E.G.S. PILLAY ENGINEERING COLLEGE

(Autonomous)

NAGAPATTINAM – 611002

(Affiliated to Anna University, Chennai | Accredited by NAAC with 'A++' Grade|Accredited by NBA T1(B.E. – CSE, CIVIL, ECE, EEE, MECH& B.Tech – IT) | Approved by AICTE, New Delhi)

B.E. ELECTRONICS AND COMMUNICATION ENGINEERING R - 2023

THIRD YEAR

CURRICULUM AND SYLLABUS FOR FIFTH SEMESTER

COURSE CODE	COURSE NAME	CATEGORY	L	T	P	C	MAX. MARKS		
							CA	ES	TOTAL
THEORY COURSES									
2302EC501	Digital Communication	PCC	3	0	0	3	40	60	100
2302EC502	Networks and Security	PCC	3	0	0	3	40	60	100
2302EC503	Transmission Lines and Waveguides	PCC	3	0	0	3	40	60	100
2302EC504	VLSI and Chip Design	PCC	3	0	0	3	40	60	100
	Elective – I	PEC	3	0	0	3	40	60	100
	Open Elective – I	OEC	3	0	0	3	40	60	100
PRACTICAL COURSES									
2302EC551	Communication Systems Laboratory	PCC	0	0	2	1	60	40	100
2302EC552	VLSI and Chip Design Laboratory	PCC	0	0	2	1	60	40	100
OTHER COURSES									
2304GE501	Professional Development Course - III	EEC	0	0	2	1	100	--	100
2301LS501	Life Skills – V	LS	--	--	--	--	--	--	--
TOTAL			**18**	**0**	**6**	**21**	**460**	**440**	**900**

L-Lecture |T –Tutorial |P- Practical |CA – Continuous Assessment |ES – End Semester

2302EC501 DIGITAL COMMUNICATION

L	T	P	C
3	0	0	3

PREREQUISITE:

1. 2302EC301 - Signals and Systems
2. 2302EC402 - Analog Communication

COURSE OBJECTIVES:

1. To understand the fundamentals of Pulse Modulation
2. To analyze the Base band modulation
3. To design passb and modulation

COURSE OUTCOMES:

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

CO1: Describe the concepts of pulse modulation in communication systems
CO2: Apply wave shaping techniques to minimize ISI
CO3: Analyze and Design different types of passband modulation techniques
CO4: Differentiate and apply Source Coding and Error control coding in Communication
CO5: Analyze Spread spectrum Techniques

COs Vs POs MAPPING:

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2
CO1	3	3	3	2	-	-	-	-	-	-	3	-	3
CO2	3	3	3	2	-	-	-	-	-	-	3	-	3
CO3	3	3	3	2	-	-	-	-	-	-	3	-	3
CO4	3	3	3	2	-	-	-	-	-	-	3	-	3
CO5	3	3	3	2	-	-	-	-	-	-	3	-	3

COURSE CONTENTS:

MODULE I PULSE MODULATION **9 Hours**

Block diagram of a Digital Communication systems - Sampling process (Qualitative): Low pass and Band pass sampling, Aliasing, Signal Reconstruction Quantization: Uniform & non uniform quantization, quantization noise, Logarithmic Companding of speech signal Waveform coding: Pulse Code Modulation (PCM), Differential pulse code modulation, Adaptive differential pulse code modulation, Delta modulation.

MODULE II BASEBAND MODULATION **7 Hours**

Digital line encoding techniques: Need for line shaping of signals, Properties of Line codes, Unipolar / Polar RZ & NRZ, Bipolar NRZ, Manchester – Matched filter – Inter Symbol Interference and Nyquist criteria for ISI cancellation – Pulse shaping with raised cosine filter – Correlative level coding – M ary PAM transmission – Optimum linear receivers – Equalization techniques – Eye pattern.

MODULE III PASS BAND MODULATION **11 Hours**

Generation and detection of Amplitude Shift Keying (ASK) Modulation, Generation and detection of Frequency Shift Keying (FSK) Modulation, Generation and detection of Binary Phase Shift Keying (BPSK) Modulation, Generation and detection of Quaternary Phase Shift Keying QPSK) and QAM Performance of BPSK, QPSK and QAM in AWGN channel structure of Non-coherent Receivers, Principle of DPSK.

MODULE IV ERROR CONTROL CODING **10 Hours**

Source Coding Theorem, Data Compaction (Lossless data compression - Huffman Coding, Prefix Coding), Discrete memory-less channel, Channel Capacity, Linear Block Codes (Syndrome decoding, Minimum Distance Considerations, Hamming Codes), Cyclic Codes, Convolutional Codes (Viterbi algorithm)

MODULE V SPREAD SPECTRUM TECHNIQUES **8 Hours**

Spread Spectrum- PN Sequence code and properties – Direct Sequence and Frequency Hopping Spread Spectrum Systems –Processing gain and Jamming Margin.

TOTAL: 45 HOURS

REFERENCES:

1. *S. Haykin, MichealMoher, Communication Systems, 5th Ed., John Wiley & Sons, 2021. 3 S. Haykin, Digital Communication Systems, John Wiley & Sons, 2013.*
2. *S. Haykin, Digital Communication Systems, John Wiley & Sons, 2013.*
3. *H. Taub and D. L. Schilling, Principles of Communication Systems, 4th edition, McGraw Hill, 2017.*
4. *George Kennedy and Bernard Davis," Electronic Communication systems", 6th Edition, TMH, 2017*
5. *https://moodle.najah.edu/mod/resource/view.php?id=48306*
6. *https://nptel.ac.in/courses/108102096/*
7. *https://nptel.ac.in/courses/Webcoursecontents/IIT%20Kharagpur/.../New_index1.html*
8. *https://ocw.mit.edu/.../lecture-videos/lecture-5-error-correction-syndromedecoding/*

2302EC502 NETWORKS AND SECURITY

L	T	P	C
3	0	0	3

PREREQUISITE:

Fundamentals Of Computer Networks

COURSE OBJECTIVES:

1. To gain knowledge on the various attacks in a network
2. To acquire knowledge on various encryption standards.
3. To build the ability to develop security standard based on the requirement.

COURSE OUTCOMES:

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

CO1: Identify vulnerability of computer networks to security threats.
CO2: Acquire and understand the knowledge on existing security algorithms, cryptography standards, cryptography techniques and their implications on network security
CO3: Understand various cyber-crimes and cyber security.
CO4: Analyze the type of security threat and the appropriate security standard to be adopted
CO5: Formulate and implement new security standards.

COs Vs POs MAPPING:

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2
CO1	3	3	3	2	-	-	-	-	-	-	3	-	3
CO2	3	3	3	2	-	-	-	-	-	-	3	-	3
CO3	3	3	3	2	-	-	-	-	-	-	3	-	3
CO4	3	3	3	2	-	-	-	-	-	-	3	-	3
CO5	3	3	3	2	-	-	-	-	-	-	3	-	3

COURSE CONTENTS:

MODULE I INTRODUCTION TO NETWORK SECURITY 9 Hours

Security Threats, Security Attacks, Security Services, Mechanisms- Model for Network Security- Classical Encryption Techniques – Substitutions-Transpositions Techniques- Stream Cipher, Block Cipher-Block Cipher Modes-ECB-CBC-CFB-OFB.

MODULE II BLOCK CIPHERS AND THE DATA ENCRYPTION STANDARD, 9 Hours

Simple DES-Differential cryptanalysis- DES-Modes of operation-Triple DES-AES-RC4 –RSA. Hash Function-Message Digest algorithm (MD 5)- Secure Hash Algorithm- Diffie-Hellman Key Exchange- Key Management Techniques- Key Distribution- Key Agreement - Elliptic Curve Cryptography - Digital Signatures- Authentication Protocols.

MODULE III CYBER CRIMES AND CYBER SECURITY 9 Hours

Cyber Crime and Information Security – classifications of Cyber Crimes – Tools and Methods – Password Cracking, Keyloggers, Spywares, SQL Injection – Network Access Control – Cloud Security – Web Security – Wireless Security

MODULE IV SECURITY PRACTICE & SYSTEM SECURITY 9 Hours

Authentication applications – Kerberos – X.509 Authentication services - Internet Firewalls for Trusted System: Roles of Firewalls – Firewall related terminology- Types of Firewalls - Firewall designs - SET for E-Commerce Transactions. Intruder – Intrusion detection system – Virus and related threats – Countermeasures – Firewalls design principles – Trusted systems – Practical implementation of cryptography and security.

MODULE V E-MAIL, IP & WEB SECURITY 9 Hours

E-mail Security: Security Services for E-mail-attacks possible through E-mail - establishing keys privacy-authentication of the source-Message Integrity-Non-repudiation-Pretty Good Privacy-S/MIME. IP Security: Overview of IPSec - IP and IPv6-Authentication Header-Encapsulation Security Payload (ESP)-Internet Key Exchange (Phases of IKE, ISAKMP/IKE Encoding). Web Security: SSL/TLS Basic Protocol-computing the keys- client authentication-PKI as deployed by SSL Attacks fixed in v3 – Exportability – Encoding-Secure Electronic Transaction (SET).

TOTAL: 45 HOURS

REFERENCES:

1. *William Stallings, "Cryptography and Network Security: Principles and Practice", Prentice Hall Professional Technical Reference, Fourth Edition. 2004*
2. *Nina Godbole, SunitBelapure, "Cyber Security: Understanding Cyber-crimes, Computer Forensics and Legal Perspectives", First Edition, Wiley India, 2011.*
3. *Alfred J. Menezes, Paul C.VanOorSchot, Scott A.Van Stone, "Handbook Of Applied Cryptography", CRC*
4. *Press, 1996.*
5. *AtulKahate, "Cryptography and Network Security", Tata McGraw-Hill*
6. *Bruce Schneier, "Applied Cryptography: Protocols, Algorithms, and Source Code in C",Second Edition.*
7. *Wiley, John & Sons, Incorporated, October 1995.*
8. *Richard E. Smith, "Internet Cryptography", Addison- Wesley, 1997.*

2302EC503 TRANSMISSION LINES AND WAVEGUIDES

L	T	P	C
3	0	0	3

PREREQUISITE:

2302EC303 - Electromagnetic Fields

COURSE OBJECTIVES:

1. To introduce the various types of transmission lines and its characteristics.
2. To impart technical knowledge in impedance matching using Smith Chart.
3. To illustrate the waveguide Structures propagation in TE, TM and TEM modes
4. To understand the concepts of Rectangular and Circular waveguides
5. To learn the concepts of a Planar transmission lines

COURSE OUTCOMES:

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

CO1: Explain the characteristics of transmission lines and its losses.
CO2: Analyze impedance matching by stubs using Smith Charts.
CO3: Analyze the electromagnetic fields configuration between the parallel plane and general wave behaviors along the uniform guiding structures.
CO4: Comprehend the characteristics of TE and TM waves within a waveguide.
CO5: Understand the basic characteristics of planar transmission line.

COs Vs POs MAPPING:

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2
CO1	3	3	3	3	-	-	-	-	-	-	3	-	3
CO2	3	3	3	3	-	-	-	-	-	-	3	-	3
CO3	3	3	3	3	-	-	-	-	-	-	3	-	3
CO4	3	3	3	3	-	-	-	-	-	-	3	-	3
CO5	3	3	3	3	-	-	-	-	-	-	3	-	3

COURSE CONTENTS:

MODULE I TRANSMISSION LINE THEORY 10 Hours

General solution of transmission line – The two standard forms for voltage and current of a line terminated by an impedance – Physical significance of the equation and the infinite line – Wavelength and velocity of propagation – Waveform distortion – Distortion less transmission line – The telephone cable – Inductance loading of telephone cables – Input impedance of lossless lines – Reflection on a line not terminated by Z_O – Transfer impedance – Reflection coefficient - Reflection factor and reflection loss.

MODULE II THE LINE AT RADIO FREQUENCIES 10 Hours

Standing waves and standing wave ratio on a line – One Eighth wave line – Quarter wave line and impedance matching – The half-wave line – Smith chart – Properties and Applications of the smith chart – Single stub matching and double stub matching.

MODULE III GUIDED WAVES 8 Hours

Waves between parallel planes of perfect conductors – Transverse electric and transverse magnetic waves – Characteristics of TE and TM waves – Transverse electromagnetic waves – Attenuation of TE and TM waves in parallel plane guides –Wave impedances.

MODULE IV RECTANGULAR AND CIRCULAR WAVEGUIDES 9 Hours

Transverse magnetic waves in rectangular wave guides – Transverse electric waves in rectangular waveguides – Characteristics of TE and TM waves – Cutoff wavelength and phase velocity – Impossibility of TEM waves in waveguides – Dominant mode in rectangular waveguide – Attenuation of TE and TM modes in rectangular waveguide – Wave impedance – Characteristic impedance – Excitation of modes.

Bessel functions – Solution of field equations in cylindrical co-ordinates – TM and TE waves in circular

guides –Wave impedances and characteristic impedance – Dominant mode in circular waveguide – Excitation of modes.

MODULE V PLANAR TRANSMISSION LINES 8 Hours

Introduction to Planar transmission lines- Strip line – Microstrip Line: Basic Characteristics - Coplanar Waveguide & Coplanar Strip Line: Basic Characteristics, Slot Line: Basic Characteristics.

TOTAL: 45 HOURS

REFERENCES:

1. *Ryder J. D., "Networks, Lines and Fields", PHI, 2003.*
2. *Jordan E. C. and Balmain K. G., "Electro Magnetic Waves and Radiating System", PHI, 2003.*
3. *Ramo, Whineery and Van Duzer, "Fields and Waves in Communication Electronics", John Wiley, 2003.*
4. *David M. Pozar, "Microwave Engineering", 2nd Edition, John Wiley, 1997.*
5. *David K.Cheng, "Field and WavesinElectromagnetism", Pearson Education, 1989.*
6. *Anand K. Verma ,Introduction To Modern Planar Transmission Lines: Physical, Analytical, and Circuit Models Approach, Wiley – IEEE press , 2021*

2302EC504 VLSI AND CHIP DESIGN

L	T	P	C
3	0	0	3

PREREQUISITE:

2302EC302 – Digital Electronics

COURSE OBJECTIVES:

1. To understand the fundamentals of CMOS fabrication process and CMOS circuits.
2. To study and design combinational logic circuits using various Logic Styles.
3. To provide basic knowledge about sequential logic circuits, memory, clocking and ASIC design.

COURSE OUTCOMES:

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

CO1: Demonstrate CMOS Fabrication process, MOS technology and Layout Design.
CO2: Understand the Combinational logic circuits and design principles
CO3: Understand the sequential circuits, CMOS Memories and clocking strategies.
CO4: Describe the CMOS subsystem design process
CO5: Understand the ASIC design process.

COs Vs POs MAPPING:

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2
CO1	3	3	3	3	-	-	-	-	-	-	3	3	-
CO2	3	3	3	3	-	-	-	-	-	-	3	3	-
CO3	3	3	3	3	-	-	-	-	-	-	3	3	-
CO4	3	3	3	3	-	-	-	-	-	-	3	3	-
CO5	3	3	3	3	-	-	-	-	-	-	3	3	-

COURSE CONTENTS:

MODULE I FABRICATIONOFCMOSICANDPHYSICALDESIGN 9 Hours

An overview of Silicon Semiconductor technology- NMOS fabrication - CMOS fabrication: n-well, P-well - Twin Tub and SOI Process –Layout design rules –Lambda Design Rules Stick Diagrams – VLSI Layout Design-Layout of Basic Structures – CMOS Logic Gates –Implementation of given logic function using CMOS logic.

MODULE II COMBINATIONAL LOGIC CIRCUITS AND DESIGN PROCESS 9 Hours

Examples of combinational logic circuits, Pass Transistor and Transmission Gate, Static CMOS design, Pseudo NMOS–Dynamic CMOS logic, Clocked CMOS logic, Precharged domino log ic- Keeper Circuits - Dual Rail - Cascode voltage Switch Logic, Low power design principles.

MODULE III SEQUENTIAL LOGIC CIRCUITSANDCLOCKING 9 Hours

Sequencing Static Circuits, Conventional CMOS Latches and Flip-Flops, Klass Semi dynamic Flip-Flop (SDFF) –TSPC Latches and FF–Memory architecture - Flash Memory, CMOS Static RAM-Dynamic RAM and CAM- CMOS, Clocking Styles.

MODULE IV ARITHMETIC CIRCUITS AND DIGITAL LOGIC DESIGN 9 Hours

CMOSMux-EqualityDetector-ShiftandRotationOperation–Priorityencoder –Ripple Carry Adder –Carry Look Ahead Adder- Carry Skip Adder-Carry select and Carry save - Adder–Braun /Baugh Wooley- Modified Booth, Encoded Multiplier.

MODULE V ASIC DESIGN 9 Hours

Introduction to ASIC design, Types of ASICS - Full Custom, Semi-Custom, Structured ASICs. Hardware Description Languages (HDLs) for ASIC Design, Introduction to physical design steps - Floor planning, Placement, and Routing Standard Cell Libraries and IP Integration.

TOTAL: 45 HOURS

REFERENCES:

1. *JohnP.Uyemura,"IntroductiontoVLSIcircuitsandsystems",JohnWiley&Sons,2015.*
2. *Neil.H.EWeste, "Kamran Eshranghian principles of CMOS VLSIDesign:ASystemsPerspective",Addison Wesley, 2009.*
3. *KamranEshraghian,DouglasA.Pucknell,"EssentialsofVLSICircuitsandSystems",PrenticeHallofIndia,2015.*
4. *Keng, Lablebick, "CMOSDigitalIntegratedCircuits",TataMcGrawHill,2014.*
5. *Michael J smith, "Application specific integrated circuits", Addison Welsey.*

2303EC001 WEARABLEDEVICES

L	T	P	C
3	0	0	3

PREREQUISITE:

1. Electronics circuits
2. Analog integrated circuits

COURSE OBJECTIVES:

1. To know the hardware requirement of wearable systems
2. To understand the communication and security aspects in the wearable devices
3. To know the applications of wearable devices in the field of medicine

COURSE OUTCOMES:

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

CO1: Describe the concepts of wearable system.
CO2: Explain the energy harvestings in wearable device.
CO3: Use the concepts of BAN in health care.
CO4: Illustrate the concept of smart textile
CO5: Compare the various wearable devices in healthcare system

COs Vs POs MAPPING:

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2
CO1	3	3	3	-	-	-	-	-	-	-	3	2	-
CO2	3	3	3	-	-	-	-	-	-	-	3	2	-
CO3	3	3	3	-	-	-	-	-	-	-	3	2	-
CO4	3	3	3	-	-	-	-	-	-	-	3	2	-
CO5	3	3	3	-	-	-	-	-	-	-	3	2	-

COURSE CONTENTS:

MODULE I INTRODUCTIONTOWEARABLESYSTEMSANDSENSORS 9 Hours

Wearable Systems- Introduction, Need for Wearable Systems, Drawbacks of Conventional SystemsforWearableMonitoring,ApplicationsofWearableSystems,TypesofWearableSystems,ComponentsofwearableSystems.Sensorsforwearablesystems-Inertiamovementsensors,Respirationactivitysensor,InductivePlethysmography,ImpedancePlethysmography,Pneumography,Wearablegroundreactionforcesensor.

MODULE II SIGNAL PROCESSING ANDENERGY HARVESTING FOR WEARABLEDEVICES 9 Hours

Wearability issues -physical shape and placement of sensor, Technical challenges - sensor design, signal acquisition, sampling frequency forreduced energy consumption, Rejection of irrelevant information. Power Requirements- Solar cell, Vibration based, Thermal based, Human body as a heat source for power generation, Hybrid thermoelectric photovoltaic energy harvests,Thermopiles.

MODULE III WIRELESSHEALTHSYSTEMS 9 Hours

Need for wireless monitoring, Definition of Body area network, BAN and Healthcare, TechnicalChallenges-Systemsecurityandreliability,BANArchitecture–Introduction,WirelesscommunicationTechniques.

MODULE IV SMARTTEXTILE 9 Hours

Introduction to smart textile- Passive smart textile, active smart textile. Fabrication Techniques-Conductive Fibres, Treated Conductive Fibres, Conductive Fabrics, Conductive Inks. Case study-smart fabric for monitoring biological parameters-ECG, respiration

MODULE V APPLICATIONSOFWEARABLESYSTEMS **9 Hours**

Medical Diagnostics, Medical Monitoring-Patients with chronic disease, Hospital patients, Elderly patients, neural recording, Gait analysis, Sports Medicine.

TOTAL: 45 HOURS

REFERENCES:

1. *Sandeep K.S, Gupta, Tridib Mukherjee and Krishna Kumar Venkatasubramanian, Body Area NetworksSafety,Security, andSustainability,CambridgeUniversityPress,2013.*
2. *Guang-ZhongYang,BodySensor Networks,Springer,2006.*

2303EC031 FUNDAMENTALS OF NANO-ELECTRONICS L T P C
3 0 0 3

PREREQUISITE:

1. Electronics circuits
2. Electronic Devices

COURSE OBJECTIVES:

1. To understand the concepts of Nano-Electronics and quantum electronics.
2. To understand the concepts of Nano-Electronic devices, transistors, tunneling devices and superconducting devices.
3. To understand the basics of Nanotube devices.

COURSE OUTCOMES:

On successful completion of this course, the student will be able to

CO1: Understand the basics of Nano-Electronics including quantum wires, dots and wells.
CO2: Use the mechanism behind Quantum Electronic devices.
CO3: Understand the basics of Nano-Electronic transistors.
CO4: Analyze the key performance aspects of tunneling and superconducting Nano-Electronic devices.
CO5: Apply the knowledge in the development of Nanotubes and Nanostructure devices.

COs Vs POs MAPPING:

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2
CO1	3	3	2	-	-	-	-	-	-	-	2	2	-
CO2	3	3	3	-	-	-	-	-	-	-	2	2	-
CO3	3	3	3	-	-	-	-	-	-	-	2	2	-
CO4	3	3	2	-	-	-	-	-	-	-	2	2	-
CO5	3	3	3	-	-	-	-	-	-	-	2	2	-

COURSE CONTENTS:

MODULE I INTRODUCTION TO NANO-ELECTRONICS 9 Hours

Scaling to Nano - Light as a wave and particle - Electrons as waves and particles - origin of quantum mechanics - General postulates of quantum mechanics - Time independent Schrodinger wave equation- Electron confinement - Quantum dots, wires and well-Spin and angular momentum

MODULE II QUANTUM ELECTRONICS 9 Hours

Quantum electronic devices - Short channel MOS transistor - Split gate transistor - Electron wave transistor - Electron wave transistor - Electron spin transistor - Quantum cellular automata Quantum dot array, Quantum memory

MODULE III NANO ELECTRONIC TRANSISTORS 9 Hours

Coulomb blockade - Coulomb blockade in Nano capacitors - Coulomb blockade in tunnel junctions - Single electron transistors, Semiconductor nanowire FETs and SETs, Molecular SETs and molecular electronics - Memory cell.

MODULE IV NANO ELECTRONIC TUNNELING AND SUPER CONDUCTING DEVICES 9 Hours

Tunnel effect - Tunneling element -Tunneling diode - Resonant tunneling diode - Three terminal resonant tunneling devices- Superconducting switching devices- Cryotron- Josephson tunneling device.

MODULE V NANOTUBES AND NANOSTRUCTURE DEVICES 9 Hours

Carbon Nanotube - Fullerenes - Types of nanotubes – Formation of Nanotubes –Assemblies – Purification of carbon Nanotubes – Electronic properties – Synthesis of carbon Nanotubes – Carbon Nanotube interconnects – Carbon Nanotube FETs and SETs –Nanotube for memory applications – Nano-structures and Nano-structured devices

TOTAL: 45 HOURS

REFERENCES

1. *Hanson, "Fundamentals of Nanoelectronics", Pearson education, 2009.*
2. *Jan Dienstuhl, Karl Goser, and Peter Glosekotter, "Nanoelectronics and Nanosystems: From Transistors to Molecular and Quantum Devices", Springer-Verlag, 2004.*
3. *Mircea Dragoman and Daniela Dragoman, "Nanoelectronics: Principles and Devices", Artech House, 2009.*
4. *Robert Puers, LivioBaldi, Marcel Van de Voorde and Sebastiaan E. Van Nooten, "Nanoelectronics: Materials, Devices, Applications", Wiley, 2017*
5. *Brajesh Kumar Kaushik, "Nanoelectronics: Devices, Circuits and Systems", Elsevier science, 2018.*

2303EC037 **ANALOG AND DIGTIAL COMMUNICATION** **L T P C**
3 0 0 3

PREREQUISITE:

1. Fundamental Of Physics

COURSE OBJECTIVES:

1. To introduce the concepts of various modulations and their spectral characteristics.
2. To learn Pulse modulation techniques.
3. To understand the various Band pass signaling schemes and spread spectrum techniques.

COURSE OUTCOMES:

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

CO1: Examine the spectrum and methods of generation and detection of AM systems and its types.
CO2: Develop the mathematical model for time domain representation, spectrum and methods of generation and detection of angle modulation systems.
CO3: Apply the concepts of sampling process and determine the characteristics of Pulse Modulation schemes.
CO4: Analyze the performance of different digital modulation /demodulation techniques
CO5: Apply the knowledge on the principle of spread spectrum and synchronization.

COs Vs POs MAPPING:

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2
CO1	3	3	2	-	-	-	-	-	-	-	2	-	2
CO2	3	3	2	-	-	-	-	-	-	-	2	-	2
CO3	3	3	2	-	-	-	-	-	-	-	2	-	2
CO4	3	3	2	-	-	-	-	-	-	-	2	-	2
CO5	3	2	2	-	-	-	-	-	-	-	2	-	2

COURSE CONTENTS:

MODULE I AMPLITUDE MODULATION **9 Hours**

Introduction to communication systems – Modulation – Need for modulation – Classifications of modulation techniques – Amplitude Modulation – Generation and Detection of AM – Transmitters and Receivers of AM –Super heterodyne receiver – Double Side Band Suppressed Carrier (DSBSC) systems - generation and detection – Single Side Band (SSB) systems – SSB-SC generation and detection, Vestigial Side Band (VSB) – Comparison of various AM systems.

MODULE II ANGLE MODULATION **9 Hours**

Frequency modulation: Narrowband and wideband FM – Generation of FM signal: Direct FM, indirect FM – Demodulation of FM signals using detectors – FM transmitters – FM receivers – Phase Modulation – Phase Locked Loop – Comparison of AM,FM and PM.

MODULE III PULSE MODULATION TECHNIQUES **9 Hours**

PAM – PWM – PPM – Comparison of Pulse modulation – Sampling of Band limited signals – Anti aliasing and reconstruction filters - Quantization – Companding - Pulse Code Modulation – Differential pulse code modulation - Delta modulation – Adaptive Delta modulation – Intersymbol Interference – Eye pattern.

MODULE IV PASSBAND DATA TRANSMISSION TECHNIQUES **9 Hours**

Generation, Detection, Representation of signal, Signal constellation diagram, Error probability and Power spectrum of ASK, FSK, BPSK, DPSK, QPSK, MSK, GMSK and QAM coherent schemes – Comparison and BER Analysis.

MODULE V SYNCHRONIZATION AND SPREAD SPECTRUM TECHNIQUES **9 Hours**

Importance of Synchronization – Carrier, frame and symbol/Chip synchronization techniques, Spread Spectrum- PN Sequence code and properties – Direct Sequence and Frequency Hopping Spread Spectrum Systems –Processing gain and Jamming Margin – Multiple access techniques TDMA – FDMA – CDMA

TOTAL: 45 HOURS

REFERENCES:

1. *Simon Haykin, "Communication Systems" John Wiley &Sons, 4th Edition, 2016.*
2. *J.G. Proakis, "Digital Communications" McGraw Hill, 5th edition, 2007*
3. *B.P. Lathi, "Communication Systems" BS Publication-2004.*
4. *V.Chandrasekar, "Analog communication", Oxford University press, 2010*
5. *Bernard Sklar, "Digital Communication", 2nd Edition, Pearson Education, 2006.*
6. *Nptel link: https://nptel.ac.in/courses/117/105/117105143*
7. *Nptel link : https://onlinecourses.nptel.ac.in/noc20_ee17/course*

2303EC040 GENERATIONS OF COMMUNICATION TECHNOLOGY

L	T	P	C
3	0	0	3

PREREQUISITE:

1. Fundamental Of Physics

COURSE OBJECTIVES:

1. To impart the fundamentals concepts of wireless communication systems.
2. To introduce various technologies and protocols involved in wireless cellular communication.
3. To differentiate the concepts of various generations in wireless cellular communication technology.

COURSE OUTCOMES:

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

CO1: Explain the evolution and concept of 1G communication technology
CO2: Summarize the concept of 2G concept and architecture of cellular networks.
CO3: Describe the 3G communication technology, concept and architecture.
CO4: Elucidate the 4G networks and architecture
CO5: Compare the different generations in communication.

COs Vs POs MAPPING:

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2
CO1	2	2	3	-	-	-	-	-	-	-	2	-	2
CO2	3	3	3	-	-	-	-	-	-	-	2	-	3
CO3	3	3	3	-	-	-	-	-	-	-	2	-	3
CO4	3	3	3	-	-	-	-	-	-	-	3	-	3
CO5	3	3	3	-	-	-	-	-	-	-	3	-	3

COURSE CONTENTS:

MODULE I 1G EVOLUTIONS **9 Hours**

History of Wireless Cellular Technology, Radio Communication, Concept of Cellular Radio System, Antenna used in 1G, Security measures in 1G, Advantages and Disadvantages in First Generation.

MODULE II 2G EVOLUTIONS **9 Hours**

Review of cellular standards, Migration and Advancement of GSM Architecture and CDMA Architecture, WLAN – IEEE 802.11 and HIPERLAN, Bluetooth.

MODULE III 3G EVOLUTIONS **9 Hours**

IMT-2000 - W-CDMA, CDMA 2000 – Radio & Network components, Network structure, Packet-data transport process flow, Channel Allocation, Core network, Interference-Mitigation techniques, UMTS-services, Air Interface, Network Architecture of 3GPP, UTRAN – Architecture, High Speed Packet Data-HSDPA, HSUPA.

MODULE IV 4G EVOLUTION **9 Hours**

Introduction to LTE-A – Requirements and Challenges, Network architectures – EPC, E-UTRAN architecture - Mobility management, Resource management, Services, Channel-Logical and Transport channel mapping, Downlink/Uplink data transfer, MAC control element, PDU packet formats, Scheduling services, Random access procedure.

MODULE V 5G EVOLUTIONS **9 Hours**

Introduction, Need for 5G, Evolution of 5G, Comparison of different generations, QoS, 5G network architecture, Future enhancement.

TOTAL: 45 HOURS

REFERENCES:

1. *KavehPahlavan, "Principles of wireless networks", Prentice-Hall of India, 2008*
2. *A.F.Molisch, Wireless Communications, Wiley, 2005.*
3. *T.S.Rappaport, Wireless Communications: Principles and Practice, Second Edition, Pearson Education / Prentice Hall of India, Third Indian Reprint 2003.*
4. *Vijay K.Garg, "Wireless Network Evolution- 2G & 3G" Pearson, 2013.*
5. *K. Daniel Wong, "Fundamentals of Wireless Communication Engineering Technologies" Wiley, 2012.*
6. *P.MuthuChidambara Nathan, Wireless Communications, PHI, 2008*
7. *A.Goldsmith, Wireless Communications, Cambridge University Press, 2005.*

2302EC551 COMMUNICATION SYSTEMS LABORATORY

L	T	P	C
0	0	2	1

PREREQUISITE:

1. 2302EC453 - Electronic Circuits Lab

COURSE OBJECTIVES:

To equip students with various issues related to analog and pulse communication
To design a Passband Modulation Techniques.
To generate different channel codes.

COURSE OUTCOMES:

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

CO1: Design and Analyze analog modulation Techniques.
CO2: Design pulse modulation Techniques (PWM.PPM).
CO3: Design and Analyze Passband modulation Techniques.
CO4: Simulate Analog and Digital modulation Techniques.
CO5: Simulate Error control and PN Sequence Generation Techniques.

COs Vs POs MAPPING:

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2
CO1	3	3	3	3	-	-	-	3	-	3	2	-	3
CO2	3	3	3	3	-	-	-	3	-	3	2	-	3
CO3	3	3	3	3	-	-	-	3	-	3	2	-	3
CO4	3	3	3	3	3	-	-	3	-	3	2	-	3
CO5	3	3	3	3	3	-	-	3	-	3	2	-	3

LIST OF EXPERIMENTS:

1.	Amplitude Modulation and Demodulation	**2 Hours**
2.	Frequency Modulation and Demodulation	**2 Hours**
3.	Sampling and Reconstruction	**2 Hours**
4.	Time Division Multiplexing	**2 Hours**
5.	Pulse Code Modulation / Delta Modulation	**2 Hours**
6.	Generation of PWM/ PPM signals	**2 Hours**
7.	Passband Modulation and Demodulation : BPSK and BFSK	**2 Hours**
8.	Line Coding and Decoding Techniques	**2 Hours**
9.	Study of wireless Communication system using USRP/Deep Radio	**2 Hours**

Simulation using MATLAB

1.	Analog Modulation	**2 Hours**
2.	Passband Digital Modulation	**2 Hours**
3.	Pre-emphasis and De-emphasis	**2 Hours**
4.	Frequency Division Multiplexing	**2 Hours**
5.	Error control Coding Techniques	**2 Hours**
6.	PN Sequence Generation	**2 Hours**

TOTAL: 30 HOURS

REFERENCES:

1. *Simon Haykins, Communication Systems John Wiley & Sons 4th Edition, 2016.*
2. *K. Sam Shanmugam, Analog and Digital Communication, Wiley, 2005.*
3. *H. Taub and D. L. Schilling, Principles of Communication Systems, 4th edition, McGraw Hill, 2017.*
4. *George Kennedy and Bernard Davis," Electronic Communication systems", 6th Edition, TMH, 2017.*

2302EC552 VLSI AND CHIP DESIGN LABORATORY

L	T	P	C
0	0	2	1

PREREQUISITE:

2302EC351 - Digital Electronics Laboratory

COURSE OBJECTIVES:

1. To design, develop and simulate the digital circuits with Verilog HDL.
2. To apply concepts and methods of Digital system design using HDL/FPGA.
3. To understand the fundaments principles of VLS.I design in digital domain.
4. To understand the fundaments principles of VLSI design in analog domain.
5. To provide hands on design experience with EDA platforms.

COURSE OUTCOMES:

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

CO1: Write HDL code for basic as well as advanced digital integrated circuits.
CO2: Import the logic modules into FPGA boards.
CO3: Synthesize place and route the digital Intellectual properties.
CO4: Design, simulate and extract the layouts of Digital & Analog IC blocks using EDA tools
CO5: Test and verification IC design.

COs Vs POs MAPPING:

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2
CO1	3	3	3	3	3	-	-	3	-	3	3	3	-
CO2	3	3	3	3	3	-	-	3	-	3	3	3	-
CO3	3	3	3	3	3	-	-	3	-	3	3	3	-
CO4	3	3	3	3	3	-	-	3	-	3	3	3	-
CO5	3	3	3	3	3	-	-	3	-	3	3	3	-

LIST OF EXPERIMENTS:

1. Design of basic combinational and sequential circuits using HDL. Simulate it using Xilinx/ Altera software. **1Hours**
2. Design an adder; subtractor using HDL. Simulate it using Simulate it using Xilinx / Altera software. **1Hours**
3. Design and implement shift register using HDL. Simulate it using Xilinx / Altera software. **1Hours**
4. Design 3 bit synchronous up/down counter using HDL. Simulate it using Xilinx / Altera software and implement it by Xilinx/Altera FPGA **2Hours**
5. Design 4 bit synchronous up/down counter using HDL. Simulate it using Xilinx / Altera software and implement it by Xilinx/Altera FPGA **3Hours**
6. Design and simulate CMOS basic gates; Flipflops. Generate Manual/ Automatic layout. **1Hours**
7. Design 4 bit synchronous up/down counter using a Flipflop. Simulate it using Xilinx / Altera software and generate manual/ automatic layout. **1Hours**
8. Design and simulate basic common source, common gate and common drain amplifiers. **1Hours**
9. Design and simulate differential amplifier using EDA tool. **1Hours**
10. Design and simulate CMOS inverting amplifier using EDA tool. **3 Hours**

TOTAL: 30 HOURS

REFERENCES:

1. *E.Fabricious,"IntroductiontoVLSIDesign",1st Edition,McGrawHill,2014.*
2. *Neil.H.EWesteDavidHarris,"CMOSVLSIDesign:ACircuitsandSystemsPerspective", 4th Edition,PearsonAddisonWesley,2015.*
3. *KamranEshraghian,DouglasA.Pucknell,"EssentialsofVLSICircuitsandSystems",PrenticeHallofIndia, 2015.*
4. *JohnP.Uyemura,"IntroductiontoVLSIcircuits andsystems",JohnWiley&Sons,2015.*