COURSE OUTCOMES:

At the end of the course the students will be able to

CO1:Analyze various types of feedback amplifiers

CO2:Design oscillators, tuned amplifiers, wave-shaping circuits and multivibrators

CO3:Design and simulate feedback amplifiers,oscillators, tuned amplifiers, wave- shaping circuits and multivibrators, filters using SPICE Tool.

CO4:Design amplifiers, oscillators, D-A converters using operational amplifiers.

CO5:Design filters using op-amp and perform an experiment on frequency response

CO's-PO's & PSO's MAPPING

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	2	3	3	3	-	-	-	-	-	-	1	1
CO2	2	3	3	3	-	-	-	-	-	-	1	1
CO3	2	3	3	3	-	-	-	-	-	-	1	1
CO4	2	3	3	3	2	-	-	-	-	-	1	1
CO5	-	-	-	-	-	-	-	-	-	-	-	-
Avg	2	3	3	3	2	-	-	-	-	-	1	1

1 - low, 2 - medium, 3 - high, '-' - no correlation

EC3501 WIRELESS COMMUNICATION L T P C

3 0 2 4

COURSE OBJECTIVES:

- To study and understand the concepts and design of a Cellular System.
- To Study And Understand Mobile Radio Propagation And Various Digital Modulation Techniques.
- To Understand The Concepts Of Multiple Access Techniques And Wireless Networks

UNIT-I THE CELLULAR CONCEPT-SYSTEM DESIGN FUNDAMENTALS 9

Introduction-FrequencyReuse-Channel Assignment Strategies-**Handoff Strategies:**Prioritizing Handoffs, Practical Handoff Considerations. **Interference And System Capacity**: Co-Channel Interference And System Capacity-Channel Planning For Wireless Systems, Adjacent Channel Interference, Power Control For Reducing Interference, Trunking And Grade Of Service. **Improving Coverage And Capacity In Cellular Systems:** Cell Splitting, Sectoring.

UNIT-II MOBILE RADIO PROPAGATION 9

Large Scale Path Loss: Introduction To Radio Wave Propagation - Free Space Propagation Model – **Three Basic Propagation Mechanism:** Reflection – Brewster Angle- Diffraction-Scattering.**Small Scale Fading And Multipath:** Small Scale Multipath Propagation, Factors Influencing Small-Scale Fading, Doppler Shift, Coherence Bandwidth, Doppler Spread And Coherence Time. **Types Of Small- Scale Fading:** Fading Effects Due To Multipath Time Delay Spread, Fading Effects Due To Doppler Spread.

UNIT- III MODULATION TECHNIQUES AND EQUALIZATION AND DIVERSITY 9

Digital Modulation – **An Overview**: Factors That Influence The Choice Of Digital Modulation, **Linear Modulation Techniques:** Minimum Shift Keying (MSK), Gaussian Minimum Shift Keying(GMSK), **Spread Spectrum Modulation Techniques:** Pseudo- Noise (PN) Sequences, Direct Sequence Spread Spectrum (DS-SS)- Modulation Performance In Fading And Multipath

Channels- **Equalization, Diversity And Channel Coding:** Introduction-Fundamentals Of Equalization- **Diversity Techniques:** Practical Space Diversity Considerations, Polarization Diversity, Frequency Diversity, Time Diversity.

UNIT- IV MULTIPLE ACCESS TECHNIQUES 9

Introduction: Introduction To Multiple Access- Frequency Division Multiple Access(FDMA)- Time Division Multiple Access(TDMA)- Spread Spectrum Multiple Access-Code Division Multiple Access(CDMA)- Space Division Multiple Access(SDMA)- **Capacity Of Cellular Systems:** Capacity Of Cellular CDMA, Capacity Of CDMA With Multiple Cells.

UNIT- V WIRELESS NETWORKING 9

Introduction: Difference Between Wireless And Fixed Telephone Networks, The Public Switched Telephone Network(PSTN), **Development Of Wireless Networks:** First Generation Wireless Networks, Second Generation Wireless Networks, Third Generation Wireless Networks, Fixed Network Transmission Hierarchy, **TrafficRoutingInWireless Networks**: Circuit Switching, Packet Switching- **Personal Communication Services/ Networks(PCS/PCNs):**Packet Vs Circuit Switching For PCN, Cellular Packet- Switched Architecture- Packet Reservation Multiple Access(PRMA)- **Network Database**s**:** Distributed Database For Mobility Management- Universal Mobile Telecommunication Systems(UMTS).

45 PERIODS

PRACTICAL EXERCISES: 30 PERIODS

1. Modeling of wireless communication systems using Matlab(Two ray channel and Okumura –Hata model)
2. Modeling and simulation of Multipath fading channel
3. Design, analyze and test Wireless standards and evaluate the performance measurements such as BER, PER, BLER, throughput, capacity, ACLR, EVM for 4G and 5G using Matlab
4. Modulation: Spread Spectrum – DSSS Modulation & Demodulation
5. Wireless Channel equalization: Zero-Forcing Equalizer (ZFE),MMSE Equalizer(MMSEE),Adaptive Equalizer (ADE),Decision Feedback Equalizer (DFE)
6. Modeling and simulation of TDMA, FDMA and CDMA for wireless communication

TOTAL:75 PERIODS

COURSE OUTCOMES :

Upon successful completion of the course the student will be able to:

CO1:Understand The Concept And Design Of A Cellular System.
CO2:Understand Mobile Radio Propagation And Various Digital Modulation Techniques.
CO3:Understand The Concepts Of Multiple Access Techniques And Wireless Networks
CO4:Characterize a wireless channel and evolve the system design specifications
CO5:Design a cellular system based on resource availability and traffic demands.

TEXT BOOK :

1. Rappaport,T.S.,-Wireless communications", Pearson Education, Second Edition, 2010.

REFERENCES :

1. Wireless Communication –Andrea Goldsmith, Cambridge University Press, 2011
2. Van Nee, R. and Ramji Prasad, —OFDM for wireless multimedia communications, Artech House, 2000
3. David Tse and Pramod Viswanath, —Fundamentals of Wireless Communication, Cambridge University Press, 2005.
4. Upena Dalal, —Wireless Communication", Oxford University Press, 2009.
5. Andreas.F. Molisch, —Wireless Communications", John Wiley – India, 2006.

6. Wireless Communication and Networks –William Stallings ,Pearson Education, Second Edition 2002.

CO's-PO's & PSO's MAPPING

CO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO1 0	PO1 1	PO1 2	PSO 1	PSO 2	PSO 3
1	3	2	2	3	3	1	-	-	-	-	-	1	3	1	1
2	3	3	2	1	3	2	-	-	-	-	-	-	3	1	2
3	3	3	3	3	2	2	-	-	-	-	-	1	3	1	2
4	2	3	2	2	2	2	-	-	-	-	-	1	2	1	1
5	2	-	3	3	2	1	-	-	-	-	-	1	2	2	2
CO	**3**	**3**	**2**	**2**	**2**	**2**	-	-	-	-	-	**1**	**3**	**1**	**2**

1 - low, 2 - medium, 3 - high, '-' - no correlation

EC3552 VLSI AND CHIP DESIGN L T P C

3 0 0 3

COURSE OBJECTIVES:

- Understand the fundamentals of IC technology components and their characteristics.
- Understand combinational logic circuits and design principles.
- Understand sequential logic circuits and clocking strategies.
- Understand ASIC Design functioning and design.
- Understand Memory Architecture and building blocks

UNIT I MOS TRANSISTOR PRINCIPLES 9

MOS logic families (NMOS and CMOS), Ideal and Non Ideal IV Characteristics, CMOS devices. MOS(FET) Transistor Characteristic under Static and Dynamic Conditions, Technology Scaling, power consumption

UNIT II COMBINATIONAL LOGIC CIRCUITS 9

Propagation Delays, stick diagram, Layout diagrams, Examples of combinational logic design, Elmore's constant, Static Logic Gates,Dynamic Logic Gates, Pass Transistor Logic, Power Dissipation, Low Power Design principles.

UNIT III SEQUENTIAL LOGIC CIRCUITS AND CLOCKING STRATEGIES 9

Static Latches and Registers, Dynamic Latches and Registers, Pipelines, Nonbistable Sequential Circuits.Timing classification of Digital Systems, Synchronous Design, Self-Timed Circuit Design .

UNIT IV INTERCONNECT , MEMORY ARCHITECTURE AND ARITHMETIC CIRCUITS 9

Interconnect Parameters – Capacitance, Resistance, and Inductance, Electrical WireModels, Sequential digital circuits: adders, multipliers, comparators, shift registers. Logic Implementation using Programmable Devices (ROM, PLA, FPGA), Memory Architecture and Building Blocks,Memory Core and Memory Peripherals Circuitry

UNIT V ASIC DESIGN AND TESTING 9

Introduction to wafer to chip fabrication process flow. Microchip design process & issues in test and verification of complex chips, embedded cores and SOCs, Fault models, Test coding. ASIC Design Flow, Introduction to ASICs, Introduction to test benches, Writing test benches in Verilog HDL,

Automatic test pattern generation, Design for testability, Scan design: Test interface and boundary scan.

TOTAL: 45 PERIODS

COURSE OUTCOMES:

Upon successful completion of the course the student will be able to

CO1: In depth knowledge of MOS technology
CO2: Understand Combinational Logic Circuits and Design Principles
CO3: Understand Sequential Logic Circuits and Clocking Strategies
CO4: Understand Memory architecture and building blocks
CO5: Understand the ASIC Design Process and Testing.

TEXTBOOKS

1. Jan D Rabaey, Anantha Chandrakasan, " Digital Integrated Circuits: A Design Perspective", PHI, 2016.(Units II, III and IV).
2. Neil H E Weste, Kamran Eshranghian, " Principles of CMOS VLSI Design: A System Perspective," Addison Wesley, 2009.(Units - I, IV).
3. Michael J Smith ," Application Specific Integrated Circuits, Addison Wesley, (Unit - V)
4. Samir Palnitkar," Verilog HDL:A guide to Digital Design and Synthesis", Second Edition, Pearson Education,2003.(Unit - V)
5. Parag K.Lala," Digital Circuit Testing and Testability", Academic Press, 1997, (Unit - V)

REFERENCES

1. D.A. Hodges and H.G. Jackson, Analysis and Design of Digital Integrated Circuits, International Student Edition, McGraw Hill 1983
2. P. Rashinkar, Paterson and L. Singh, "System-on-a-Chip Verification-Methodology and Techniques", Kluwer Academic Publishers,2001
3. SamihaMourad and YervantZorian, "Principles of Testing Electronic Systems", Wiley 2000
4. M. Bushnell and V. D. Agarwal, "Essentials of Electronic Testing for Digital, Memory and Mixed-Signal VLSI Circuits", Kluwer Academic Publishers,2000

CO's-PO's & PSO's MAPPING

C	PO	PO	PO	PO	PO	PO	PO	PO	PO	PO1	PO1	PO1	PSO	PSO	PSO
1	1	1	-	-	-	-	-	-	-	-	-	-	3	3	3
2	3	2	3	2	-	-	-	-	-	-	-	1	3	3	3
3	2	3	2	3	1	1	-	-	-	-	-	2	3	2	3
4	-	-	1	1	-	-	-	-	-	-	-	3	3	3	2
5	-	-	-	-	-	2	-	-	-	-	1	-	3	2	2
C	**2**	**2**	**2**	**2**	**1**	**1.5**	-	-	-	-	**1**	**2**	**3**	**3**	**3**

1 - low, 2 - medium, 3 - high, '-' - no correlation

EC3551 TRANSMISSION LINES AND RF SYSTEMS L T P C
3 0 0 3

COURSE OBJECTIVES:

- To introduce the various types of transmission lines and its characteristics
- To understand high frequency line, power and impedance measurements
- To impart technical knowledge in impedance matching using Smith Chart.
- To introduce passive filters and basic knowledge of active RF components
- To learn the concepts of a RF system transceiver design.

UNIT I TRANSMISSION LINE THEORY 9

General theory of Transmission lines - the transmission line - general solution - The infinite line - Wavelength, velocity of propagation - Waveform distortion - the distortion less line - Loading and different methods of loading - Line not terminated in Z 0 - Reflection coefficient - calculation of current, voltage, power delivered and efficiency of transmission - Input and transfer impedance - Open and short circuited lines - reflection factor and reflection loss.

UNIT II HIGH FREQUENCY TRANSMISSION LINES 9

Transmission line equations at radio frequencies - Line of Zero dissipation - Voltage and current on the dissipation less line, Standing Waves, Nodes, Standing Wave Ratio - Input impedance of the dissipation less line - Open and short circuited lines - Power and impedance measurement on lines - Reflection losses - Measurement of VSWR and wavelength.

UNIT III IMPEDANCE MATCHING IN HIGH FREQUENCY LINE 9

Impedance matching: Quarter wave transformer ,One Eighth wave line, Half wave line- Impedance matching by stubs- Single stub and double stub matching - Smith chart – Application of Smith chart, Solutions of problems using Smith chart - Single and double stub matching using Smith chart.

UNIT IV WAVEGUIDES 9

Waves between parallel planes of perfect conductors- Transverse Electric waves and Transverse Magnetic waves, Characteristics of TE and TM waves, Transverse Electromagnetic waves, TM and TE waves in Rectangular waveguides, TM and TE waves in Circular waveguides.

UNIT V RF SYSTEM DESIGN CONCEPTS 9

Active RF components: Semiconductor basics in RF, bipolar junction transistors, RF field effect transistors, High electron mobility transistors, Fundamentals of MMIC, Basic concepts of RF design: Filters, couplers, power dividers, Amplifier power relations, Low noise amplifiers, Power amplifiers.

COURSE OUTCOMES:

CO1: Explain the characteristics of transmission lines and its losses.
CO2: Calculate the standing wave ratio and input impedance in high frequency transmission lines.
CO3: Analyze impedance matching by stubs using Smith Charts.
CO4: Comprehend the characteristics of TE and TM waves.
CO5: Design a RF transceiver system for wireless communication

TOTAL:45 PERIODS

TEXTBOOKS

1. John D Ryder, “Networks lines and fields”,Prentice Hall of India,New Delhi,2005.(Unit I–IV)
2. Mathew M. Radmanesh, “Radio Frequency &Microwave Electronics”, Pearson Education Asia, Second Edition, 2002 (Unit – V)
3. Annapurna Das, Sisir K. Das, “Microwave Engineering”, McGraw Hill Education (India) private limited, Third edition,2000.(Unit – V)

REFERENCES

1. Reinhold Ludwig and Powel Bretchko, “RF Circuit Design” – Theory and Applications”, Pearson Education Asia, First Edition, 2001.
2. D. K. Misra, “Radio Frequency and Microwave Communication Circuits”- Analysis and Design, John Wiley & Sons, 2004.
3. Richard Chi-Hsi Li - , “RF Circuit Design” – A John Wiley & Sons, Inc, Publications
4. W.Alan Davis, Krishna Agarwal, “Radio Frequency Circuit Design”, John willy & Sons,2001

CO's-PO's & PSO's MAPPING

CO	PO 1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
1	3	3	3	3	2	1	-	-	-	1	-	1	2	1	1
2	3	2	2	3	2	1	-	-	-	1	-	1	2	1	1
3	3	3	3	2	1	2	-	-	-	1	-	1	2	1	1
4	3	3	2	3	2	1	-	-	-	1	-	1	2	1	1
5	3	2	3	2	2	1	-	-	-	1	-	1	2	1	1
CO	**3**	**3**	**3**	**3**	**2**	**1**	-	-	-	**1**	-	**1**	**2**	**1**	**1**

1 - low, 2 - medium, 3 - high, '-' - no correlation

EC3561 VLSI LABORATORY L T P C
0 0 4 2

COURSE OBJECTIVES:

- To learn Hardware Descriptive Language (Verilog/VHDL).
- To learn the fundamental principles of Digital System Desing using HDL and FPGA.
- To learn the fundamental principles of VLSI circuit design in digital domain
- To learn the fundamental principles of VLSI circuit design in analog domain
- To provide hands on design experience with EDA platforms.

LIST OF EXPERIMENTS:

1. Design of basic combinational and sequential (Flip-flops) circuits using HDL. Simulate it using Xilinx/Altera Software and implement by Xilinx/Altera FPGA
2. Design an Adder ; Multiplier (Min 8 Bit) using HDL. Simulate it using Xilinx/Altera Software and implement by Xilinx/Altera FPGA
3. Design and implement Universal Shift Register using HDL. Simulate it using Xilinx/Altera Software
4. Design Memories using HDL. Simulate it using Xilinx/Altera Software and implement by Xilinx/Altera FPGA
5. Design Finite State Machine (Moore/Mealy) using HDL. Simulate it using Xilinx/Altera Software and implement by Xilinx/Altera FPGA
6. Design 3-bit synchronous up/down counter using HDL. Simulate it using Xilinx/Altera Software and implement by Xilinx/Altera FPGA
7. Design 4-bit Asynchronous up/down counter using HDL. Simulate it using Xilinx/Altera Software and implement by Xilinx/Altera FPGA
8. Design and simulate a CMOS Basic Gates & Flip-Flops. Generate Manual/Automatic Layout .
9. Design and simulate a 4-bit synchronous counter using a Flip-Flops. Generate Manual/Automatic Layout
10. Design and Simulate a CMOS Inverting Amplifier.
11. Design and Simulate basic Common Source, Common Gate and Common Drain Amplifiers.
12. Design and simulate simple 5 transistor differential amplifier.

COURSE OUTCOMES:

On completion of the course, students will be able to:

CO1: Write HDL code for basic as well as advanced digital integrated circuit
CO2: Import the logic modules into FPGA Boards
CO3: Synthesize Place and Route the digital Ips

CO4: Design, Simulate and Extract the layouts of Digital & Analog IC Blocks using EDA tools
CO5: Test and Verification of IC design

TOTAL: 60 PERIODS

CO's-PO's & PSO's MAPPING

C	PO	PO	PO	PO	PO	PO	PO	PO	PO	PO1	PO1	PO1	PSO	PSO	PSO
1	2	-	-	-	-	-	-	-	-	-	-	-	2	3	2
2	3	3	1	1	-	-	-	-	-	-	-	-	2	1	2
3	1	2	2	2	-	-	-	-	-	-	1	1	2	2	2
4	-	1	3	3	1	-	-	-	-	-	1	1	2	2	2
5	3	3	3	3	1	-	-	-	-	-	1	1	2	2	2
C	**2.2**	**2.2**	**2.2**	**2.2**	**1**	-	-	-	-	-	**1**	**1**	**2**	**2**	**2**

1 - low, 2 - medium, 3 - high, '-' - no correlation

ET3491 EMBEDDED SYSTEMS AND IOT DESIGN L T P C
3 0 2 4

COURSE OBJECTIVES :

- Learn the architecture and features of 8051.
- Study the design process of an embedded system.
- Understand the real – time processing in an embedded system.
- Learn the architecture and design flow of IoT.
- Build an IoT based system.

UNIT I 8051 MICROCONTROLLER 9

Microcontrollers for an Embedded System – 8051 – Architecture – Addressing Modes – Instruction Set – Program and Data Memory – Stacks – Interrupts – Timers/Counters – Serial Ports – Programming.

UNIT II EMBEDDED SYSTEMS 9

Embedded System Design Process – Model Train Controller – ARM Processor – Instruction Set Preliminaries – CPU – Programming Input and Output – Supervisor Mode – Exceptions and Trap – Models for programs – Assembly, Linking and Loading – Compilation Techniques – Program Level Performance Analysis.

UNIT III PROCESSES AND OPERATING SYSTEMS 9

Structure of a real – time system – Task Assignment and Scheduling – Multiple Tasks and Multiple Processes – Multirate Systems – Pre emptive real – time Operating systems – Priority based scheduling – Interprocess Communication Mechanisms – Distributed Embedded Systems – MPSoCs and Shared Memory Multiprocessors – Design Example – Audio Player, Engine Control Unit and Video Accelerator.

UNIT IV IOT ARCHITECTURE AND PROTOCOLS 9

Internet – of – Things – Physical Design, Logical Design – IoT Enabling Technologies – Domain Specific IoTs – IoT and M2M – IoT System Management with NETCONF – YANG – IoT Platform Design – Methodology – IoT Reference Model – Domain Model – Communication Model – IoT Reference Architecture – IoT Protocols - MQTT, XMPP, Modbus, CANBUS and BACNet.