Course Code	Course Title	Hours/Week			Credits	Maximum Marks			ESE
		L	T	P		Continuous Evaluation	End Sem Exam	Total	Duration (Hrs)
PCCET501P	Java Programming Lab	0	0	4	2	25	25	50	-

Course Objective

The course is intended to inculcate programming skills by providing in-depth knowledge of Java programming concepts, constructs, libraries etc. and to develop an aptitude for problem solving, so as to boost employability and explore entrepreneurship ideas.

Course Outcomes

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

CO1	**Apply**: Make use of Object Oriented Programming concepts, Java Interfaces, Packages, Streams and Collection frameworks to develop Java applications.
CO2	**Analyze:** Analyze the Java applications using concepts of networking and multithreading for fulfilling given requirements.
CO3	**Create:** Develop Java applications using the concepts of Spring boot and Java Database programming.

SYLLABUS

MODULE-I: Object Oriented Programming and Java

Object-oriented concepts, Need of Java programming, Basics of Java: History, Features, Paradigms, Programming constructs, Static modifier, Final modifier, Object Oriented Programming concepts in Java: Classes and objects, Constructors, Overloading methods, Inheritance, Polymorphism, Wrapper classes, Applications: Object as a parameter, Argument passing, Command line arguments, Returning object, Nested classes: Inner classes, Garbage collection, Arrays, Strings.

Exposure to modern Integrated Development Environment (IDE's) used in industry.

MODULE II: Java Interfaces and Packages

Interfaces: Defining an Interface, Implementing an Interface, Using Interface Type, Evolving Interfaces, Default Methods, Packages: Importing a class, Creating a package, Naming a package, Using package members, Managing source and class files, Developing and deploying Jar files.

MODULE III: Java Streams and Collections

Java Streams: Byte oriented streams, Character oriented streams, Reading and writing files, Serialization, Collection framework : Introduction, util package interfaces, List, Set, Map, List interface & classes, Set interface & classes, Map interface & classes.

MODULE IV: Networking and Multithreading

Networking: Overview of networking, Networking basics, Working with URLs, Creating an URL, Parsing a URL, Reading Directly from URL, Connecting to a URL, Reading from and writing to an URL connection, Sockets, Reading from and writing to a socket, Writing a Datagram Client and Server.
Multithreading: Fundamentals and methods.
Use of multithreading in game development and other applications in industry.

MODULE V: Java 8 & Spring Boot

Java 8: Lambda expressions, Method references, Functional interfaces, Stream API, for Each, Date/Time API, Java 8 security enhancements, Spring boot: Definition, Need, Features of spring boot, Web application development using spring boot.

MODULE VI: Database Programming

Design of JDBC (Java Data Base Connection), Introduction to JDBC, Databases and Drivers, Types of Driver, Loading a driver class file, Establishing the connection to database with different drivers, Structured Query Language.

Suggested References

1. "Programming with Java", E Balagurusamy, 6th Edition, 2019, McGraw Hill Education.
2. "Java -The Complete reference", Herbert Schildt, 11th Edition, 2018, McGraw Hill Education.
3. "Thinking in Java", Bruce Eckel, 4th Edition, 2008, Prentice Hall.
4. "Java™ How To Program", Deitel Paul, Deitel Harvey, 10th Edition, 2014, PHI Learning.

NOTE: Minimum Eight Practicals to be performed covering the above complete syllabus of the course [PCCET501P].

Course Code	Course Title	Hours/Week			Credits	Maximum Marks			ESE
		L	T	P		Continuous Evaluation	End Sem Exam	Total	Duration (Hrs)
PECET501T	CMOS-VLSI	3	0	0	3	40	60	100	3

Course Objective
The course is intended to understand the complexities and challenges associated with CMOS VLSI Design, inculcate skills in manufacturing and testing techniques and their underlying scientific principles in the context of technologies used in VLSI chip fabrication in view of employability in semiconductor industry.

Course Outcomes	
After successful completion of this course, students will be able to:	
CO1	**Understand:** Understand fundamental principles of Very Large Scale Integration (VLSI) and layout design, for developing CMOS logic.
CO2	**Apply:** Apply CMOS fabrication technologies and testing techniques for the design of subsystems.
CO3	**Analyze:** Analyze physical VLSI design issues and estimate performance parameters.
CO4	**Design:** Design building blocks of large-scale CMOS Integrated circuits.

SYLLABUS
UNIT I: Basic MOS Technology Overview of VLSI design methodology, Design flow MOS Transistor theory, Threshold voltage equation, Body effect, MOS device design equation.
UNIT II: CMOS Inverter DC Transfer characteristic, βn/βp ratio, Noise Margin, Static and Dynamic Behavior, Transmission Gate, Tristate Inverter. *Exposure to modern simulation tool through design and simulation of CMOS inverter.*

UNIT III: MOS Processing Technology Fabrication process flow, N-well, P-well, Twin Tub, Silicon on insulator, Layout design rules, Stick diagram, Layout design, Latch up.
UNIT IV: Circuit Characterization and Performance Estimation Resistance estimation, Capacitance estimation, Switching characteristics, CMOS-Gate transistor sizing, Power dissipation, Sizing, Charge sharing, Scaling at MOS transistor dimensions.
UNIT V: CMOS Circuit and Logic Design Design of logic Gates, Logic Structures: Bicmos, CMOS Domino logic, Pass transistor logic, Pseudo NMOS logics, Design of latches & flipflops. *Layout design and simulation of combinational circuit using modern simulation tool.*
UNIT VI: MOS Testing Introduction, Design strategies, Chip level & system level test techniques, Layout design for improved testability.

Text Books Recommended
1. "Principles of CMOS VLSI Design", Neil H. E. Weste, Kamran Eshraghian, Addison Wesley, 2nd Edition, 1993, Pearson Publication.
2. "Fundamental of Microelectronics", Behzad Razavi, 3rd Edition, 2021, Wiley Publications.

Reference Books Recommended
1. "Design of Analog CMOS Integrated Circuits", Behzad Razavi, 2nd Edition, 2017, McGraw-Hill, Inc.
2. "CMOS Circuit Design, Layout and Simulation", R. J. Baker, 4th Edition, 2019, Wiley Publications.
3. "Microwind & Dsch User's Manual Version 2.7", Etienne Sicard, 2003, National Institute of Applied Sciences, Toulouse, France.

Course Code	Course Title	Hours/Week			Credits	Maximum Marks			ESE
		L	T	P		Continuous Evaluation	End Sem. Exam	Total	Duration (Hrs.)
PECET502T	Fuzzy Logic and Neural Network	3	0	0	3	40	60	100	3

Course Objective
The course is envisioned to provide in-depth knowledge of Fuzzy Logic and Neural Networks to inculcate skills for soft computing so as to solve real-world problems and enhance employability.

Course Outcomes	
After successful completion of this course, students will be able to:	
CO1	**Apply:** Understand and apply the fundamentals of fuzzy logic and feed forward neural network in the field of engineering.
CO2	**Analyze:** Apply and analyze Neural Network & Fuzzy Logic models to solve real world problems.
CO3	**Apply:** Interpret and apply fuzzy logic control to real time systems.
CO4	**Create:** Design and develop neural network paradigms and their applications.

SYLLABUS

Unit I: Fuzzy Logic

Introduction, Uncertainty, Imprecision, Partial truth and fuzziness, Crisp set; Fuzzy sets: Basic concepts, Operations, Properties; Fuzzy relations: Basic concepts, Operations, Properties; Value assignment approaches.

Unit II : Membership Functions

Features, Fuzzification: Membership value assignments, Fuzzy rule based systems, Graphical technique of inference; Defuzzification: Lambda-cuts, Max membership principle, Centroid method, Weighted average method, Mean max membership and Fuzzy relations.

Unit III: Application of Fuzzy Logic

Fuzzy classification, Pattern recognition: Single sample identification, Multi feature recognition; Fuzzy logic control system design.

Simulation of handwriting analysis in Jupiter Notebook using Python.

Unit IV: Neural Network Introduction, Biological neurons, Artificial models, Neural computing, Components of artificial neuron, Weights, Thresholds, Transfer function.
Unit V: Supervised and Unsupervised Learning Supervised: Single layer network, Perceptron, Training algorithms and limitations; Multilayer network: Architecture of feed forward network, Learning rules, Generalized delta rule, Back propagation algorithm; Unsupervised: Counter propagation networks, Kohonen's self-organizing maps, Hopfield networks. *Simulation of stock market prediction based on Support Vector Machine Algorithm using Python.*
Unit VI: Applications of Neural Network Pattern recognition, Characters recognition, Robot kinematics, Anti-lock Breaking System (ABS). *Implementation of Anti-lock Breaking System (ABS) using modern simulation tool.*

Text Book Recommended
1. "Fuzzy Logic with Engineering Applications", T. Ross, 3rd Edition, 2010, Wiley.
2. "Introduction to Artificial Neural Systems", J. M. Zurada, 1st Edition, 1994, Jaico Publishing House.

Reference Books Recommended
1. "Neuro-Fuzzy and Soft Computing", J.S.R. Jang, T. Sun, E. Mizutani, 1st Edition, 2004, Pearson Education.
2. "Neural Networks, Fuzzy Logic, and Genetic Algorithms Synthesis and Applications", S. Rajasekaran, G. A. Vijayalakshmi Pai, 2003, PHI.
3. "Neural Networks in Computer Intelligence", Limin Fu, 1st Edition, 2003, Tata McGraw Hill.

Course Code	Course Title	Hours / Week			Credits	Maximum Marks			ESE
		L	T	P		Continual Evaluation	End Sem. Exam	Total	Duration (Hrs.)
PECET503T	Digital Image Processing	3	-	-	3	40	60	100	3

Course Objective
The course is intended to provide different skills of image enhancement, compression, segmentation and restoration for multi-dimensional real time application in order to boost employability and entrepreneurship.

Course Outcomes	
After successful completion of this course, students will be able to:	
CO1	**Understand**: Interpret and apply the fundamental concepts of image processing.
CO2	**Apply:** Apply image transformation techniques for image analysis in frequency domain.
CO3	**Apply**: Apply enhancement, compression and segmentation techniques for various morphological operations.
CO4	**Apply**: Apply image restoration techniques to retrieve clear and original image.

SYLLABUS
Unit I: Digital Image Fundamentals Components of Image Processing System, Image sensing and acquisition, Image sampling & quantization, Spatial and gray level resolution, Relationships between pixels, Statistical parameters: Mean, Standard deviation, Variance, SNR, PSNR.
Unit II: Image Transformation Transform: 2D-DFT, FFT, DCT, KL Transform, Walsh and Hadamard Transform, Haar Transform, Slant Transform, Basics of wavelet transform.
Unit III: Image Enhancement Spatial Domain: Introduction, Gray level transformation, Histogram processing, Equalization, Arithmetic and logical operations between images, Basics of spatial filtering; Smoothening and sharpening in frequency domain.

Unit IV: Image Compression
Basic compression methods, Error free compression, Variable length, Bit plane, LZW arithmetic, Lossless predictive, Lossy compression, Lossy predictive, JPEG, MPEG.
Image compression based on 2D-DFT using Modern Simulation tool.

Unit V: Image Segmentation
Point and Line segmentation, Hough Transform, Edge detection, Boundary detection, Thresholding, Region based segmentation.
Image enhancement and segmentation using Modern Simulation tool.

Unit VI: Image Restoration and Reconstruction
Image degradation model, Noise Models, Restoration in spatial domain. Inverse filtering, Wiener filtering, Image reconstruction from projections, Applications of Image Processing.

Text Books Recommended

1. "Digital Image Processing", Gonzalez R. C. and Woods R.E., 4th Edition, 2018, Prentice-Hall.
2. "Digital Image Processing", William K. Pratt, 4th Edition, 2007, A John Wiley & Sons, Inc., Publication.

Reference Books Recommended

1. "Fundamentals of Digital Image Processing", Jain A.K., 1988, PHI Learning Private Ltd..
2. "Image Processing, Analysis and Machine Vision", Sonka M, Vaclav Hlavac, and Roger Boyle 4th Edition, 2013, CL Engineering.
3. "Digital Image Processing & Computer Vision", Schalkoff R.J., 1989, John Wiley & Sons.

Course Code	Course Title	Hours/Week			Credits	Maximum Marks			ESE
		L	T	P		Continuous Evaluation	End Sem Exam	Total	Duration (Hrs)
PCCET502T	Microprocessor and Microcontroller	3	1	0	4	40	60	100	3

Course Objective
The course is intended to inculcate skills for the development of microprocessor and microcontroller based systems to foster employability and entrepreneurship.

Course Outcomes	
After successful completion of this course, students will be able to:	
CO1	**Understand**: Understand the fundamentals of microprocessor and microcontroller.
CO2	**Apply:** Demonstrate proficiency in assembly language programming for the implementation of application.
CO3	**Apply:** Comprehend and interface peripherals with microprocessors/microcontrollers for system design.
CO4	**Analyze:** Analyze problem and formulate appropriate solution for real world application.

SYLLABUS
UNIT I: 16-Bit 8086/88 Microprocessor Evolution of microprocessors, Architecture, Description of data registers, Address registers, Pointer and index registers, Program Status Word (PSW), Queue, Bus Interface Unit (BIU) and Execution Unit (EU), Pin diagram, Minimum mode, Maximum mode, Memory organization and interfacing.
UNIT II: 8086 Instruction Set and Math Co-processor Addressing modes, Instruction format, Instruction set and assembly language programming, Interrupts, Math Coprocessor (8087): Introduction, Interfacing. *Exposure to 8086 emulator for understanding Timing and Control Unit.*

UNIT III: Programmable Peripheral Devices -I
Memory mapped I/O, I/O mapped I/O, Programmable Peripheral Interface (IC8255 PPI), Interfacing of multiplexed seven segment display and keyboard using IC8255 PPI, Programmable counter/interval timer (IC8254).

UNIT IV: Programmable Peripheral Devices -II
Programmable interrupt controller (IC8259), Universal Synchronous Asynchronous Transmitter Receiver (IC8251), Programmable keyboard and Display controller (IC8279).

UNIT V: 8051 Microcontroller
Introduction, Architecture, I/O Ports, Memory organization, Addressing modes and instruction set, Assembly language programming, Interrupts.
Exposure to microcontroller IDE.

UNIT VI: 8051 Interfacing
Timer/Counter and Serial communication, Interfacing: A/D and D/A Converters, Seven Segment Display, Stepper Motor.
Applications: Measurement and control of electrical and physical quantities, case studies.
Simulation of microcontroller based system using modern tool.

Text Books Recommended

1. "Advanced Microprocessors and Peripherals", A. K. Ray and K. M. Bhurchandi, 3rd Edition, 2017, TMH.
2. "The 8051 Microcontroller and Embedded Systems", M.A. Mazidi and J.G. Mazidi, 2nd Edition, 2014, Prentice-Hall of India Pvt. Ltd.

Reference Books Recommended

1. "Microprocessors and Interfacing", D. V. Hall, 2nd Edition, 2006, Tata McGraw Hill Education.
2. "The 8051 Microcontroller", Kenneth. J. Ayala, 3rd Edition, 2010, Cengage learning.
3. "Microcontrollers and Application", Ajay V. Deshmukh, 2005, Tata McGraw Hill Education.

Course Code	Course Title	Hours/Week			Credits	Maximum Marks			ESE
		L	T	P		Continuous Evaluation	End Sem. Exam	Total	Duration (Hrs.)
PCCET502P	Microprocessor and Microcontroller Lab	0	0	2	1	25	25	50	-

Course Objective
The course is intended to develop the programming & interfacing skills of microprocessor and microcontroller for system design using modern tools to improve employability.

Course Outcomes	
After successful completion of this course, students will be able to:	
CO1	**Apply:** Develop assembly language program for microprocessor and microcontroller based applications.
CO2	**Apply:** Interface the microprocessor/microcontroller with various peripherals to develop real world applications.
CO3	**Create:** Design & implement microcontroller 8051 based systems

Sr. No.	List of Experiments
	Pre Lab Introduction to Laboratory. • Introduction to the Hardware kits of Microprocessor and Microcontrollers. • Introduction to various peripherals like ADC, DAC, Stepper Motor, Seven Segment Display. • Exposure to the software for the compilation of Microprocessor and Microcontrollers applications.
1	Write and execute 8086 program to copy 10 bytes from address 2000H: 0100H to effective address 2000H: 0200H. Verify the output using 8086 Trainer Kit and Simulation Software. Write the same program using string instructions.

2	Write and execute 8086 program A) To find smallest byte from a block of 10 bytes present in DMS. B) To find largest byte from a block of 10 bytes present in DMS. And verify using 8086 Trainer kit and Simulation.
3	Write and execute 8086 program to separate positive and negative byte from a block of 10 bytes stored in DMS. Verify the output using 8086 Trainer Kit and Simulation Software. Write the same program without using rotate and shift instruction.
4	Write and execute 8086 program A) To arrange 10 bytes stored from effective address 2000H in ascending order. B) To arrange 10 bytes stored from effective address 2000H in descending order. Verify the output using 8086 Trainer Kit and Simulation Software.
5	Write and execute 8086 program to check whether the two string matches using string instruction. If it does set AL=FF otherwise reset AL=00H. Verify the output using Simulation software.
6	Interface LEDs with 8086 through 8255 and write 8086 program to blink alternate LEDs.
7	Interface Stepper Motor with 8086 through 8255 and write 8086 program to rotate stepper motor in clock wise direction.
8	Interface Multiplexed Seven Segment Display with 8086 through 8255 and write 8086 program to display the count value from 0000 to 9999 on Seven Segment Display.
9	Interface DAC with 8086 through 8255 and write 8086 program to generate square wave using DAC.
10	Write and execute 8051program to add first 10 natural numbers and similarly write generalize program to add 'n' numbers and store result in internal memory
11	Write and execute 8051 program A) To copy 5 bytes of data from internal RAM address 30 H to internal RAM address 40H. B) To copy 10 bytes from external RAM address 2000 H to external RAM address 3000 H.
12	Write an 8051 program to generate a square wave of 50% duty cycle using timer 0 and also generate the delay using timer1 and then by using instruction set to know the precision you are getting with timers.
13	Write and execute 8051 program to transmit the string "Hello, How are you?" serially at 9600 baud rate and do it same for different baud rate and evaluate the difference. Also try to double the baud rate using PCON register.
14	a. Interfacing Multiplexed seven segment display with 8051 using modern simulation software and writing program to display Numbers on seven segment display. b. Microcontroller (8051) interfacing with display device using virtual lab.

15	Interfacing stepper motor with 8051 uC using modern simulation software and write a program to rotate it clock wise by 45 degrees continuously.
16	Develop an assembly program to display messages "FIRE" and "HELP" alternately with flickering effects on a 7-segment display interface for a suitable period of time. Ensure a flashing rate that makes it easy to read both the messages.
17	Develop an assembly program to drive a Stepper Motor interface and rotate the motor in specified direction (clockwise or counter-clockwise) by N steps (Direction and N are specified by the examiner). Introduce suitable delay between successive steps. (Any arbitrary value for the delay may be assumed by the student).
18	Develop an assembly language program to a. Generate the Sine Wave using DAC interface (The output of the DAC is to be displayed on the CRO). b. Generate a Half Rectified Sine waveform using the DAC interface. (The output of the DAC is to be displayed on the CRO) c. Microcontroller (8051) interfacing with ADC and DAC using virtual lab.
Post Lab	
19	Mini project:Traffic Light System Controller using Microcontroller
20	Mini project:Password-Based Digital Locking System using Microcontroller.
21	Mini project:Ultrasonic Range Finder.
22	Open ended experiment.

NOTE: Minimum Eight experiments to be performed based on above list with minimum one experiment on Virtual Lab wherever possible.

Suggested References
1. "Advanced Microprocessors and Peripherals", A. K. Ray and K.M. Bhurchandi, 3rd Edition, 2017, TMH.
2. "The 8051 Microcontroller and Embedded Systems", M.A. Mazidi and J.G. Mazidi, 2nd Edition, 2014, Prentice Hall of India Pvt. Ltd.
3. "Microprocessors and Interfacing", D. V. Hall, 2nd Edition, 2006, Tata McGraw Hill Education.
4. "The 8051 Microcontroller", Kenneth. J. Ayala, 3rd Edition, 2010, Cengage Learning.

Course Code	Course Title	Hours/Week			Credits	Maximum Marks			ESE
		L	T	P		Continuous Evaluation	End Sem. Exam	Total	Duration (Hrs.)
PCCET503T	Analog Communication	3	1	0	4	40	60	100	3

Course Objective
The course is offered to provide fundamental concepts and techniques of analog communication for improving technical skills & solving real life problems to enhance employability & entrepreneurship in the digital era.

Course Outcomes	
After successful completion of this course, students will be able to:	
CO1	**Analyze:** Understand various amplitude modulation and demodulation techniques & compute the parameters by analyzing time & frequency domain spectrum.
CO2	**Analyze:** Interpret & analyze Angle modulation and demodulation techniques in presence of noise.
CO3	**Analyze:** Analyze analog to digital conversion process & illustrate various pulse modulation techniques.
CO4	**Evaluate:** Comprehend & Evaluate the effect of noise in the communication system.
CO5	**Evaluate:** Acquire in-depth knowledge of various analog receivers to estimate the performance parameters.
CO6	**Evaluate:** Evaluate the performance of analog communication for modern telecommunication systems.

SYLLABUS
UNIT I: Amplitude Modulation Baseband & carrier communication, Amplitude Modulation(AM), Generation of AM and its spectrum, Double Sideband Full Carrier, Double Sideband Suppressed Carrier, Single Sideband Suppressed Carrier, Independent Sideband & Vestigial Sideband.

UNIT II: Angle Modulation Concept of Angle Modulation, Types of angle modulation, Frequency Modulation(FM) & Phase Modulation(PM), Types of FM, Multitone FM, Generation of FM.
UNIT III: Pulse Modulation Sampling and types of sampling techniques, Analog pulse modulation: Pulse Amplitude Modulation(PAM), Pulse Width Modulation(PWM), Pulse Position Modulation(PPM), Pulse Code Modulation(PCM), Delta Modulation, Adaptive Delta Modulation.
UNIT IV: Noise sources and types Introduction to noise, Sources of noise, Types of noise & parameters, Noise analysis, Power Spectral Density(PSD) & its properties, Gaussian Process, Gaussian and white noise characteristics, Noise in AM systems, Noise in FM systems.
UNIT V: AM and FM Receivers Introduction to Receivers, Super heterodyne receiver, Performance characteristics, AM detection techniques, FM detection techniques.
UNIT VI: Acoustics Introduction to acoustic transducers, Microphone and loudspeakers, Construction, Types, Characteristics and applications, High quality audio: Stereophonic, Dolby, Surround, 3D.

Text Books Recommended
1. "Electronic Communication Systems", Gorge Kennedy, 6th Edition, 2017, Tata McGraw-Hill.
2. "Electronics Communication", Denenis Roddy & John Coolen, 4th Edition, 2012, Pearson Publication.

Reference Books Recommended
1. "Fundamentals of Communication Systems", John G. Proakis and Masoud Salehi, 2nd Edition, Prentice-Hall of India Pvt. Ltd.
2. "Modern Digital & Analog Communication Systems", B. P. Lathi, 4th Edition, 2010, Oxford University Press.
3. "Analog and Digital Communication", T L Singal, 1st Edition, McGraw Hill Education.

Course Code	Course Title	Hours/Week			Credits	Maximum Marks			ESE
		L	T	P		Continuous Evaluation	End Sem. Exam	Total	Duration (Hrs.)
PCCET503P	Analog Communication Lab	0	0	2	1	25	25	50	-

Course Objective
The course is envisioned to develop the skills of analog communication engineering using modern tools to improve employability.

Course Outcomes	
After successful completion of this course, students will be able to:	
CO1	**Analyze:** Analyze the fundamental parameters of pulse analog modulation and demodulation techniques in engineering applications.
CO2	**Evaluate:** Evaluate the performance of various continuous modulation and demodulation techniques used in communication systems.
CO3	**Create:** Design & develop analog communication system using modern simulation tools.

Sr. No.	List of Experiments
	Pre Lab An Introduction to Analog Communication Lab. • Introduction to various trainer kits used in lab. • Introduction to Spectrum Analyzer. • Exposure to the software used for the simulation of analog communication system.
1	Modeling of an amplitude modulated (AM) signal; method of setting and measuring the depth of modulation; waveforms and spectra.
2	Demonstrate incoherent detection / envelope detection/diode peak detection of AM signal (DSB with carrier).
3	Generation and detection of a Double Side Band-Suppressed Carrier (DSB-SC) using a Balanced Modulator & analyze the output.

4	Generation and reconstruction of Single Side Band (SSB) using Phase Shift Method & signify its importance in the field of communication.
5	Demonstrate Frequency Modulation using Voltage Controlled Oscillator and observe the sidebands on spectrum analyzer and confirm selected aspects of the FM spectrum.
6	Demonstrate Frequency Demodulation using Phase Locked Loop and analyze the effect on frequency deviation.
7	Realization & testing the characteristics of Pre-Emphasis and De-Emphasis circuit for Frequency Modulation.
8	Generation and Reconstruction of Pulse Amplitude Modulated Wave (PAM) & study the effect of amplitude variations on the PAM output.
9	Generation and Reconstruction of Pulse Width Modulation (PWM) and observe the effect of variations in amplitude and pulse width of Pulse train on the PWM output
10	Generation and Reconstruction of pulse position modulation (PPM) and observe the effect of amplitude of the modulating signal on output.
11	Analyze a Delta modulation system and interpret the modulated and demodulated waveforms.
12	To study the characteristics of phase lock loop and calculate its capture range, lock range and free running VCO frequency.
13	Demonstrate the performance characteristics-sensitivity, selectivity, and fidelity of AM Super heterodyne Radio Receiver.
14	Analyze effect of change in Signal to Noise Ratio (SNR) on Bit Error Rate (BER) of BPSK in presence of AWGN.
15	Simulation of Analog modulation techniques using MATLAB and observe the effect on modulating signal.
16	Simulation of Analog demodulation techniques using LabView to visualize the effects of the modulation coefficient on the quality of the demodulated signal and the effects of different parameters
17	Simulation of Frequency modulation techniques using MATLAB to visualize the effects of frequency modulation in the time and frequency domains.
18	Simulation of Pulse Code Modulation (PCM) using MATLAB.
19	Simulation of Analog modulation techniques using virtual lab
Post Lab	
20	Mini Project: To design and analyze the characteristics of a mixer circuit.
21	Mini Project: Decoding DTMF using IC UM91214B
22	Open Ended Experiment.

NOTE: Minimum Eight experiments to be performed based on above list with minimum one experiment on Virtual Lab wherever possible.

Suggested References
1. "Electronics Communication", Denenis Roddy & John Coolen,4th Edition, Pearson Publication
2. "Fundamentals of Communication Systems", John G. Proakis and Masoud Salehi,2nd Edition, Prentice-Hall of India Pvt. Ltd.

Course Code	Course Title	Hours/Week			Credits	Maximum Marks			ESE
		L	T	P		Continuous Evaluation	End Sem. Exam	Total	Duration (Hrs.)
OECET501T	Wireless Sensor Networks	3	0	0	3	40	60	100	3

Course Objective
The course is envisioned to endow with knowledge of architectures design and protocols of wireless sensor networks for inculcating skills to develop applications for fostering employability and entrepreneurship.

Course Outcomes	
After successful completion of this course, students will be able to:	
CO1	**Understand:** Identify and compare the types of sensor networks and their challenges for emerging applications.
CO2	**Apply:** Interpret and apply the knowledge of various hardware/software components for the design of wireless sensor networks.
CO3	**Evaluate:** Evaluate the performance of different routing protocols and standards used in wireless sensor networks.
CO4	**Analyze:** Comprehend and analyze the issues in establishment and efficient management of Ad-hoc and sensor network.

SYLLABUS
UNIT-I: Overview of Wireless Sensor Networks (WSN) Introduction, Unique constraints, Issues and challenges in sensor networks, Advantage of sensor networks, Types of sensor networks.
UNIT-II: Sensor Node Architecture Single node architecture, Hardware components & design constraints, Mobile Ad-hoc Networks (MANETs) and Wireless sensor networks, Enabling technologies for wireless sensor networks.
UNIT-III: MAC and Routing Protocol Routing protocols, MAC protocols: Classification of MAC protocols, S-MAC protocol, B-MAC

protocol, IEEE 802.15.4 standard and ZigBee. *Implementation of basic routing protocols using simulation tool.*
UNIT-IV: Time synchronization and Localization Localization, Clustering, Dissemination protocol for large sensor network, Data dissemination, Data gathering and data fusion, Quality of a sensor network, Real-time traffic support, Security protocols.
UNIT-V: Transport Control Protocol for WSN Design principles for WSNs, Operating systems and execution environments, Gateway concepts, WSN to internet communication, Internet to WSN Communication, Energy management scheme. *Analysis of WSN architecture using modern simulation tool.*
UNIT-VI: Operating System for Wireless Sensor Networks Operating system design issues, TinyOs, Mate, SenOS, Cooja Contiko, Applications of wireless sensor networks.

Textbooks Recommended
1. "Protocols and Architectures for Wireless Sensor Networks", H. Karl, and A. Willig, 2005, John Wiley and Sons Publications.

Reference Books Recommended
1. "Wireless sensor networks", C. S. Raghavendra, Krishna M. Sivalingam, Taieb F. Znati, 2nd Edition, 2004, Springer.
2. "Wireless Sensor Networks", F. Zhao and L. Guibas, 3rd Edition, 2004, Morgan Kaufmann Publication.
3. "Wireless Sensor Networks": Technology, Protocols and Applications", Kazem Sohrby, Daniel Minoli, Taieb Znati, 2007, John Wiley and Sons Publications.

Course Code	Course Title	Hours/Week			Credits	Maximum Marks			ESE
		L	T	P		Continuous Evaluation	End Sem. Exam	Total	Duration (Hrs.)
PROJET502	Mini Project	0	0	4	2	25	25	50	-

Course Objective
The course is envisioned to enhance testing and troubleshooting skills of electronic systems for the design & fabrication of hardware and software product.

Course Outcomes	
After successful completion of this course, students will be able to:	
CO1	**Apply**: Apply acquired knowledge within the chosen area of technology for project development.
CO2	**Analyze**: Identify, discuss and justify the technical aspects of the chosen project with a comprehensive and systematic approach.
CO3	**Create**: Work as an individual or in a team in development of technical projects.
CO4	**Evaluate**: Communicate and report effectively project related activities and findings.