SKILL ORIENTED COURSES

20ECS01: INTRODUCTION TO MATLAB

Credits – 2 **Sessional Marks: 40**
L: T: P: 0: 1:2 **University Exam Marks: 60**

CourseObjectives:

1. To provide background and fundamentals of MATLAB tool for the analysis and processing of signals and to generate various continuous and discrete time signals.
2. To provide an overview of signal transmission through linear systems, convolution and correlation of signals and sampling.
3. To understand the concept and importance of Fourier and Z-Transforms
4. To perform operations on signals and sequences find the simulation results.

CourseOutcomes:

After successful completion of the course the students should be able to

1. Analyze the generation Various Signals and Sequences in MATLAB, including the operations on Signals and Sequences.
2. Verification of Sampling Theorem, Linearity and Time Invariance Properties of a given Signals/ Systems.
3. Analyze the Fourier Transform of a given signal and plotting its magnitude and phase spectrum and also plot Pole-Zero Maps in Z-Plane.
4. Analyze and design various combinational using VHDL like Adder, Subtractor, Multiplexers, etc.

LIST OF EXPERIMENTS USING MATLAB

1. Introduction to MATLAB, MATLAB help system

2. Arrays, Multidimensional arrays, Operations

3. Functions

4. Arithmetic and Logical operators

5. Conditional statements and loops

6. Plotting, special plotting: 3D plotting

7. Generation of various signals and sequences

8. Simulink Basics

9. Simulink modeling of basic modulation systems

10. Editing and Debugging MATLAB Programs

11. Mini Project

*Minimum of 9 experiments to be completed including mini project

TextBooks:

1. MATLAB and Simulation Books NI Engineering Signals and Systems, 2nd edition
2. Introduction to MATLAB for Engineers William J.Palm III

ReferenceBooks:

1. MATLAB Programming for Engineers Stephen J. Chapman
2. Essentials of MATLAB Programming Stephen J. Chapman
3. Introduction to MATLAB for Engineers William J.Palm III
4. Text Mining MATLAB E. Banchs.

Course Outcomes-Program Outcomes- Program Specific Outcomes (CO-PO-PSO) Mapping

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO10	PO11	PO12	PSO 1	PSO 2	PSO 3
CO 1		L											M		
CO 2	M		H	M										H	M
CO 3			H	L	H								M		H
CO 4		L		M									L	M	
CO 5															

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20ECS02: ELECTRONIC CIRCUIT DESIGN

(By using Software Methodology)

Credits – 2 **Sessional Marks:40**

L: T: P:: 0: 1 :2 **University Exam Marks:60**

COURSE OBJECTIVES:

1. To give a comprehensive exposure to all types of amplifiers and oscillators constructed with discrete components. This helps to develop a strong basis for building linear and digital integrated circuits
2. To study about feedback amplifiers and oscillators principles
3. To design oscillators.
4. To study about turned amplifier.
5. To understand the analysis and design of LC and RC oscillators, amplifiers, multivibrators, power amplifiers and DC convertors.

COURSE OUTCOMES:

Upon completion of the course, the student should be able to:

CO1: Explore different types of amplifiers, oscillator and multivibrator circuits

CO2: Design BJT amplifier and oscillator circuits

CO3: Analyze transistorized amplifier and oscillator circuits

CO4: Learn and analyze feedback amplifiers

CO5: Design LC and RC oscillators, tuned amplifiers, wave shaping circuits, multivibrators, power amplifier and DC convertors.

List of Experiments

(By using Software Methodology)

1. PN Junction diode characteristics A. Forward bias B. Reverse bias.
2. Zener diode characteristics and voltage regulator
3. Halfwave Rectifier with and without filter.
4. Fullwave Rectifier with and without filter.
5. Transistor CB characteristics (Input and Output).
6. Transistor CE characteristics (Input and Output).
7. frequency response of CE Amplifier
8. frequency response of CC Amplifier (Emitter Follower)
9. UJT characteristics.
10. SCR characteristics.
11. FET Characteristics
12. Frequency Response of CS Amplifier
13. Frequency Response of CD Amplifier
14. Mini Project

*Minimum of 11 experiments to be completed including mini project

TEXT BOOKS:

1. Sedra and Smith, ―Micro Electronic Circuits‖; Sixth Edition, Oxford University Press, 2011. (UNIT I, III,IV,V)
2. Jacob Millman, ―Microelectronics‘, McGraw Hill, 2nd Edition, Reprinted, 2009.(UNIT I,II,IV,V)

REFERENCES:

1. Robert L. Boylestad and Louis Nasheresky, ―Electronic Devices and Circuit Theory‖, 10th Edition, Pearson Education / PHI, 2008
2. David A. Bell, ―Electronic Devices and Circuits‖, Fifth Edition, Oxford University Press, 2008.
3. Millman J. and Taub H., ―Pulse Digital and Switching Waveforms‖, TMH, 2000.
4. Millman and Halkias. C., Integrated Electronics, TMH, 2007.

Course Outcomes-Program Outcomes- Program Specific Outcomes (CO-PO-PSO) Mapping

	PO 1	PO 2	PO 3	PO 4	PO 5	PO6	PO7	PO8	PO9	PO1 0	PO1 1	PO1 2	PSO 1	PSO 2	PSO 3
CO1	**M**												**H**	**M**	
CO2		**L**	**H**		**H**								**M**	**L**	**H**
CO3	**H**	**M**		**H**									**L**		**M**
CO4					**M**								**M**		**H**
CO5			**H**										**M**	**L**	**H**

20ECS03: FUNDAMENTALS OF PCB DESIGN

Credits – 2 **Sessional Marks:40**
L: T: P:: 0: 1 :2 **University Exam Marks:60**

Course Objectives:

1. Understand the need for PCB Design and steps involved in PCB Design and Fabrication process.
2. Familiarize Schematic and layout design flow using Electronic Design Automation (EDA) Tools.
3. Become familiar with the simulation software.
4. Learn to use Power logic and power PCB.
5. Learn various types of PCBs. Schematic Design. Entry Rules for Schematic Entry, Component Layout methods.

Course Outcomes:

After successful completion of the course the students should be able to

CO1: Explore different aspect of Printed Circuit Board Design and fabrication.
CO2: Apply advance techniques, skills and modern tools for designing and fabrication of PCBs.
CO3: learn various types of PCBs. Schematic Design. Entry Rules for Schematic Entry, Component Layout methods.
CO4: Placement Rules, Routing Techniques for Single Sided Board.

CO5: Design and fabricate their own PCB for their Project and can also work in PCB Designing and Fabrication area.

Software Lab Session

1. Fundamental of basic electronics
2. Component identification
3. Component symbols & their footprints
4. Understand schematic
5. Design rule checking
6. Creating new PCB
7. Track width selection
8. Browsing footprints libraries
9. Component selection
10. Setting up the PCB layers
11. Routing and completion of design

PCB Design Lab

1. Introduction to PCB manufacturing machines Understanding the manufacturing process of PCB

2. Ultraviolet exposure and developing
3. Introduction to the Machines
4. Drilling and Etching Process
5. Developing the negative film
6. Printing the PCB layout design
7. Copper clad preparation[photo Resist Dip Coating]
8. Diagram, Board, Routing.

Text Books:

1. Printed circuit board design ,fabrication assembly and testing By R. S. Khandpur, Tata McGraw Hill2006
2. Printed Circuits Handbook, Sixth Edition, by Clyde F. Coombs, Jr, Happy T. Holden, Publisher:McGraw-Hill Education Year: 2016

Reference Books:

1. Printed circuit Board Design and technology, Walter C. Bosshart
2. Complete PCB Design Using OrCAD Capture and PCB Editor,Kraig Mitzner BobDoe Alexander Akulin Anton Suponin Dirk Müller, 2nd Edition 2009.
3. Introduction to System-on-Package, Rao R Tummala&MadhavanSwaminathan, McGraw Hill,2008.
4. EMC and Printed circuit board **,** Design theory and layout**,** Mark I Montrose IEEEcompatibility society
5. Flexible Printed circuit board Design and manufacturing ,By Robert torzwell

Course Outcomes-Program Outcomes- Program Specific Outcomes (CO-PO-PSO) Mapping

	PO 1	PO 2	PO 3	PO 4	PO 5	PO6	PO7	PO8	PO9	PO1 0	PO1 1	PO1 2	PSO 1	PSO 2	PSO 3
CO1	**M**												**H**	**M**	**L**
CO2			**L**		**H**								**M**	**M**	
CO3	**M**	**M**		**H**									**H**	**M**	**L**
CO4					**M**								**M**	**M**	
CO5													**H**	**L**	

20ECS04: ADVANCED PCB DESIGN

Credits – 2 **Sessional Marks:40**
L: T: P:: 0: 1 :2 **University Exam Marks:60**

Course Objectives:

The objective of this course is to provide students with

1. Understanding of the designing and generation of artwork of the pcbs for analog, digital, high frequency and power electronics applications.
2. Understanding of fabrication of different types of pcbs such as ssb, dsb, path.
3. Understanding of fabrication techniques such as photo printing, screen printing.
4. Knowledge of different mechanical and electrical operations required for fabrication of pcbs.
5. Knowledge of chemicals and materials used for the pcb fabrication.
6. Understanding of the fabrication of small series of highly reliable, professional quality pcbs with low investment cost.

Course Outcomes:

1. The students will be able to design electrical and electronic circuits and conduct experiments, analyze and interpret data.
2. The students will be use advance techniques, skills and modern tools for designing PCBs.
3. The student will be able to apply creativity in the design of systems, components or processes appropriate to program objectives.
4. The students will be able to work in R&D laboratories in telecommunication and biomedical electronics.
5. The students will be able to understand advance technology such as CMOS VLSI and nanotechnology fabrication techniques.

LIST OF PROGRAMS

Draw the layout and prepare the PCB for the design, construction and testing of the following,

1. Identification of various types of Printed Circuit Boards (PCB) and soldering techniques.
2. Identifying different components R, L, C, Diodes, Transistors, Switches.
3. Ultraviolet exposure and developing.
4. Drilling and Etching process.
5. Copper clad preparation.
6. Adders(Half adder, Full adder).
7. Random Access Memory.
8. Read Only Memory.
9. Digital to Analog Converter.

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10.Analog to Digital Converter.

11. CE Amplifier.

12. Printing the PCB layout design.

Course Outcomes – Program Outcomes – Program Specific Outcomes (CO-PO-PSO) Mapping

	PO 1	**PO 2**	**PO 3**	**PO4**	**PO 5**	**P O6**	**P O7**	**P O8**	**P O9**	**PO 10**	**PO 11**	**PO 12**	**PSO 1**	**PSO 2**	**PSO 3**	**PSO 4**
C O1		H		L	H			L					H			L
C O2	M	M		L	H	L							M			L
C O3		M			H	M							M			L
C O4		M			H								M			L
C O5		M	H													L

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20ECS05: FUNDAMENTALS OF EMBEDDED SYSYTEMS

Credits – 2 **Sessional Marks:40**
L:T:P::0:1:2 **UniversityExamMarks:60**

CourseObjectives:

The objectives of this course is to make the students

1. To learn the basic elementsembedded systems
2. To understandProgramming using Arithmetic and logical instructions of 8051.
3. To learn various interfacing controls in embedded systems
4. Understanding of ARM state mode by using MRS/MMSR instruction
5. Study of Testing embedded software , Performance testing , Maintenance.

CourseOutcomes:

After successful completion of the course the students should be able to

CO1: Identifythefunctionalityofdevelopmentboardstoimplementembeddedapplications.

CO2:Compile bug freeassemblyorClanguageprogramsformicrocontrollerstoarequiredtask.CO3 DesignanelectroniccircuitfordiverseI/Odevices usedinrealtimeembeddedapplicationsCO4: DesignanInterfacing of Stepper motorusedinrealtimeembeddedapplications.

CO5: Develop a product with all sub systems of functional requirements in optimal hardwareandsoftware components.

1	Introduction to embedded systems lab content.
2	Programming using Arithmetic and logical instructions of 8051.
3	Timer programming of 8051.
4	Counter programming of 8051.
5	Serial port programming of 8051.
6	Interfacing of Stepper motor
7	Using of more complex memory and branch type instructions such asLDMFD/STMFD, B and BL.
8	InterfacingofTemperaturesensorandRelaycontrol.
9	Basic reg/mem visiting and simple arithmetic/logic computing.
10.	Changing ARM state mode by using MRS/MMSR instruction and specify a startaddress of the text segment by using command line.
11.	Mini Project

*Minimum of 9 experiments to be completed including mini project

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coordinator (ECE)	Professor (ECE)	BoS Chairman (ECE)	Director, SE&T

TextBooks:

1. Arnold S. Berger – Embedded System Design CMP books, USA 2002.
2. Sriram Iyer, "Embedded Real time System Programming"
3. ARKIN, R.C., Behaviour-based Robotics, The MIT Press, 1998

ReferenceBooks:

1. ARKIN, R.C., Behaviour-based Robotics, The MIT Press, 1998
2. Steve Furber, "ARM System-on-Chip Architecture", Pearson India, 2015.
3. AndrewSloss,DominicSymesandChrisWright,"ARMSystemDeveloper'sGuide:DesigningandOptimizing System Software", Morgan Kaufumann Publisher, 2011.
4. DavidA.PattersonandJohnL.Hennessy,"ComputerOrganizationandDesign– TheHardware/Software Interface", ARM Edition, Morgan Kaufmann Publisher, 2010.

Course Outcomes-Program Outcomes- Program Specific Outcomes (CO-PO-PSO) Mapping

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO 1	PS O2	PS O3
CO1		H		M			L				L			H	
CO2		H			H		H		H	H	M	H	H		M
CO3	L	H		H		L		L						H	
CO4	L		L		H			L		M	H	H		H	
CO5	L		H			L	L		H		L		H		M

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20ECS06 ADVANCED EMBEDDED SYSTEM

Credits - 2 **Sessional Marks: 30**

L: T: P:2:1:0 **University Exam Marks: 70**

Laboratory Objective:

Upon successful completion of this Lab the student will be able to:

- Apply the design concepts for development of a process and interpret data.
- Demonstrate knowledge of programming environment, compiling, debugging, linking and executing variety of programs.
- Demonstrate documentation and presentation of the algorithms / flowcharts / programs in a record form.
- Validate the process using known input-output parameters.
- Employ analytical and logical skills to solve real world problem and demonstrate oral communication skills.

Program Outcomes

1. Engineering knowledge: Apply the knowledge of mathematics, science, engineering fundamentals and an engineering specialization to the solution of complex engineering problems.

2. Problem analysis: Identify, formulate, review research literature, and analyze complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences.

3. Design/development of solutions: Design solutions for complex engineering problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and environmental considerations.

4. Conduct investigations of complex problems: Use research-based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions.

5. Modern tool usage: Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools including prediction and modeling to complex engineering activities with an understanding of the limitations.

6. The engineer and society: Apply reasoning informed by the contextual knowledge to assess societal, health, safety, legal and cultural issues and the consequent responsibilities relevant to the professional engineering practice.

7. Environment and sustainability: Understand the impact of the professional engineering solutions in societal and environmental contexts, and demonstrate the knowledge of, and need for sustainable development.

8. Ethics: Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practice.

9. Individual and team work: Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings.

10. Communication: Communicate effectively on complex engineering activities with the engineering community and with society at large, such as, being able to comprehend and write effective reports and design documentation, make effective presentations, and give and receive clear instructions.

11. Project management and finance: Demonstrate knowledge and understanding of the engineering and management principles and apply these to one's own work, as a member and leader in a team, to manage projects and in multidisciplinary environments.

12. Lifelong learning: Recognize the need for, and have the preparation and ability to engage in independent and lifelong learning in the broadest context of technological change.

Programme Specific Outcomes:

1. The ECE graduates will work as software engineers for providing solutions to real world problems using structured and object-oriented programming languages and open source software.

2. The ECE graduates will work as System engineer, Software analyst and Tester for IT and ITes.

LIST OF PROGRAMS

1. Write a program to toggle all the led to port and with some time delay using ARM7
2. Write a program to interface LCD with ARM7
3. Write a program to interface 4*4 matrix keypad with ARM7
4. Write a program for interfacing LED and PWM and to verify the output in the ARM7
5. Write a program to interface Stepper motor with ARM7
6. Write a program for interfacing of DC motor with ARM7
7. Write a program to study and characteristics of the programmable gain amplifier (PGA)
8. Write a Program realization of low pass, high pass and band pass filters and their characteristics
9. Write a program to interface ADC and DAC with PSOC
10. Write a program for digital function implementation using digital blocks
    A. Counter for blinking LED B. PWM C. Digital buffer and digital inverter
11. Write a program to verify Timer operation in different modes
12. Write a Program to interface stepper motor with PSOC
13. Mini Project

    *Minimum of 9 experiments to be completed including mini project

ATTAINMENT OF PROGRAM OUTCOMES AND PROGRAM SPECIFIC OUTCOMES:

Exp. No	Experiment	Program Outcomes	Attained Program Specific Outcomes Attained
1	Write a program to toggle all the led to port and with some time delay using ARM7	PO1, PO2	PSO1
2	Write a program to interface LCD with ARM7	PO1, PO2	PSO1
3	Write a program to interface 4*4 matrix keypad with ARM7	PO1, PO2	PSO1
4	Write a program for interfacing LED and PWM and to verify the output in the ARM7	PO1, PO2	PSO1
5	Write a program to interface Stepper motor with ARM7	PO1, PO2, PO3	PSO1, PSO2
6	Write a program for interfacing of DC motor with ARM7	PO1, PO2, PO3	PSO1
7	Write a program to study and characteristics of the programmable gain amplifier (PGA)	PO1, PO2	PSO1
8	Write a Program realization of low pass, high pass and band pass filters and their characteristics	PO1, PO2	PSO1
9	Write a program to interface ADC and DAC with PSOC	PO5, PO6	PSO1
10	Write a program for digital function implementation using digital blocks A. Counter for blinking LED B. PWM C. Digital buffer and digital inverter	PO5, PO6, PO7	PSO1, PSO2
11	Write a program to verify Timer operation in different modes	PO5, PO6, PO8	PSO2
12	Write a Program to interface stepper motor with PSOC	PO5, PO6	PSO2

MAPPING COURSE OBJECTIVES LEADING TO THE ACHIEVEMENT OF PROGRAM OUTCOMES:

Course Objectives	Program Outcomes												Program Specific Outcomes		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
I	✓	✓										✓	✓		
II	✓	✓										✓	✓		

Reference Books: 1. Michael J. Pont, “Embedded C”, Pearson Education, 2nd Edition, 2008. 2. Nigel Gardner, “The Microchip PIC in CCS C”. Ccs Inc, 2nd Revision Edition, 2

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20ECS07: ANTENNA MEASUREMENTS

Credits – 2 **Sessional Marks:40**
L: T: P:: 0: 1 :2 **University Exam Marks:60**

CourseObjectives:

1. Fundamental antenna parameters and numerical methods to analyze and differentiate the antennas.
2. Become familiar with the simulation software.
3. Concept of radiation mechanism of various antennas.
4. Mechanism and models for radio-wave propagation.
5. To learn about linear wire antenna elements and Antenna arrays.

CourseOutcomes:

After successful completion of the course the students should be able to

CO1: Identify various antenna parameters.
CO2: Analyze radiation patterns of antennas.
CO3: Illustrate techniques for antenna parameter measurements
CO4: Understand the various applications of antennas.
CO5: Identify the characteristics of radio-wave propagation.

1	Introduction to Equipment, Antennas and Software **I. FunctionalBlock** A. Front PanelDescription B. Horizontal AssemblyDescription C. Vertical AssemblyDescription D. Vertical MountAssembly **II. TechnicalSpecifications** A. List ofAntennas B. Deliverables **III. SoftwareInstallation** A. Operation Modes B. Software ControlMode C. Panel ControlMode
2	Measure the variation of field strength/Inverse square law.
3	Prove the reciprocity theorem of antenna.
4	Plot Radiation pattern of all Wired Antennas.
5	Plot Radiation pattern of all Aperture Antennas.
6	Plot Radiation pattern of all Reflector Antennas.
7	Plot Radiation pattern of all Array Antennas.
8	Measurement of Co-polarization and Cross Polarization.
9	Circularly Polarized Antenna Trainer.
10.	Resistive and Impedance Stub Loading Characterization.
11.	Mini Project

*Minimum of 9 experiments to be completed including mini project

TextBooks:

1. Antennas and Wave Propagation – J.D. Kraus, R.J. Marhefka and Ahmad S. Khan, TMH, New Delhi, 4th ed., (Special Indian Edition), 2010.
2. Electromagnetic Waves and Radiating Systems – E.C. Jordan and K.G. Balmain, PHI, 2nd ed., 2000.

ReferenceBooks:

1. Antenna Theory - C.A. Balanis, John Wiley & Sons, 3rd Ed., 2005.
2. Antennas and Wave Propagation – K.D. Prasad, Satya Prakashan, Tech India Publications, New Delhi, 2001.
3. Radio Engineering Handbook- Keith henney, 3rd edition TMH.
4. Antenna Engineering Handbook –John Leonidas Volakis, 3rd edition, 2007.

Course Outcomes-Program Outcomes- Program Specific Outcomes (CO-PO-PSO) Mapping

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	H	H		M			L							H	
CO2	H	H							H	H	M	H	H		M
CO3		H		H		L		L						H	
CO4	H				H			L		M	H	H		H	
CO5	H		H				L		H				H		M

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20ECS08: MICROSTRIP PATCH ANTENNA DESIGN

Credits:2 **Sessional marks:40**
L-0;T-1;P-2 **University Exam marks:60**

Course Objectives:

1. Mathematical calculation of various parameters of Microstrip patch antennas such as width, length, Microstrip feed line, thickness of copper, Effective dielectric constant.
2. The Course provides basic information on the different planar transmission lines.
3. The course helps to design microstrip patch antenna using different softwares.
4. The course objective is also to understand the design of microstrip patch antenna with different feeding techniques.

Course Outcomes:

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

CO1: Design and solve basic microstrip problems.

CO2: Design of microstrip patch antenna with various feeding techniques.

CO3: Analysis of various characteristics of sample shapes of Microstrip patch antennas such as Voltage Standing Wave Ratio (VSWR), Return loss, Gain, Bandwidth, Radiation pattern, Current distribution, Input impedance etc.

CO4: Analysis and Comparison of different dielectric substrates and their result

CO5: Know the various applications of microstrip patch antenna

List of Experiments

1. To plot the radiation pattern of all Microstrip antenna and observe its parameters using Antenna Measurement System (AMS) Software.
2. Design and study of basic Microstrip shapes antenna and its configurations using AMS software
3. Effect of different feeding techniques in Microstrip antenna using AMS software
4. Design of fundamental parameters of the antenna and an overview of HFSS to measure different antenna parameters.
5. Design of a Half-wave dipole antenna.
6. Design of a Quarter-wave monopole antenna.
7. Design and simulation of Rectangular microstrip patch antenna with a particular operating frequency, dielectric constant and substrate thickness.
8. Design of Microstrip patch antenna using a coaxial feeding technique.
9. Design and simulation of Rectangular microstrip patch antenna using CPW feeding with slot for bandwidth enhancement.
10. Design of Aperture coupled Rectangular microstrip patch antenna with two different substrates.

11. Design of Proximity coupled rectangular Microstrip patch antenna.
12. Design and Simulation of Microstrip Patch Antenna using MATLAB.
13. Design and Simulation of Microstrip Patch Antenna using the CST Microwave Studio Suite 2020.
14. Mini Project

*Minimum of 11 experiments to be completed including mini project

TEXTBOOKS:

1. C A Balanis, *Antenna Theory: Analysis and Design*, John Wiley & Sons, 2nd. Edn.
2. J D Kraus, *Antennas*, McGraw Hill.

REFERENCE BOOKS:

1. E. C. Jordan and K. G. Balmain, *Electromagnetic waves and Radiating systems*, Pearson Education India
2. J D Kraus etal., *Antennas for all applications*, Tata McGraw Hill

Course Outcomes - Program Outcomes - Program Specific Outcomes (CO – PO - PSO) Mapping

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3
CO1	**H**	**H**	**H**									**H**	**H**		**H**
CO2	**H**			**M**								**H**	**H**		**H**
CO3		**M**	**M**		**M**							**H**	**H**		**M**
CO4	**H**	**M**		**L**	**M**							**H**	**M**	**M**	**M**
CO5						**H**			**L**	**M**		**H**		**H**	**M**