Course Code	Course Title	Hours/Week			Credits	Maximum Marks			ESE
		L	T	P		Continuous Evaluation	End Sem. Exam	Total	Duration (Hrs.)
PCCET401T	Electromagnetic Fields	3	1	0	4	40	60	100	3

Course Objective

Course is envisioned to provide thorough knowledge of coordinate systems, electric & magnetic fields and Maxwell`s equations to enhance analytical skills for solving the problems associated with wave propagation.

Course Outcomes

After successful completion of this course, students will be able to:

CO1	**Apply:** Understand and apply coordinate system concepts in electric and magnetic fields.
CO2	**Analyze:** Identify and analyze the complex engineering problems using electromagnetic laws and mathematical concepts.
CO3	**Analyze:** Examine the Maxwell's equations and boundary conditions for static and time-varying fields.
CO4	**Evaluate:** Estimate various parameters of uniform plane wave in different medias.

SYLLABUS

Unit I: Coordinate Systems

Vector algebra, Coordinate systems and conversion, Differential length, Differential surface and Differential volume.

Graphical representation of vectors in different coordinate system using modern simulation tool.

Unit II: Electrostatics

Coulomb's Law, Electric field intensity: Single point charge, Multiple point charge; Charge density: Line, Surface & Volume charge distribution; Electric flux density, Gauss's Law, Divergence Theorem, Electric Potential, Potential Gradient, Energy Density, Application of Coulomb's Law and Gauss's Law.

Visualization of Electric Fields in practical devices using modern simulation tools.

Unit III: Magnetostatics

Biot Savart's Law, Ampere's Circuital Law, Curl, Stokes Theorem, Magnetic flux density, Scalar and vector magnetic potential, Application of Magnetostatics.

Visualization of Magnetic Fields in practical devices using modern simulation tools.

Unit IV: Maxwell's Equations & Boundary Conditions
Current density, Continuity equations, Maxwell's equations and Boundary conditions.
Unit V: Uniform Plane Wave
Electromagnetic wave equation and its solution, Wave propagation: Free space, Perfect dielectric and Perfect conductor; Skin effect, Poynting Vector Theorem, Standing Wave Ratio, Plane wave reflection at oblique incidence angle, Snell's Law, Brewster's angle.
Unit VI: Guided Waves
Transmission Line Equation, Characteristics impedance, Lossy and Lossless transmission line, Stub matching, Smith Chart. Rectangular Waveguide: Field Components, TE, TM, TEM waves in rectangular guide, Wave impedance.

Text Book Recommended
1. "Engineering Electromagnetics", W. H. Hayt & J. A. Buck, 1st Edition, 2007, TATA McGraw-Hill.

Reference Books Recommended
1. "Elements of Engineering Electromagnetics", Matthew N.O. Sadiku, 4th Edition, 2007, Oxford University Press.
2. "Electromagnetic Waves and Radiating Systems", E.C. Jordan & K.G. Balmain. 1st Edition, 2006, Pearson Education.
3. "Electromagnetism Theory and Application", Ashutosh Pramanik, 3rd Edition, 2008, Prentice Hall.

Course Code	Course Title	Hours/Week			Credits	Maximum Marks			ESE
		L	T	P		Continuous Evaluation	End Sem. Exam	Total	Duration (Hrs.)
PCCET402T	Signal Processing	3	1	0	4	40	60	100	3

Course Objective
Course is intended to provide in-depth knowledge of signal processing for enhancing skills to design digital filters addressing real life problems and improve employability.

Course Outcomes	
After successful completion of this course, students will be able to:	
CO1	**Apply:** Comprehend and apply the basic concepts of signal processing in the field of engineering.
CO2	**Analyze:** Apply transform techniques to analyze various signals and systems in frequency domain.
CO3	**Create:** Design and develop digital filters for digital signal processing.
CO4	**Create:** Identify the needs and devise systems for real life applications.

SYLLABUS
Unit I: Analysis of Continuous Time Signals and Systems Introduction to signals, Fourier Series, Fourier Transform, Properties of Fourier Transform, Classification of systems, Analysis of Linear Time Invariant (LTI) systems. *Fourier analysis of Periodic / Aperiodic signal using Modern simulation tool.*
Unit II: Discrete Time Signals and Systems Introduction, Elements of Digital Signal Processing (DSP), Advantages, Sampling theorem, Discrete time signals, Basic operations of DSP, Linear convolution, Auto correlation, Cross correlation, Power Spectral Density. *Validation of Sampling theorem on Virtual lab.* *Implementation of Convolution on Modern simulation tool.*
Unit III: Discrete Fourier Transform Discrete Time Fourier Transform, Discrete Fourier Transform, Inverse Discrete Fourier Transform, Properties of Discrete Fourier Transform, Circular convolution, Radix- 2 Fast Fourier Transform, Computational cost analysis of Radix-2 and Radix-3.

Unit IV: Analysis of Discrete LTI Systems
Introduction, Importance of Z Transform, Region of Convergence, Signal analysis, Inverse Z Transform, Properties of Z Transform, Analysis of LTI systems, Unilateral Z Transform, Solution to difference equation for causal systems.
Analysis of signals and LTI systems using Modern simulation tools.

Unit V: Filter Design & Realization
Design of IIR filter, IIR filter structure: Direct form-I, Direct form-II, Parallel form and Cascade form, FIR filter, FIR filter design using windowing techniques: Rectangular, Bartlett, Hanning, Hamming and Blackman; Frequency sampling method.
Design of digital filter for a given application and its simulation on modern tool.

Unit VI: DSP Applications
Bio-Medical Applications: Hearing Aid, Signal processing: Arterial Blood Pressure signal, ECG signal and EEG signal.
Audio Processing: High fidelity audio signal, Sound quality and data rate, Speech synthesis and recognition.
Introduction to DSP processor TMS320 family.
Exploring the area of signal processing for employability in the domain of Bio-Medical Engineering, Digital Communication, Entertainment Industry, RADAR etc.

Text Books Recommended

1. "Digital Signal Processing: Principles, Algorithms and Applications", J.G. Proakis and D.G. Manolakis , 4th Edition, 2007, PHI.
2. "Modern Digital & Analog Communication Systems", B. P. Lathi, 4th Edition, 2010, Oxford University Press.
3. "Digital Signal Processing", S. Salivahanan, A Vallavaraj, C. Gnanapriya , 3rd Edition , 2015, McGraw Hill.

Reference Books Recommended

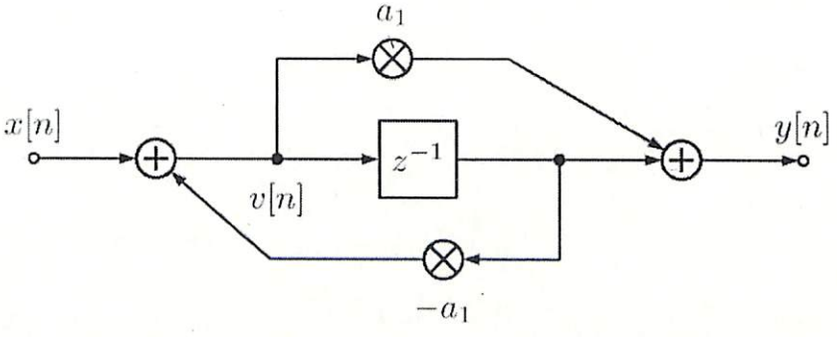
1. "Discrete Time Signal Processing", Oppenheim & Schafer, 1st Edition, 2007, PHI.
2. "Digital Signal Processing", S. K. Mitra, 3rd Edition, 2008, McGraw Hill.
3. "Signals and Systems", Simon Haykin, 2nd Edition, 2008, Wiley.

Course Code	Course Title	Hours/Week			Credits	Maximum Marks			ESE
		L	T	P		Continuous Evaluation	End Sem. Exam	Total	Duration (Hrs.)
PCCET402P	Signal Processing Lab	0	0	2	1	25	25	50	-

Course Objective
Course is intended to develop the skillset for signal analysis, system design and evaluation using modern tools to improve employability.

Course Outcomes	
After successful completion of this course, students will be able to:	
CO1	**Apply:** Interpret and apply the techniques of signal processing for the analysis of systems.
CO2	**Analyze:** Analyze signals and systems in frequency domain.
CO3	**Create:** Design, develop and implement digital systems as per the need of application.

Sr. No.	List of Experiments
Pre-Lab	Introduction to Laboratory.
1	To generate and plot standard test signals and recognize the utility of these signals for the analysis of systems.
2	Demonstrate sampling theorem for different sampling rate and retrieve the original signal. Also observe the effect of under-sampling using virtual lab.
3	Examine the behavior of system using linear convolution for a given sequence of input and impulse response. Also implement the linear convolution using C Language.
4	Analyze the degree of similarity/dissimilarity of a signal with same/another signal using correlation techniques and signify its importance in the field of signal processing.
5	Implement and analyze time domain signal using DFT and plot its magnitude and phase spectrum. Also identify the advantages of DFT over DTFT/CWFT.

6	Apply Z-transform to various sequences for the analysis of signals and plot pole-zero diagram. Also signify the importance of Z-transform compared to other transform techniques.
7	Design digital Butterworth low pass filter operating at sampling rate of 100KHz with a 0.3dB cut off frequency at 15KHz and a minimum stop band attenuation of 45dB at 25KHz using Bilinear transformation method. Determine the order of filter and transform analog into digital filter using M-file Bilinear. Plot the gain and Phase response.
8	Design FIR filter using windowing technique for a specification given below $H_d(e^{j\omega})$= e-j3ω , $-3\pi/4 \leq \omega \leq 3\pi/4$ $= 0, 3\pi/4 < \omega \leq \pi$ Determine the frequency response H ($e^{j\omega}$) of the designed filter. Use Hamming Window.
9	Evaluate the performance of Decimator/Interpolator for a discrete time signal in frequency domain.
10	Design a Multirate signal processing filter for the specified parameters.
11	Implement linear convolution on TMS320 family processor using code composer studio.
12	Implement FFT on TMS320 family processor using code composer studio.
13	Implement the first order all pass filter for the block diagram given below and also plot magnitude and phase response. 
14	Design Frequency-Domain FIR filter block to filter a sinusoid with the Overlap-Add and Overlap-Save FFT methods.
Post-Lab	1. Mini Project: Dual Tone Multiple Frequency (DTMF) signal generation. 2. Mini Project: Speech recognition in MATLAB using correlation. 3. Mini Project: Analysis of Electrocardiograph (ECG) signal for the detection of abnormalities using MATLAB. 4. Open ended experiment.

Minimum eight experiments (excluding Pre-Lab and Post-Lab Sessions) to be performed based on the above list with minimum one experiment on virtual lab.

Suggested References
1. "Digital Signal Processing: Principles, Algorithms and Applications", J.G. Proakis and D.G. Manolakis , 4th Edition, 2007, PHI.
2. "Digital Signal Processing", S. Salivahanan, A Vallavaraj, C. Gnanapriya , 3rd Edition , 2015, McGraw Hill.
3. "Discrete Time Signal Processing", Oppenheim & Schafer, 1st Edition, 2007, PHI.
4. "Digital Signal Processing", S. K. Mitra, 3rd Edition, 2008, McGraw Hill.

Course Code	Course Title	Hours/Week			Credits	Maximum Marks			ESE
		L	T	P		Continuous Evaluation	End Sem Exam	Total	Duration (Hrs)
PCCET403T	Python Programming	3	0	0	3	40	60	100	3

Course Objective

The course familiarizes the prospective engineers with fundamentals of Python Programming language, numpy library, panda library and Django web framework in order to enhance their skills, employability and explore entrepreneurship ideas.

Course Outcomes

After successful completion of this course, students will be able to:

CO1	**Apply:** Apply knowledge of Python Scripting, control structure, string and functions to solve given problems effectively.
CO2	**Apply:** Utilize concepts of numpy, data structures, files and data frames to develop efficient solution for given problems.
CO3	**Analyze:** Analyse problems using knowledge of object-oriented programming and exception handling to develop useful applications.
CO4	**Evaluate:** Select appropriate libraries and modules available in python programming to solve given problems efficiently.
CO5	**Create:** Design and develop solutions using Python libraries and Web framework for the given problem statement.

SYLLABUS

Unit I: Fundamentals of Python Programming

Scripting: Introduction to Python, Installation, Python IDLE, Scripting using Google Colab.

Basics: Data Types, Keywords, Variables, Operators, Expressions, Scope of variables and input() function.

Control Structure: If statement, If-else statement, If-elif-else, For loop, Iterating over a range, While loop, Else clause in loop, Nesting of loops.

Unit II: Strings and Functions

Strings: Creating string, Character extraction from string, Iterating over strings, String slicing, Modify string, Concatenate string and String operations.

Function: Defining a function, Calling a function, Pass by reference, Pass by value, Types of function Arguments, Anonymous function and Recursion.
Exposure to Spyder IDE.

Unit III: Data Structures
List: Creation, Iterating list, List slicing, Appending a list and List operations.
Tuple: Understanding tuple, Iterating over tuple, Slicing, Indexing and Tuple methods.
Set: Understanding set, Iterating over set and Set operations.
Dictionary: Understating Dictionary, Iterating over dictionary, Indexing, Dictionary operations, Comparison among List, Tuple, Set and Dictionary.
Introduction to Numpy: Need of numpy, Features, Creating arrays, Array indexing, Numpy array operations.

Unit IV: File Handling and Dataframes
File Handling: Introduction to files, file object attributes, File operations: open(), close(), read(), write(), rename(), remove(), Positioning, Copying, Merging and Appending.
Dataframes: Introduction to Pandas, Data import, Data export, Data processing using Pandas.
Exposure to Jupyter Notebook.

Unit V: Object Oriented Programming and Exceptions Handling
Object Oriented Programming: Classes, Objects, Attributes, Accessing attribute, Instantiation, Methods, Calling methods, Inheritance and Overloading.
Exception Handling: Debugging, Syntax error, Exceptions, try clause, except clause, raise clauses, Handling and raising an exception.

Unit VI: Web Framework
Introduction to Django: Need of framework, Features of Django framework.
Project Set-Up: Django installation, Create Django project, Virtual environment set-up, Configuration files.
URL Mapping: Handle request and response, Handle static file.
Deployment of web application.

Text Books Recommended

1. "Learning Python", Mark Lutz, 4th Edition, 2000, O'Reilly Media, Inc.
2. "Python Data Science Handbook", Jake Vaderplas, 1st Edition, 2016, O'Reilly Media, Inc.

Reference Books Recommended

1. "Python: The Complete Reference", Martin C Brown, 1st Edition, 2001, McGraw Hill.
2. "Python Essential Reference", David M. Beazley, 4th Edition, 1999, Developer's Library.
3. "Django for APIs: Build Web APIs with Python and Django", William S Vincent, 2018, Kindle Edition.

Course Code	Course Title	Hours/Week			Credits	Maximum Marks			ESE
		L	T	P		Continuous Evaluation	End Sem Exam	Total	Duration (Hrs)
PCCET403P	Python Programming Lab	0	0	2	1	25	25	50	-

Course Objective
The course is intended to inculcate programming skills by providing in-depth knowledge of Python programming concepts, its constructs, libraries etc. and to develop an aptitude for problem solving, so as boost the employability.

Course Outcomes	
After successful completion of this course, students will be able to:	
CO1	**Apply:** Apply concepts of python programming to provide solution for a given problem.
CO2	**Evaluate:** Select appropriate data structures, libraries and modules available in python to solve the given problem efficiently.
CO3	**Create:** Develop applications based on web framework and python programming concepts.

Minimum eight experiments (excluding Pre-Lab and Post-Lab Sessions) to be performed covering the complete syllabus of the theory course [PCCET403T].

Suggested References
1. "Python: The complete Reference", Martin C Brown, 1st Edition, 2001, McGraw Hill.
2. "Learning Python", Mark Lutz, 4th Edition, 2000, O'Reilly Media, Inc.
3. "Django for APIs: Build Web APIs with Python and Django", William S Vincent, 2018, Kindle Edition.

Course Code	Course Title	Hours/Week			Credits	Maximum Marks			ESE
		L	T	P		Continuous Evaluation	End Sem. Exam	Total	Duration (Hrs.)
OECET401T	Actuators and Sensors	3	0	0	3	40	60	100	3

Course Objective

Course is offered to provide skills to select and utilize the actuators & sensors for developing industrial applications using PLC and SCADA that help to inculcate entrepreneurship skills and improve the employability.

Course Outcomes

After successful completion of this course, students will be able to:

CO1	**Understand:** Comprehend the working principle of sensors and actuators for various applications.
CO2	**Apply:** Compare and select appropriate sensor and actuator for the specific application.
CO3	**Apply:** Select and apply Signal Conditioning & Data Acquisition method as per application.
CO4	**Create:** Design and develop systems using PLC and SCADA for industrial applications.

SYLLABUS

Unit I: Sensors and Transducers
Introduction, Different types of variables and measurement systems, Working principle, Classification, Characteristics and Selection criteria.

Unit II: Pressure, Displacement and Position Measurement
Pressure sensors: Strain Gauge, Diaphragm, Bellows, Bourdon tube and Piezoelectric.
Displacement sensors: Linear and Rotary displacement sensor, Potentiometer, Capacitive and Inductive displacement sensor.
Position sensors: Optical encoder, Photoelectric sensor, Hall Effect sensor.
Virtual demonstration of sensor using modern simulation tools.

Unit III: Proximity, Flow and Temperature Measurement
Proximity sensors: Inductive, Capacitive and Photoelectric.
Flow sensors: Ultrasonic, Electromagnetic flow meter, Pitot tube and Orifice plate.

Temperature sensors: Thermocouples, Thermistors and Resistance Temperature Detector (RTD).
Unit IV: Signal Conditioning & Data Acquisition (DAQ) System Introduction, Process adopted in signal conditioning, Functions of signal conditioning, AC/DC conditioning systems, Instrumentation amplifier, Operational amplifier, Multiplexers, Analog to Digital & Digital to Analog converter, Generalized data acquisition system: single channel and multi-channel DAQ.
Unit V: Actuators Basic principle of Electrical Switching, Switching devices: Mechanical switches and Relays, Solid-state switches, Solenoid device; Electrical Drive System: DC motor, AC motor, Induction motor synchronous motor, Stepper motor, Servo motor; Introduction to Pneumatics and Hydraulic systems. *Implementation of sensors and actuators based application using Simulation software.*
Unit VI: Programmable Logic Controller (PLC) & Supervisory Control and Data Acquisition (SCADA) **PLC:** Introduction, System structure, Relay logic fundamentals, Timers, Counters & Comparators, Digital and Analog Input/Output, Ladder diagram and programming. **SCADA:** Introduction, Functions, Components, Architecture, Communication technologies. Monitoring and supervisory functions, Human Machine Interface (HMI), SCADA applications. *Demonstration of PLC and SCADA using modern simulation tools.* *Exploring the job perspective of sensors and actuators in smart phone industries, IoT development and automation industries, Bio-Medical Engineering etc.*

Text Books Recommended
1. "Sensors and Actuators: Engineering System Instrumentation" Clarence W. de Silva, 2nd Edition, 2015, CRC Press.
2. "A Course in Electrical & Electronic Measurements & Instrumentation", A. K. Sawhney, 2010, Dhanpat Rai and Co.
3. "PLC and SCADA Theory and Practice", Rajesh Mehara, 1st Edition, 2011, Lakshmi Publication.

Reference Books Recommended
1. "Electronic Instrumentation and Measurement Techniques", Cooper W.D and Helfrick A.D, 4th Edition, 2004, Pearson Education.
2. "Sensors and Signal Conditioning", Ramon Pallas-Areny, John G. Webster, 2nd Edition, 2012, John Wiley and Sons Inc.