit Binary number using Generate statements.

Sequential Design & Implementation Exercises:

12. Design and implementation of all type of Flip-Flops using (if-then-else) Sequential Constructs
13. Design and implementation of 8-Bit Shift Register with shift Right, shift Left, Load and Synchronous reset.
14. Design and implementation of Synchronous 8-bit Johnson Counter.
15. Design and implementation of counters (MOD3, MOD5, MOD8, MOD16).
16. Design and implementation of a decimal up/down counter that counts up from 00 to 99 or down from 99 to 00.
17. Design and implementation of 3-line to 8-line decoder with address latch.

Course No.	Subject	Teaching Periods	Credits
		P	
PCCECE44L	**Signals and Systems Lab**	2	1

List of Experiments

1. Introduction to:
    a. MATLAB
    b. Basic operations on matrices
    c. Logical operations and loops
    d. Function files etc
2. Generation of various signals and sequences
3. Operation on signals and sequences
4. Generation of even & odd components of a signal
5. Check different properties of given systems
6. Perform convolution of continuous time signals & discrete time sequences
7. Auto correlation and Cross correlation
8. Gibbs phenomenon
9. Fourier analysis of periodic signals using a) trigonometric Fourier series b) using exponential Fourier series
10. Plot magnitude and Phase response of a given system.
11. Inverse Fourier transform
12. Properties of Fourier transform (linearity, scaling, shifting, duality, differentiation etc)
13. Laplace transform and it's Inverse
14. Discrete time Fourier transform and it's Inverse
15. Z-transform and its Inverse

Course No.	Subject	Teaching Periods	Credits
		P	
PCCECE46L	**EDA Tools Lab – II**	2	1

Introduction to MATLAB

1. Introduction to MATLAB and its workspace.
2. Working with matrices: creation of 1d, 2d, 3d and nd matrices, acquisition of matrices, processing and operations on matrices.
3. Various plotting tools. Plotting vector and matrix data, Plot labeling, curve labeling and editing, 2D and 3D plot, surface, mesh and grid plotting.
4. Working with Complex numbers and their operations.
5. MATLAB Programming: Automating commands with scripts, writing programs with logic and flow control, Writing functions, Control statement Programming, Conditional Statement Programming, Examples.
6. M files: Working with script tools, Writing Script file, executing script files, The MATLAB Editor, Saving m files.
7. GUI Design: Introduction Of Graphical User Interface, GUI Function Property, GUI Component Design, GUI Container, Writing the code of GUI Callback, Dialog Box, Menu Designing, Applications.
8. MATLAB SIMULINK: Introduction of SIMULINK, SIMULINK Environment & Interface, Study of Library, Circuit Oriented Design, Equation Oriented Design, Model, Subsystem Design, Connect Call back to subsystem, Application.
9. Image Processing with MATLAB: Importing and Visualizing Images, Importing and displaying images, converting between image types, Exporting images, Interactive Exploration of Images.
10. Symbolic Math in MATLAB: Calculus-Numerical Integration, Linear Algebra, Roots of Polynomials, Algebraic equations, Differential Equations (1st & 2nd order), Transforms (Fourier, Laplace, etc), Ordinary Differential equations, Examples of few ODEs.

Introduction to PCB Design

1. Definition and Need/Relevance of PCB, Background and History of PCB, Types of PCB, Classes of PCB Design, Terminology in PCB Design, Different Electronic design automation (EDA) tools and comparison. PCB Design Process, PCB Design Flow, Placement and routing, Steps involved in layout design, Artwork generation Methods - manual and CAD, General design factor for digital and analog circuits, Layout and Artwork making for Single-side, double-side and Multilayer Boards. Design for manufacturability Design-specification standards.

2. Introduction to PCB Fabrication & Assembly, Steps involved in fabrication of PCB. PCB Fabrication techniques-single, double sided and multilayer, Etching: chemical principles and mechanisms, Post operations- stripping, black oxide coating and solder masking, PCB component assembly processes.

3. Using any Electronic design automation (EDA) software, Practice following PCB Design steps (Open source EDA Tool KiCad Preferable) Example circuit: Basic RC Circuit ,Schematic Design: Familiarization of the Schematic Editor, Schematic creation, Annotation, NETLIST generation, Layout Design: Familiarization of Footprint Editor, Mapping of components, Creation of PCB layout Schematic, Create new schematic components, Create new component footprints.