



SATHYABAMA

**INSTITUTE OF SCIENCE AND TECHNOLOGY
(DEEMED TO BE UNIVERSITY)**

Accredited "A" Grade by NAAC | 12B Status by UGC | Approved by AICTE

www.sathyabama.ac.in

SCHOOL OF ELECTRICAL AND ELECTRONICS

Minutes of Board of Studies Meeting held on 7th May 2022

(Virtual Meeting conducted on Zoom Platform (Time: 10.30 a.m. to 12 noon))

- Dr.N.M.Nandhitha, Prof. & Dean School of Electrical and Electronics started the meeting by welcoming both the external and the internal members to the Board of Studies meeting (07.05.2022, 10.00 a.m. to 12.00 noon)
- Dr.T.Ravi, Head, Dept. of Electronics and Communication Engineering informed the board that core competencies are identified from the feedback obtained from the students, faculty, Alumni and employers.
- Dr.P.Kavipriya presented the revision carried out in the course Machine Learning Techniques. Dr.M.D.Selvaraj Associate Professor, IIITDM accepted the changes and suggested to include topics such as Occam learning, accuracy and confidence boosting.
- Dr.E.Annadevi suggested to introduce 'IoT in Logistics Sector' in the course IoT for Real Time Application. Dr.N.Sivakumaran Prof.,NIT, Tiruchy accepted the inclusion and also suggested to include Healthcare monitoring Technique for Diabetes Patients.
- Dr.P.Chitra suggested to include the topics 'Machine learning, Artificial neural networks and deep Architectures' in the course Digital Image Processing for Real Time Applications. Dr.Sugudev presented the syllabus revision carried in the course Wireless Communication. Dr.N.Shivakumaran accepted the changes for both the courses.
- Having discussed the revisions in the existing courses, faculty then presented the syllabus for the new courses. Dr.T.Ravi presented the syllabus 'Graphical Programming for Engineers', 'Augmented Reality and Virtual Reality', 'Advanced Electronic Test Engineering' and 'Industry 5.0 for Electronics Engineers' for UG courses. The new syllabus introduced for PG 'Artificial Intelligence for Industrial Applications' and 'Strategies in Industry 5.0' is also briefed by HOD. Dr.M.D.Selvaraj accepted the syllabus for all the courses.

BoS members are happy that the new and the revised courses enhance employability/Entrepreneurship/Skills of the students.

EXTERNAL MEMBERS:

1. Dr.N.Sivakumaran
2. Dr.M.D.Selvaraj
3. Mr.J.Visweswaran

INTERNAL MEMBERS:

1. Dr.N.M.Nandhitha *me*
2. Dr.T.Ravi *Oh*
3. Dr.P.Chitra *Purita*
4. Dr.S.Barani *Barani*
5. Dr.S.Poornapushpakala. *Skanda*
6. Dr.M.Sumathi *Sum*
7. Dr.S.Lakshmi *lenu*
8. Dr.P.Kavipriya *P*
9. Mr M Sugadev *msug*
10. Ms.E.Anna Devi *E Anna*
11. Ms.S.Yogalakshmi *yoga*



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SCHOOL OF ELECTRICAL AND ELECTRONICS

Minutes of Board of Studies Meeting held on 26th NOVEMBER 2021

(Virtual Meeting conducted on Zoom Platform (Time: 10.30 a.m. to 12 noon))

- Dr.N.M.Nandhitha, Prof. & Dean School of Electrical and Electronics started the meeting by welcoming both the external and the internal members to the Board of Studies meeting (26.11.2021, 10.00 a.m. to 12.00 noon)
- Dr.T.Ravi, Head, Dept. of Electronics and Communication Engineering informed the board that core competencies are identified from the feedback obtained from the students, faculty, Alumni and employers.
- Dr.I.Rexlin sheeba proposed to include Signalling System R2, SS7 Layers and its Protocol topic in Telecommunication and switching System. Dr.M.D.Selvaraj Associate Professor, IIITDM accepted the changes and suggested to include topics such as Techniques to improve the Quality of service, Format, Protocol in multicast and IETF Data Tracker.
- Dr.V.VijayaKumar suggested to introduce 'sensor and actuators for IoT Application' in the course Measurement and Instrument. Dr.N.Sivakumaran Prof.,NIT, Tiruchy accepted the inclusion and also suggested to introduce infrared sensors.
- Dr.M.Sumathi suggested to include the topics 'Realizing application in FPGA' in the course Programming in HDL. Dr.N.Shivakumaran accepted the changes.
- Having discussed the revisions in the existing courses, faculty then presented the syllabus for the new courses. Dr.P.Chitra presented the syllabus Deep Learning for Computer Vision and Real-time System Design. Dr.M.D.Selvaraj accepted the syllabus for both the courses.
- Dr.M.Sugadev presented the syllabus for Digital System Design and Verification using System Verilog. Dr.N.Sivakumaran suggested to include Real Time implementation topic in the syllabus.

BoS members are happy that the new and the revised courses enhance employability/ Entrepreneurship/Skills of the students.

EXTERNAL MEMBERS:

1. Dr.N.Sivakumaran
2. Dr.M.D.Selvaraj
3. Mr.J.Visweswaran

INTERNAL MEMBERS:

1. Dr.N.M.Nandhitha *me*
2. Dr.T.Ravi *oh*
3. Dr.P.Chitra *Pulite*
4. Dr.S.Barani *Balu*
5. Dr.S.Poornapushpakala. *Shesha*
6. Dr.M.Sumathi *Sam*
7. Dr.S.Lakshmi *lenu*
8. Dr.P.Kavipriya *B*
9. Mr M Sugadev *msug*
10. Ms.E.Anna Devi *E. Anna*
11. Ms.S.Yogalakshmi *yoga*

SECA3002 (OLD)	TELECOMMUNICATION SYSTEMS AND SERVICES	L	T	P	Credits	Total Marks
		3	0	0	3	100

COURSE OBJECTIVES

- To introduce the history and the terms of telecommunication systems.
- To study the various signalling techniques used in the telecommunication system.
- To acquire knowledge on traffic in telecommunication systems.
- To introduce the service engineering and the protocols used in telecommunication services.
- To study the various impairments in telecommunication

UNIT 1 FUNDAMENTALS OF TELECOMMUNICATION

9Hrs.

Switching system functions – strowger switching system – cross bar exchange – SPC exchange-End users, nodes and connectivity, telephone numbering and Routing, use of Tandem switches in Local area connectivity, Busy Hour and Grade of Service, Simplex, Half duplex and full duplex, One-way and two-way circuits, Network topologies, **variations in traffic flow, quality of service.**

UNIT 2 SIGNALLING IN TELECOMMUNICATION SYSTEMS

9Hrs.

Introduction, purpose of signalling, Defining the functional areas-supervisory signalling, address signalling and Call Progress-audio and visual. Signalling techniques - conveying signalling information, evolution of signalling subscriber call progress tones and push button codes, compelled signalling, concepts of Link-by-link and end-to-end signalling, effects of numbering on signalling, associated and disassociated channel signalling, signalling in the subscriber loop-**background and purpose, functional signalling, Object-oriented signalling.**

UNIT 3 TRAFFIC ENGINEERING

9Hrs.

Network traffic load and parameters-Unit of Traffic-Erlang, Centum call second-Grade of Service and blocking probability- Modelling the switching systems, Blocking Models and Loss Estimate-Lost calls cleared system, lost calls returned system, lost calls Held system, Delay Systems.

UNIT 4 TELECOMMUNICATION SERVICES ENGINEERING

9Hrs.

Introduction, definition for service and service engineering. Telecommunication services engineering- Telecommunication services on broadband networks-basics of ATM, connection oriented and connectionless services.

UNIT 5 QUALITY OF SERVICE AND TELECOMMUNICATION IMPAIRMENTS

9Hrs.

QoS (voice, data and image) - signal-to-noise ratio, voice transmission, data circuits, video. Basic impairments – amplitude distortion, phase distortion and noise. Level- typical levels, echo and singing. QoS issues in video transmission- problems and solutions. Protocols for QoS support for audio and video applications - RSVP applications, Real-Time Streaming Protocol Applications and Active Streaming Format, Internet **stream protocol(version2) , IP Multicast.**

Max.45Hrs.

COURSE OUTCOMES

On completion of the course, student will be able to

CO1-Analyze various terminologies of the telecommunication systems.

CO2-Analyze the classical signalling with the advanced signalling techniques in telecommunication systems

CO3-Apply the Supporting protocols for various applications.

CO4-Implement and regulate the performance of telecommunication networks using various models

CO5-Analyze and predict the importance of Service engineering.

CO6-Develop the impairments in telecommunication systems

TEXT/REFERENCEBOOKS

1. Roger L. Free man, “FundamentalsofTelecommunications”,4thEdition, JohnWiley&Sons,2010.
2. JyrkiJ.Penttinen,” The Telecommunications Handbook: Engineering Guidelines for Fixed, Mobile and Satellite Systems”,1st Edition, Wiley,2015.
3. Thiagarajan Viswanathan, Mana Bhatnagar,” Telecommunication Switching Systems and Networks”,2nd Edition, PHIlearning,2015.

SECA3025 (Revised)	TELECOMMUNICATION SYSTEMS AND SERVICES	L	T	P	Credits	Total marks
		3	0	0	3	100
Pre requisite: Nil		Co Requisite: Nil				
Course Objectives - To introduce the history and the terms of telecommunication systems. - To study the various signalling techniques used in the telecommunication system. - To acquire knowledge on traffic in telecommunication systems. - To introduce the service engineering and the protocols used in telecommunication services. - To study the various impairments in telecommunication						
UNIT	CONTENTS					HOURS
I	FUNDAMENTALS OF TELECOMMUNICATION Models of telecommunication system. The concept of information volume. Characteristics of analogue audio and video signals. Analogue modulations and their implementations: amplitude and angle modulation, Frequency Division Multiplexing, switching system functions – strowger switching system – cross bar exchange – SPC exchange-End users, nodes and connectivity, telephone numbering and Routing, use of Tandem switches in Local area connectivity, Busy Hour and Grade of Service, Simplex, Half duplex and full duplex, One-way and two-way circuits, Network topologies.					9
II	SIGNALLING IN TELECOMMUNICATION SYSTEMS Introduction, purpose of signalling, Defining the functional areas-supervisory signalling, address signalling and Call Progress-audio and visual. Signalling techniques - conveying signalling information, evolution of signalling subscriber call progress tones and pushbutton codes, compelled signalling, concepts of Link-by-link and end-to-end signalling, effects of numbering on signalling, associated and disassociated channel signalling, signalling in the subscriber loop, Signalling System R2, SS7 Layers and its Protocol. Synchronous digital hierarchy. Multiplexing PDH signals into SDH STM-1 transport module					9
III	TRAFFIC ENGINEERING Network traffic load and parameters-Unit of Traffic -Erlang, Centum call second-Grade of Service and blocking probability- Modeling the switching systems, Blocking Models and Loss estimate- Lost calls cleared system, lost calls returned system, lost calls Held system, Delay Systems					9
IV	TELECOMMUNICATION SERVICES ENGINEERING Introduction, definition for service and service engineering. Telecommunication services engineering-Telecommunication services on broad band networks- basics of ATM, connection oriented and connectionless services.					9
V	QUALITY OF SERVICE AND TELECOMMUNICATION IMPAIRMENTS QoS (voice, data and image)-signal-to-noise ratio, voice transmission, data circuits, video. Basic impairments-amplitude distortion, phase distortion and noise. Level- typical levels, echo and singing. QoS issues in video transmission- problems and solutions. Protocols for QoS support for audio and video applications - RSVP applications, Real-Time Streaming Protocol					9

	Applications and Active Streaming, Techniques to improve the Quality of service, Format, Protocol in multicast, IETF Data Tracker.	
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Maximum Hours: 45

Course Outcomes

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

CO1 – Analyse the terminologies, and various modulation techniques in telecommunication systems.
CO2-Analyze the classical signalling with the advanced signalling techniques in telecommunication systems.

CO3 - Apply the Supporting protocols and to implement various applications.

CO4 -Implement and regulate the performance of telecommunication networks using various models

CO5 – Analyse and predict the importance of Service engineering.

CO6 - Develop the impairments and quality of service in telecommunication systems.

TEXT/REFERENCEBOOKS

1. Roger L. Freeman, “Fundamentals of Telecommunications”, 4th Edition, John Wiley & Sons, 2010.
2. Jyrki T. J. Penttinen,” The Telecommunications Handbook: Engineering Guidelines for Fixed, Mobile and Satellite Systems”, 1st Edition, Wiley, 2015.
3. Thiagarajan Viswanathan, Manav Bhatnagar,” Telecommunication Switching Systems and Networks”, 2nd Edition, PHI learning, 2015.

		L	T	P	Credits	TotalMarks
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SEIA3001 (OLD)	Measurements and Instrumentation	3	0	0	3	100
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COURSE OBJECTIVES

- To learn about various measurement concepts.
- To learn about signal generators and signal analysers.
- To know about the data acquisition systems.
- To know about the measurement in optical domain.

UNIT 1 BASIC MEASUREMENT

9

Hrs.

Measurement systems – Static and dynamic characteristics – units and standards of measurements – error :- accuracy and precision, types, statistical analysis – moving coil, moving iron meters – Electrodynamo meter type wattmeter- Energy meter multimeters – Bridge measurements : – Maxwell, Hay, Schering, Anderson and Wien bridge

UNIT 2 BASIC ELECTRONIC MEASUREMENTS 9 Hrs.

Electronic multimeters – Cathode ray oscilloscopes – block schematic – applications – special oscilloscopes - delayed time base oscilloscopes, analog and digital storage oscilloscope, sampling oscilloscope – Q meters – Vector meters – RF voltage and power measurements – True RMS meters.

UNIT 3 SIGNAL GENERATORS AND ANALYZERS

9

Hrs.

Function generators – pulse and square wave generators, RF signal generators –Sweep generators – Frequency synthesizer – wave analyzer – Harmonic distortion analyzer–spectrum analyzer :- digital spectrum analyzer, Vector Network Analyzer – Digital L,C,R measurements, Digital RLC meters

UNIT 4 DIGITAL INSTRUMENTS

9

Hrs.

Comparison of analog and digital techniques – digital voltmeter – multimeters – frequency counters – measurement of frequency and time interval – extension of frequency range – Automation in digital instruments, Automatic polarity indication, automatic ranging, automatic zeroing, fully automatic digital instruments, Computer controlled test systems, Virtual instruments.

UNIT 5 ACQUISITION MEASUREMENT SYSTEMS AND FIBER OPTIC DATA

9 Hrs.

Elements of a digital data acquisition system – interfacing of transducers – multiplexing – data loggers –computer controlled instrumentation – IEEE 488 bus – fiber optic measurements for power and system loss – optical time domains reflectometer.

Max.45 Hrs.

COURSE OUTCOMES

On completion of the course, student will be able to

CO1 - Understand the basics of measurement system.

CO2 - Design a measuring instrument and study about various oscilloscopes.

CO3 - Choose proper method for analysing the signals using signal generators. CO4 - Identify the latest technology for modern digital instruments.

CO5 - Evaluate the various digital measurement techniques.

CO6 - Develop a data acquisition system and measurement system.

TEXT / REFERENCE BOOKS

1. Albert D.Helfrick and William D.Cooper, "Modern Electronic Instrumentation and Measurement Techniques", Pearson / Prentice Hall of India, 2007.
2. Ernest O. Doebelin, "Measurement Systems- Application and Design", TMH, 2007.
3. Joseph J.Carr, "Elements of Electronics Instrumentation and Measurement", Pearson Education, 2003.
4. Alan S. Morris, "Principles of Measurements and Instrumentation", 2nd Edition, Prentice Hall of India, 2003.
5. David A. Bell, "Electronic Instrumentation and measurements", Prentice Hall of India Pvt. Ltd., 2003.
6. B.C. Nakra and K.K. Choudhary, "Instrumentation, Measurement and Analysis", 2nd Edition, TMH, 2004.
7. James W. Dally, William F. Riley, Kenneth G. McConnell, "Instrumentation for Engineering Measurements", 2nd Edition, John Wiley, 2003.

ENDSEMESTEREXAMINATIONQUESTIONPAPERPATTERN

SEIA3014	MEASUREMENTS AND INSTRUMENTATION	L	T	P	Credits	Total marks
		3	0	0	3	100
Pre requisite: Nil		Co Requisite: Nil				
Course Objectives - To learn about various measurement concepts. - To learn about various types of instruments. - To know about the data acquisition systems. - To know about the sensors and actuators in IoT applications.						
UNIT	CONTENTS					HOURS
I	BASIC MEASUREMENT Methods of Measurement, Measurement System, Classification of instrument system, Functional Elements of measurement system –Characteristics of instruments: Static and Dynamic characteristic - Types of errors - sources of errors - methods of elimination- Analysis of data - Limiting errors - Relative limiting error - Combination of Quantities with limiting errors - Statistical treatment of data: Histogram, Mean, Measure of dispersion from the mean, Range, Deviation, Average deviation, Standard Deviation, Variance-Calibration and Standards - Process of Calibration.					9
II	ANALOG MEASUREMENTS Measurement of Voltage and Current: PMMC and PMMI – Measurement of Voltmeter ammeter method, Ammeter voltmeter method, Electro-dynamic wattmeter - Low power factor wattmeter Power, Energy - Measurement of Passive Components: DC and AC Bridges.					9
III	DIGITAL INSTRUMENTS Comparison of analog and digital techniques – Digital L,C,R measurements, Digital RLC meters -digital voltmeter – multimeters – frequency counters – measurement of frequency and time interval – extension of frequency range – Automation in digital instruments, Automatic polarity indication, automatic ranging, automatic zeroing, fully automatic digital instruments, Computer controlled test systems, Virtual instruments					9
IV	SENSORS AND ACTUATORS FOR INTERNET OF THINGS Sensors for measurement of Temperature, Humidity, Pressure, Gas, Level Sensor – Accelerometer – Gyroscope – Proximity Sensors – Optical Sensors – Infrared Sensors – Electrical Actuators.					9
V	ACQUISITION MEASUREMENT SYSTEMS AND FIBER OPTIC DATA Elements of a digital data acquisition system – interfacing of transducers – multiplexing – data loggers –computer-controlled instrumentation – IEEE 488 bus – fiber optic measurements for power and system loss – optical time domains reflectometer.					9

COURSE OUTCOMES

On completion of the course, student will be able to

CO1 – Apply statistical analysis for a measurement data.

CO2 – Apply suitable instruments for specific applications.

CO3 – Identify the latest technology for modern digital instruments.

CO4 – Choose appropriate sensors and actuators for specific IoT applications.

CO5 - Design a data acquisition system and measurement system.

CO6 - Develop a measurement system for real - time applications.

TEXT / REFERENCE BOOKS

1. Albert D.Helfrick and William D.Cooper, "Modern Electronic Instrumentation and Measurement Techniques", Pearson / Prentice Hall of India, 2007.
2. Ernest O. Doebelin, "Measurement Systems- Application and Design", TMH, 2007.
3. Joseph J.Carr, "Elements of Electronics Instrumentation and Measurement", Pearson Education, 2003.
4. Alan. S. Morris, "Principles of Measurements and Instrumentation", 2nd Edition, Prentice Hall of India, 2003.
- 5.David A. Bell, "Electronic Instrumentation and measurements", Prentice Hall of India Pvt Ltd, 2003.
6. B.C. Nakra and K.K. Choudhry, "Instrumentation, Measurement and Analysis", 2nd Edition, TMH, 2004.
7. James W. Dally, William F. Riley, Kenneth G. McConnell, "Instrumentation for Engineering Measurements", 2nd Edition, John Wiley, 2003.

SECA1602 (OLD)	PROGRAMMING IN HDL	L	T	P	Credits	TotalMarks
		3	0	0	3	100

COURSE OBJECTIVES

- To focus on the basic concept of VHDL and Verilog HDL
- To introduce the style of modeling in VHDL and Verilog HDL
- To focus advanced features of Verilog HDL
- To outline the formal procedures for testing and verification of HDL
- To introduce the design of switch level modeling and high level architecture

UNIT1 BASIC CONCEPTS IN VHDL

9Hrs.

Digital system design process - Hardware simulation - Introduction to VHDL - Language elements of VHDL - Data objects - Data types - Operators - Signal assignments - Inertial delay mechanism - Transport delay mechanism - Variable assignments - Concurrent and Sequential assignments- Delta delay.

UNIT2 MODELING IN VHDL

9Hrs.

Data flow modeling - Concurrent Signal Assignment statements - Structural modeling - Component declaration - Component Instantiation - Behavioral modeling - Process statement - wait statement - Conditional and loop statements - Generics and configurations - Examples for modeling.

UNIT3 INTRODUCTION TO VERILOG HDL

9Hrs.

Basic concepts - Levels for design description - Module - Delays - Language elements - Compiler directives - value set - data types - Parameters - Expressions - Operands - operators in Verilog HDL.

UNIT4 STYLES OF MODELING

9Hrs.

Gate level modeling -Primitive Gates- Multiple input and multiple output gates - User Defined Primitives - Combination UDP - Sequential UDP- Data flow modeling - Behavioral modeling - procedural constructs - procedural assignments - conditional and loop statements - Structural Modeling - Examples for modeling.

UNIT5 FEATURES IN VERILOG HDL

9Hrs.

Tasks- Functions -systems tasks and functions - Verification - Modeling a test bench - timing and delays - Switch level modeling - state machine modeling - Moore FSM – Me lay FSM - Design of memories - Design of microcontroller CPUs.

Max:45Hrs.

COURSEOUTCOME

On completion of the course, student will be able to

On completion of the course, student will be able to

CO1 – Infer the needs of VHDL and Verilog HDL design flow.

CO2 – Interpret the Verilog language elements and its relevance to digital design

CO3 – Articulate different Modelling in HDL for Simulation, Synthesis and Test Bench Creation.

CO4 – Categorize the characteristics of Combinational and Sequential logic design using HDL.

CO5 – Evaluate and validate the digital logic circuits by State Machines.

CO6 – Design and verify the digital logic circuits in FPGA's.

TEXT/REFERENCE BOOKS

- 1 J.Bhaskar, "A VHDL Primer", Prentice Hall of India Limited. 3rd edition 2004
- 2 Stephen Brown, "Fundamental of Digital logic with Verilog Design", 3rd edition, Tata McGraw Hill, 2008
- 3 J.Bhaskar, "A Verilog HDL Primer", Prentice Hall of India Limited. 3rd edition 2004
- 4 Samir Palnitkar "Verilog HDL: A Guide to Digital Design and Synthesis", Star Galaxy Publishing; 3rd edition, 2005
- 5 Michael D Ciletti - Advanced Digital Design with VERILOG HDL, 2nd Edition, PHI, 2009.
- 6 Z Navabi - Verilog Digital System Design, 2nd Edition, McGraw Hill, 2005.

SECA1605	PROGRAMMING IN HDL	L	T	P	Credits	Total marks
		3	0	0	3	100
Pre requisite: Digital Logic Circuits			Co Requisite: Nil			
Course Objectives ● To focus on the basic concept of VHDL and Verilog HDL ● To introduce the style of modeling in VHDL and Verilog HDL ● To focus advanced features of Verilog HDL ● To outline the formal procedures for testing and verification of HDL ● To introduce the design of switch level modeling and high level architecture						
UNIT	CONTENTS					HOURS
I	CONCEPTS IN VHDL Introduction to VHDL - Language elements of VHDL -Concurrent and Sequential assignments -Data flow modeling - Concurrent Signal Assignment statements – Structural modeling - Component declaration - Component Instantiation - Behavioral modeling - Process statement - Examples for VHDL modeling.					9
II	INTRODUCTION TO VERILOG HDL Basic concepts - Levels for design description - Module - Delays - Language elements - Compiler directives – value set - data types - Parameters - Expressions - Operands - operators in verilog HDL.					9
III	STYLES OF MODELING Gate level modeling -Primitive Gates- Multiple input and multiple output gates – User Defined Primitives - Combination UDP - Sequential UDP- Data flow modeling – Behavioral modeling - procedural constructs – procedural assignments - conditional and loop statements - Structural Modeling - Examples for modeling.					9
IV	FEATURES IN VERILOG HDL Tasks- Functions -systems tasks and functions - Verification - Modeling a test bench – timing and delays -Switch level modeling - state machine modeling - Moore FSM - Melay FSM - Design of RAM, ROM.					9
V	REALIZING APPLICATIONS IN FPGA FPGA Design Flow - Architecture of Xilinx Artix7 FPGA - Configurable Logic Blocks (CLB)- Slice Description- LUT - Storage element - Programmable Interconnect - Internal Hard macros - Realizing applications in FPGA - combinational functions - N-bit functions, Encoder, Decoders - Sequential functions - N-bit register, shift registers, up/down counters- N-bit processor. Case Study: study of protocols I2C, SPI and UART.					9

Maximum Hours: 45

Course Outcomes

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

CO1 – Infer the needs of VHDL and Verilog HDL design flow.

CO2 – Interpret the Verilog language elements and its relevance to digital design

CO3 – Articulate different Modelling in HDL for Simulation, Synthesis and Test Bench Creation.

CO4 – Categorize the characteristics of Combinational and Sequential logic design using HDL.

CO5 – Evaluate and validate the digital logic circuits by State Machines.

CO6 – Design and verify the digital logic circuits in FPGA's.

TEXT / REFERENCE BOOKS

1. J.Bhaskar, "A VHDL Primer", Prentice Hall of India Limited. 3rd edition 2004
2. Stephen Brown, "Fundamental of Digital logic with Verilog Design", 3rd edition, Tata McGraw Hill, 2008
3. J.Bhaskar, "A Verilog HDL Primer", Prentice Hall of India Limited. 3rd edition 2004
4. Samir Palnitkar "Verilog HDL: A Guide to Digital Design and Synthesis", Star Galaxy Publishing; 3rd edition, 2005
5. Michael D Ciletti - Advanced Digital Design with VERILOG HDL, 2nd Edition, PHI, 2009.
6. Z Navabi - Verilog Digital System Design, 2nd Edition, McGraw Hill, 2005.

SEC1629	IoT FOR REAL TIME APPLICATIONS	L	T	P	Credits	Total marks
		2	0	2	3	100
Pre requisite: NIL		Co Requisite: NIL				
Course Objectives - To design products related to IoT based Health care applications - To design IoT enable smart cities considering various energy harvesting techniques - To develop IoT based system for supporting farmers and agriculture - To develop IoT based system for industrial automation - To analyze various IoT based system considering societal benefits - To develop an IoT based wearable device for measuring physiological parameters and physical movements						
UNIT	CONTENTS					HOURS
I	IoT FOR HEALTHCARE Architecture of IoT for Healthcare , IoT based Health Monitoring System using Arduino, Smart continuous glucose monitoring (CGM) and insulin pens, Remote Patient Monitoring- IoT Heart Rate Monitoring, remote monitoring of physiological parameters, ECG, EEG, Diabetics and BP.					9
II	IoT ENABLED SMART CITIES Energy Consumption Monitoring, Smart Energy meters to minimize power consumptions, Smart home powered by IoT, Smart Grid and Solar Energy Harvesting, Intelligent Parking System					9
III	IoT FOR SMART AGRICULTURE Animal Intrusion detection in farms, soil moisture detection and Irrigation system, Pest monitoring and control, Livestock monitoring system, IoT based Greenhouse Environment Monitoring and controlling					9
IV	IoT BASED INDUSTRIAL AUTOMATION IoT based gas leakage monitoring system, Temperature and liquid level monitoring in boilers, Fire detection system, wireless video surveillance robot, Automatic Solar Tracker					9
V	IoT FOR SOCIETY Medical Waste Management, Weather update system with IoT, Women security system, GPS Smart Sole, wearable glove to enable sign to speech conversation, IoT based air pollution meter					9

Maximum Hours: 45

Course Outcomes

On completion of the course, the student should be able to

CO1 - Design remote data sensing and aggregation system for health care

CO2 - Develop energy efficient IoT systems for smart cities

CO3 – Design Precision agricultural systems

CO4 - Develop smart automation system for Industries

CO5 - Investigate various IoT based innovative systems for societal benefits

CO6 - Develop multipurpose wearable devices

TEXT / REFERENCE BOOKS

1. Fadi Al-Turjman, Intelligence in IoT- enabled Smart Cities, 2019, 1st edition, CRC Press, ISBN-10: 1138316849
2. Giacomo Veneri, and Antonio Capasso, Hands-on Industrial Internet of Things: Create a powerful industrial IoT infrastructure using Industry 4.0, 2018, Packt Publishing.
3. Krishna P. Venkata, Sasikumar Gurumoorthy, Mohammad S.Obaidat, Internet of Things and Personalized Healthcare Systems , Springer-2019.
4. Pattnaik, Prasant Kumar, Mohanty, Suneeta, Mohanty, Satarupa, Smart Healthcare Analytics in IoT Enabled Environment, Springer-2020.
5. Avijit Mathur, Thomas Newe, Walid Elgenaidi, Muzaffar Rao, Elfed Lewis and Daniel Toal, Medical IoT systems: architecture and security by Wearable Sensors, 2017.
6. Verónica Saiz-Rubio , Francisco Rovira-Mas ,From Smart Farming towards Agriculture 5.0: A Review on Crop Data Management, Agronomy 2020, 10, 207; doi:10.3390/ agronomy 10020207

SECA3027 REVISED	IoT FOR REAL TIME APPLICATIONS	L	T	P	Credits	Total marks
		2	0	2	3	100
Pre requisite: NIL		Co Requisite: NIL				
Course Objectives ● To design products related to IoT based Health care applications ● To design IoT enable smart cities considering various energy harvesting techniques ● To develop IoT based system for supporting farmers and agriculture ● To develop IoT based system for industrial automation ● To analyze various IoT based system considering societal benefits ● To develop an IoT based wearable device for measuring physiological parameters and physical movements						
UNIT	CONTENTS					HOURS
I	IoT FOR HEALTHCARE Architecture of IoT for Healthcare , IoT based Health Monitoring System using Arduino, Healthcare monitoring Technique for Diabetes Patients, Remote Patient Monitoring- IoT Heart Rate Monitoring, remote monitoring of physiological parameters, ECG, EEG, and BP.					9
II	IoT ENABLED SMART CITIES Smart Energy meters, , , Smart home powered by IoT, Smart Lightning, Smart Traffic Control ,Smart Grid and Solar Energy Harvesting, Intelligent Parking System.					9
III	IoT FOR SMART AGRICULTURE Smart Agriculture, IoT Based Agriculture,Animal Intrusion detection in farms, soil moisture detection and Irrigation system, Livestock monitoring system, IoT based Greenhouse Environment Monitoring and controlling					9
IV	IoT BASED INDUSTRIAL AUTOMATION IoT based gas leakage monitoring system, Temperature and liquid level monitoring in boilers, Wireless video surveillance robot, Automatic Solar Tracker, IoT in Logistics Sector					9
V	IoT FOR SOCIETY Medical Waste Management, Weather update system with IoT, Women security system,wearable glove to enable sign to speech conversation, IoT based air pollution meter, Improved productivity of staff and reduced human labor					9

Maximum Hours: 45

Course Outcomes

On completion of the course, the student should be able to

CO1 - Design remote data sensing and aggregation system for health care

CO2 - Develop energy efficient IoT systems for smart cities

CO3 – Design Precision agricultural systems

CO4 - Develop smart automation system for Industries

CO5 - Investigate various IoT based innovative systems for societal benefits

CO6 - Develop multipurpose wearable devices

TEXT / REFERENCE BOOKS

1. Fadi Al-Turjman, Intelligence in IoT- enabled Smart Cities, 2019, 1st edition, CRC Press, ISBN-10: 1138316849
2. Giacomo Veneri, and Antonio Capasso, Hands-on Industrial Internet of Things: Create a powerful industrial IoT infrastructure using Industry 4.0, 2018, Packt Publishing.
3. Krishna P. Venkata, Sasikumar Gurumoorthy, Mohammad S.Obaidat, Internet of Things and Personalized Healthcare Systems , Springer-2019.
4. Pattnaik, Prasant Kumar, Mohanty, Suneeta, Mohanty, Satarupa, Smart Healthcare Analytics in IoT Enabled Environment, Springer-2020.
5. Avijit Mathur, Thomas Newe, Walid Elgenaidi, Muzaffar Rao, Elfed Lewis and Daniel Toal, Medical IoT systems: architecture and security by Wearable Sensors, 2017.
6. Verónica Saiz-Rubio , Francisco Rovira-Mas ,From Smart Farming towards Agriculture 5.0: A Review on Crop Data Management, Agronomy 2020, 10, 207; doi:10.3390/ agronomy 10020207

SEC1630	MACHINE LEARNING TECHNIQUES	L	T	P	Credits	Total marks
		2	0	2	3	100
Pre Requisite: NIL		Co Requisite: NIL				
Course Objectives ● To Recognize Different Key Paradigms For Machine Learning Concepts ● To Familiarize With Various Classifiers Used For Machine Learning ● To Understand And Differentiate Among Various Supervised Learning Concepts ● To Become Familiarize With Data Reduction And Feature Extraction Methods ● To Apply Suitable Machine Learning Algorithms For Simple Engineering Problems						
UNIT	CONTENTS					HOURS
I	INTRODUCTION TO MACHINE LEARNING Machine Learning vs Statistical Modelling, Applications of Machine Learning, Supervised vs Unsupervised Learning, Supervised Learning Classification, Unsupervised Learning Classification, Python libraries suitable for Machine Learning.					9
II	CLASSIFIERS Classification, K- nearest neighbour, Decision Trees, Implementing Decision Tree, building a Tree, Random Forests - Working of Random Forest, Pros and Cons of Random Forest, Naiver Bayes, building model Using Naiver Bayes					9
III	SUPERVISED LEARNING Regression, Types of Regression model, Building a Regressor in Python, Types of ML Algorithm, Linear Regression, Multiple Linear Regression, Non-linear Regression, Model evaluation methods.					9
IV	K-MEANS CLUSTERING Working of K-Means Clustering Algorithm, Advantages and Disadvantages, Applications of K-Means Clustering Algorithm, Hierarchical Clustering, Steps to Perform Agglomerative Hierarchical Clustering, Role of Dendrograms Agglomerative Hierarchical Clustering, Density-Based Clustering.					9
V	DIMENSIONALITY REDUCTIONS & COLLABORATIVE FILTERING Dimensionality Reduction, Feature Extraction & Selection, Linear Discriminant Analysis, Principal Component Analysis, Factor Analysis, Independent Component Analysis, Locally Linear Embedding, Least Squares Optimization, Collaborative Filtering & Its Challenges.					9

Maximum Hours: 45

Course Outcomes

On completion of the course, student should be able to

CO 1 - Classify supervised and unsupervised learning

CO 2 - Apply appropriate machine learning strategies for any given problem

CO 3 - Recommend supervised and unsupervised learning algorithms for any given problem

CO 4 - Apply the Bayesian concepts to machine learning

CO 5 – Evaluate existing machine learning algorithms

CO 6 - Develop an appropriate machine learning approach for Real World Problems

TEXT / REFERENCE BOOKS

1. Chris Albon : Machine Learning with Python Cookbook , O'Reilly Media, Inc.2018
2. Stephen Marsland, "Machine Learning – An Algorithmic Perspective", Second Edition, Chapman and Hall/CRC Machine Learning and Pattern Recognition Series, 2014
3. Tom M. Mitchell, Machine Learning, India Edition 2013, McGraw Hill Education
4. Machine Learning: The art and Science of algorithms that make sense of data, Peter Flach, Cambridge University Press, 2012
5. EthemAlpaydin, Introduction to machine learning, second edition, MIT press.
6. T. Hastie, R. Tibshirani and J. Friedman, "Elements of Statistical Learning", Springer Series , 2nd edition
7. Sebastian Raschka, "Python Machine Learning", Second Edition.Packt Publication

SECA3028 (Revised)	MACHINE LEARNING TECHNIQUES	L	T	P	Credits	Total marks
		2	0	2	3	100
Pre Requisite: NIL		Co Requisite: NIL				
Course Objectives						
● To Recognize Different Key Paradigms For Machine Learning Concepts ● To Familiarize With Various Classifiers Used For Machine Learning ● To Understand And Differentiate Among Various Supervised Learning Concepts ● To Become Familiarize With Data Reduction And Feature Extraction Methods ● To Apply Suitable Machine Learning Algorithms For Simple Engineering Problems						
UNIT	CONTENTS					HOURS
I	INTRODUCTION TO MACHINE LEARNING Machine Learning vs Statistical Modelling, Applications of Machine Learning, Supervised vs Unsupervised Learning, Supervised Learning Classification, Unsupervised Learning Classification, Python libraries suitable for Machine Learning.					9
II	CLASSIFIERS Classification, K- nearest neighbour, Decision Trees, Implementing Decision Tree, building a Tree, Random Forests - Working of Random Forest, Pros and Cons of Random Forest, Naiver Bayes, building model Using Naiver Bayes					9
III	SUPERVISED LEARNING Regression, Types of Regression model, Building a Regressor in Python, Types of ML Algorithm, Linear Regression, Multiple Linear Regression, Non-linear Regression, Model evaluation methods.					9
IV	K-MEANS CLUSTERING Working of K-Means Clustering Algorithm, Advantages and Disadvantages, Applications of K-Means Clustering Algorithm, Hierarchical Clustering, Steps to Perform Agglomerative Hierarchical Clustering, Role of Dendrograms Agglomerative Hierarchical Clustering, Density-Based Clustering.					9
V	ML- Models and Computational Learning Parameter Estimation, sufficient statistics, decision trees, neural networks, support vector machines, Bayesian networks, bag of words classifiers, N-gram models; Markov and Hidden Markov models, probabilistic relational models, association rules, nearest neighbor classifiers, locally weighted regression, ensemble classifiers. Computational Learning theory, mistake bound analysis, sample complexity analysis, VC dimension, Occam learning, accuracy and confidence boosting					9

Maximum Hours: 45

Course Outcomes

On completion of the course, student should be able to

CO 1 - Classify supervised and unsupervised learning

CO 2 - Apply appropriate machine learning strategies for any given problem

CO 3 - Recommend supervised and unsupervised learning algorithms for any given problem

CO 4 - Apply the Bayesian concepts to machine learning

CO 5 – Evaluate existing machine learning algorithms

CO 6 - Develop an appropriate machine learning approach for Real World Problems

TEXT / REFERENCE BOOKS

1. Chris Albon : Machine Learning with Python Cookbook , O'Reilly Media, Inc.2018
2. Stephen Marsland, "Machine Learning – An Algorithmic Perspective", Second Edition, Chapman and Hall/CRC Machine Learning and Pattern Recognition Series, 2014
3. Tom M. Mitchell, Machine Learning, India Edition 2013, McGraw Hill Education
4. Machine Learning: The art and Science of algorithms that make sense of data, Peter Flach, Cambridge University Press, 2012
5. EthemAlpaydın, Introduction to machine learning, second edition, MIT press.
6. T. Hastie, R. Tibshirani and J. Friedman, "Elements of Statistical Learning", Springer Series , 2nd edition
7. Sebastian Raschka, "Python Machine Learning", Second Edition.Packt Publication

SEC1628 (old)	DIGITAL IMAGE PROCESSING FOR REAL TIME APPLICATION	L	T	P	Credits	Total marks
		2	0	2	3	100
Pre requisite: NIL		Co Requisite: NIL				
Course Objectives						
- To explore the fundamental concepts of Image Processing - To become conversant with various Image Enhancement techniques - To study and understand various Morphological and segmentation concepts and techniques - To analysis the pattern classifier techniques for image understanding - To design Artificial Intelligence (AI) based image classification and object detection systems						
UNIT	CONTENTS					HOURS
I	DIGITAL IMAGE FUNDAMENTALS Image acquisition and storage; Basic Relationships between Pixels; Monochromatic Vision Models; Colour Vision Models; Colour Fundamentals; Colour Models; Image resizing; Image noise- additive and multiplicative noises; Image quality indicators (Quality Metrics)- PSNR, SSIM, VIF, accuracy, Correlation. Case study: Develop a software program to measure the quality of the given image.					9
II	IMAGE ENHANCEMENT Introduction; Point Processing - Image Negatives, Log transformations, Power Law Transformations, Piecewise-Linear Transformation Functions; Arithmetic/Logic Operations - Image Subtraction, Image Averaging; Histogram Processing - Histogram Equalization, Histogram Matching; Spatial filtering - Smoothing, Sharpening; Smoothing Frequency Domain Filters - Ideal Low Pass, Butterworth Low Pass, Gaussian Low Pass; Sharpening Frequency Domain Filters - Ideal High Pass, Butterworth High Pass, Gaussian High Pass; Image denoising- Wavelet Transform(DWT), Case study: Develop a program for the image denoising using DWT.					9
III	MORPHOLOGICAL PROCESSING & SEGMENTATION Morphological Image Processing - Logic Operations involving Binary Images; Dilation and Erosion; Opening and Closing; Basic Morphological Algorithms - Boundary Extraction, Region Filling, Thickening, Thinning; Image Segmentation - Detection of Discontinuities; Edge Linking; Boundary Detection; Thresholding - Global and Adaptive; Region based Segmentation, Case study: Develop a program for segmentation of an objects from the background and transfer them from one image to another.					9
IV	PATTERN CLASSIFIER Overview of Pattern recognition – Discriminant functions – Supervised learning – Parametric estimation – Maximum Likelihood Estimation – Bayesian parameter Estimation– Problems with Bayes approach– Pattern classification by distance functions –Minimum distance pattern classifier, Template matching – probabilistic approach- K-nearest neighbour (KNN), Path Forest- Fuzzy logic – Fuzzy Pattern Classifiers, Case study: Fuzzy clustering algorithm.					9
V	AI IN IMAGE PROCESSING Design and execute image classification, object recognition, object detection and object localization systems using machine learning, deep learning and transfer learning techniques.					9

Course Outcomes

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

CO1- Apply Suitable Mathematical Concepts For The Measurement Of Quality In Digital Images.

CO2-Analyze The Performance Of Spatial And Frequency Domain Filters In Image Enhancement.

CO3-Analyze Various Morphological Image Processing And Segmentation Techniques

CO4-Identify Suitable Pattern Classifier For Object Classification Problems.

CO5-Implement Ai Based Image Classification And Object Detection Systems.

CO6-Solve Real World Problems Using AI

TEXT / REFERENCE BOOKS

1. Rafael C. Gonzalez, Richard E. Woods, "Digital Image Processing", Pearson , Second Edition, 2004
2. Anil K. Jain, "Fundamentals of Digital Image Processing", Pearson 2002
3. Robert J.Schalkoff, "Pattern Recognition Statistical, Structural and Neural Approaches", John Wiley & Sons Inc., New York, 1992
4. R.O.Duda, P.E.Hart and D.G.Stork, "Pattern Classification", John Wiley, 2001
5. Himanshu Singh. "Practical Machine Learning and Image Processing", Apress, 2019
6. Francois Chollet "Deep Learning with Python", Manning Publications Co., NY, 2018
7. Phil Kim. "MATLAB Deep Learning: With Machine Learning, Neural Networks and Artificial Intelligence",
8. Apress, 2017.
9. Artificial Intelligence in Recognition and Classification of Astrophysical and Medical Images
10. Valentina Zharkova, Lakhmi C. Jain, "Artificial Intelligence in Recognition and Classification of Astrophysical and Medical Images", Springer, 2007

SECA3030 (Revised)	DIGITAL IMAGE PROCESSING FOR REAL TIME APPLICATIONS	L	T	P	Credits	Total marks
		2	0	2	3	100
Pre requisite: NIL		Co Requisite: NIL				
Course Objectives ● To explore the fundamental concepts of Image Processing ● To become conversant with various Image Enhancement and restoration techniques ● To study and understand various Morphological and segmentation concepts and techniques ● To analysis the pattern classifier techniques for image understanding ● To design Artificial Intelligence (AI) based image classification systems						
UNIT	CONTENTS					HOURS
I	DIGITAL IMAGE FUNDAMENTALS Image acquisition and storage; Basic Relationships between Pixels; Monochromatic Vision Models; Colour Vision Models; Colour Fundamentals; Colour Models; Image resizing; Image noise- additive and multiplicative noises; Image quality indicators (Quality Metrics)- PSNR, SSIM, VIF, accuracy, Correlation. Case study: Develop a software program to measure the quality of the given image.					9
II	IMAGE ENHANCEMENT AND IMAGE RESTORATION Histogram Matching Introduction; Point Processing - Image Negatives, Log transformations, Power Law Transformations, Piecewise-Linear Transformation Functions; Arithmetic/Logic Operations - Image Subtraction, Image Averaging; Histogram Processing - Histogram Equalization,; Spatial filtering - Smoothing, Sharpening; Wavelet Transform(DWT), Introduction to Image restoration, Image degradation, Types of image blur, Classification of image restoration techniques, Image restoration model, Linear and Nonlinear image restoration techniques, Case study: Develop a program for the image denoising using DWT.					9
III	MORPHOLOGICAL PROCESSING & SEGMENTATION Morphological Image Processing - Logic Operations involving Binary Images; Dilation and Erosion; Opening and Closing; Basic Morphological Algorithms - Boundary Extraction, Region Filling, Thickening, Thinning; Image Segmentation - Detection of Discontinuities; Edge Linking; Boundary Detection; Thresholding - Global and Adaptive; Region based Segmentation, Case study: Develop a program for segmentation of an objects from the background and transfer them from one image to another.					9
IV	PATTERN CLASSIFIER Overview of Pattern recognition – Discriminant functions – Supervised learning – Parametric estimation – Maximum Likelihood Estimation – Bayesian parameter Estimation– Problems with Bayes approach– Pattern classification by distance functions –Minimum distance pattern classifier, Template matching – probabilistic approach- K-nearest neighbour (KNN), Path Forest- Fuzzy logic – Fuzzy Pattern Classifiers, Case study: Fuzzy clustering algorithm.					9
V	AI IN IMAGE PROCESSING Image processing with machine Learning-machine learning workflow for image processing- Introduction to software tools for image processing and machine learning- Artificial neural networks, deep architectures. Design and execute image classification					9

	using machine learning and deep learning techniques.	
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Course Outcomes

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

CO1- Apply Suitable Mathematical Concepts For The Measurement Of Quality In Digital Images.

CO2-Analyze the Performance of Image enhancement and image restoration techniques.

CO3-Analyze Various Morphological Image Processing and Segmentation Techniques.

CO4-Identify Suitable Pattern Classifier for Object Classification Problems.

CO5-Implement AI Based Image Classification Systems.

CO6-Solve Real World Problems Using AI

TEXT / REFERENCE BOOKS

1. Rafael C. Gonzalez, Richard E. Woods," Digital Image Processing", Pearson , Second Edition, 2004
2. Anil K. Jain, "Fundamentals of Digital Image Processing", Pearson 2002
3. Robert J.Schalkoff, "Pattern Recognition Statistical, Structural and Neural Approaches",John Wiley & Sons Inc., New York, 1992
4. R.O.Duda, P.E.Hart and D.G.Stork, "Pattern Classification", John Wiley, 2001
5. Himanshu Singh. "Practical Machine Learning and Image Processing", Apress, 2019
6. Francois Chollet "Deep Learning with Python", Manning Publications Co., NY, 2018
7. Phil Kim. "MATLAB Deep Learning: With Machine Learning, Neural Networks and Artificial Intelligence",
8. Apress, 2017.
9. Artificial Intelligence in Recognition and Classification of Astrophysical and Medical Images
10. Valentina Zharkova, Lakhmi C. Jain, "Artificial Intelligence in Recognition and Classification of Astrophysical and Medical Images", Springer, 2007

SECA1702 (old)	WIRELESS COMMUNICATION	L	T	P	Credits	Total marks
		3	0	0	3	100
Pre requisite: NIL		Co Requisite: NIL				
Course Objectives						
- To impart knowledge on various generations of wireless communication and standards. - To classify different types of air interface used in different standards. - To understand international standardizing structure for the effective usage of spectrum, according to it. - To analyze the characteristics of different protocol structures in different cable replacement devices. - To quantify and review the advances in higher generations of wireless schemes						
UNIT	CONTENTS					HOURS
I	INTRODUCTION TO CELLULAR MOBILE SYSTEM Cellular system concepts- Frequency reuse- Practical reuse factor- cell splitting - Channel Assignment - channel models- Flat fading and frequency selective fading – Diversity reception techniques - Mobility Management: Types of Hand off					9
II	EVOLUTION OF MOBILE NETWORKS GSM /GPRS Architecture (2G) - UMTS and CDMA 2000 (3G) - Wideband CDMA (WCDMA) and EDGE (3.5G) - LTE and LTE advanced (4G) - Network architecture – Modulation – Coding schemes – Network Control - 5G systems: specifications and applications					9
III	WIRELESS LAN (WI-FI AND WI-MAX) IEEE 802 Standards – IEEE 802.11 WLAN Standards – Comparison of IEEE 802.11 a, b and g standards – WiFi and WiMAX – VOIP and WAP- OFDMA and Mobile WiMAX - Concepts of MIMO - Block diagram description of OFDM system combined with MIMO-advantages.					9
IV	PERSONAL AREA NETWORK Bluetooth -Piconet, Scatternet- BLE - Zig-Bee (Wireless Sensor Networks)- UWB – RFID.					9
V	SATELLITE MOBILE AND SPECIALIZED SERVICES Introduction, Satellite Mobile Services, VSATs, Radarsat, Global Positioning Satellite System (GPS), Orbcomm, Iridium and Teledesic system.					9

Maximum Hours: 45

Course Outcomes

On completion of the course, student will be able to

CO1 - Classify various generations of wireless communication and standards.

CO2 - Summarize different types of air interface used in different standards.

CO3 - Demonstrate the applications of different international standards in wireless communication.

CO4 - Describe the behavior of different protocol structures in different cable replacement devices.

CO5 - Appraise and report on advances in higher generations of wireless schemes.

CO6 - Design conceptually a mobile communication system according to the required standard.

TEXT BOOKS / REFERENCE BOOKS

1. William C.Y. Lee., "Wireless and Cellular Telecommunications", 3rd Edition revised reprint McGraw Hill.2011.
2. Iti saha Mishra , "Wireless Communications and Networks: 3G and Beyond" 2nd Edition McGraw Hill 2013.
3. Nishith D. Tripathi and Jeffrey H. Reed,"Cellular Communications A Comprehensive and Practical Guide" Wiley 2014.
4. Rajpandya " Mobile and Personal Communication Services and Systems", IEEE Inc., New York, 2014.
5. Gordon L. Stuber "Principles of Mobile communications", 3rd Edition 2011 Springer.
6. Louis. E. Frenzel, "Communication Electronics Principles and applications", 3rd Edition, Tata Mc.Graw Hill, 2015.

SECA1704	CONTEMPORARY WIRELESS COMMUNICATION	L	T	P	Credits	Total Marks
		3	0	0	3	100
Pre requisite: NIL			Co Requisite: NIL			
Course Objectives						
● To impart knowledge on evolution of mobile communication and standards. ● To understand current trends in wireless LAN protocols. ● To study about personal area network and M2M communication standards. ● To impart knowledge on role of satellites in mobile and internet services. ● To study about underwater wireless communication techniques.						
UNIT	CONTENTS					HOURS
I	EVOLUTION OF CELLULAR MOBILE NETWORKS UMTS and CDMA 2000 (3G) - Wideband CDMA (WCDMA) - LTE and LTE advanced (4G) - Network architecture – Modulation – Coding schemes – 5G systems: specifications and applications.					9
II	WIRELESS LAN STANDARDS IEEE 802 Standards – IEEE 802.11 WLAN Standards – Comparison of IEEE 802.11 a, b and g standards, WiFi-5 and WiGig - Concepts of MIMO, Massive MIMO and MU MIMO -Principle of Li-Fi based WLAN..					9
III	PERSONAL AREA NETWORK PROTOCOLS Bluetooth -Piconet, Scatternet- Bluetooth Low Energy(BLE) - Zig-Bee- Z-wave – UWB- LoRA Wireless Standards, LoRA WAN Gateway, LORA Applications					9
IV	SATELLITE MOBILE AND SPECIALIZED SERVICES Types of Satellites – LEO, MEO and GEO – Satellite services in Cellular Mobile communication - Satellite Phones – Satellite IoT services - Satellite Internet Service: Starlink and Viasat – GPS Services: GLONASS, IRNSS and NAVIC.					9
V	UNDERWATER WIRELESS COMMUNICATION Underwater Communication: IEEE Standards, Frequency Spectrum, Modulation Techniques - Underwater Channel models for wireless Communication – Role of Digital signal processing in Underwater Communication- Underwater localization.					9

Maximum Hours: 45

COURSE OUTCOMES:

On completion of this course, students are able to

- CO1: Classify various generations of wireless communication and standards
- CO2: Demonstrate the applications of different international standards in wireless LAN and PAN
- CO3: Develop an energy efficient system level model for IoT applications
- CO4: Appraise and report on advances in higher generations of wireless communication systems.
- CO5: Design conceptually a mobile communication system according to the required standard.
- CO6: Develop system level models for underwater communication.

TEXT / REFERENCE BOOKS

- [1] William C.Y. Lee., "Wireless and Cellular Telecommunications", 3rd Edition revised reprint McGraw Hill.2011.
- [2] Iti saha Mishra , "Wireless Communications and Networks: 3G and Beyond" 2nd Edition McGraw Hill 2013.
- [3] Nishith D. Tripathi and Jeffrey H. Reed,"Cellular Communications A Comprehensive and Practical Guide" Wiley 2014.
- [4] Rajpandya " Mobile and Personal Communication Services and Systems", IEEE Inc., New York, 2014.
- [5] Nitin Goyal, Luxmi Sapra, Jasminder Kaur Sandhu," Energy-Efficient Underwater Wireless Communications and Networking", 1st Edition, Business Science Reference , 2020



SATHYABAMA

INSTITUTE OF SCIENCE AND TECHNOLOGY

(DEEMED TO BE UNIVERSITY)

Accredited with 'A' grade by NAAC
Jeppiaar Nagar, Rajiv Gandhi Salai, Chennai - 600 119.



School of Electrical and Electronics

Minutes of Board of Studies Meeting held on 1st June, 2020

(Virtual Meeting conducted on Zoom Platform (Time: 10.30 a.m. to 12 noon))

- Dr.N.M.Nandhitha, Prof. & Dean School of Electrical and Electronics started the meeting by welcoming both the external and the internal members to the Board of Studies meeting (30.6.2020, 10.30 a.m. to 12.00 noon)
- Dr M D Selvaraj. Professor, IIITDM accepted the changes suggested by Dr S Lakshmi. However he added that “Specialized services – E-mail, Video conferencing and internet connectivity” from Unit-5 can be replaced with ‘Case studies on Weather Forecasting Satellites ‘.
- Dr.Sivakumaran, Prof., NIT, Trichy accepted the changes proposed in ‘MEMS and its Applications’ and ‘Automatic Speech Recognition’.
- Mr M Sugadev, presented the changes made in ‘Advanced Electronic Test Engineering’. He also added that this course is conducted with the infrastructure sponsored by QMAX Technologies, Chennai. Mr J Visweswaran, NI Electronics, appreciated the effort taken by the Department and the syllabus revision was accepted.
- Dr P Chitra, put forth the revisions for ‘Pattern Recognition and Image Vision’. Dr M D Selvaraj accepted the revision and added that “Classification performance measures - Risk and error probabilities” can be replaced with “Non-metric methods for pattern classification on numeric data, Decision trees, Classification and Regression Trees (CART)”.
- Dr S Lakshmi, proposed syllabus revision in ‘Mobile Adhoc Networks and Spread Spectrum Communication’. Dr M D Selvaraj, accepted the syllabus revision.
- Dr T Ravi presented the syllabus revision on Nanoelectronics to the board. Mr J Visweswaran accepted the changes and added that ‘Nanoelectronics in Random Access Memory, Mass Storage devices and related topics’ can be included.
- Dr M Sumathi presented syllabus revision in ‘Integrated Services Digital Network’ and “Radar and Navigational Aids”. Dr M D Selvaraj accepted the changes.

- Dr P Chitra proposed the revisions in ‘Signals and Systems’ to the board. Dr Sivakumaran accepted the changes and he suggested that “Speech Signal Processing” can also be included.
- Dr S Barani presented the syllabus revision in ‘Digital Signal Processing’ to the board. Dr N Sivakumaran suggested that “Audio Coding Techniques and Comparison Analysis and Related Topic” can be included.
- Dr T Ravi presented the syllabus revision in “Programming in HDL”. Dr M D Selvaraj suggested that “Case Study on related topics” can be included.
- Mr M Sugadev presented syllabus revision in ‘AI and Soft Computing’ and ‘SCADA Systems Applications’ to the board. Dr M D Selvaraj readily accepted the revisions.

S L N O	COURSE CODE	COURSE NAME	DELETED TOPICS	ADDED TOPICS
	SEC1631	SATELLITE COMMUNICATIONS	UNIT 1 satellite access, single access, pre-assigned FDMA, SCPC (spade system), TDMA, pre- assigned TDMA, demand assigned TDMA UNIT 2 Effects of rain – Uplink rain– Fade margin – Downlink rain UNIT 3 ascent guidance, satellite rendezvous. UNIT 4 Advanced very high resolution radiometer	UNIT 1 Multiple Access Techniques: Introduction, FDMA , SCPC Systems, MCPC Systems, TDMA, CDMA, SDMA UNIT 2 Satellite Link Design Fundamentals: Transmission Equation, Satellite Link Parameters, Propagation considerations. UNIT 3 Satellite subsystem: Power supply subsystem, Attitude and Orbit control, Tracking, Telemetry and command subsystem, Payload UNIT 4 Satellite Instruments: Microwave Radiometer (MWR), Infra-red Camera (NIRST), High Sensitivity Camera (HSC),Data Collection System (DCS),Technological Demonstration Package (TDP).
	SEC1632	MEMS AND ITS APPLICATIONS	UNIT 1 Working principle of micro system - Micro sensors, Micro actuators, Micro accelerometers and Micro fluidics UNIT 4 case study - Capacitive RF MEMS switch	UNIT 1 Overview of microelectronics manufacture and Microsystems technology. Laws of scaling. The multidisciplinary nature of MEMS. Survey of materials central to micro engineering. Applications of MEMS in various industries. UNIT 2

				Packaging: Microsystemspackaging,Essentialpackagingtechnologies,Selectionofpackagingmaterials. UNIT 3 engineering mechanics behind these Microsensors, Actuation using Electrostatic forces (Parallel plate, Torsion bar, Comb drive actuators), Casestudy: Combdriveactuators. UNIT 4 RF MEMS relays and switches- Micromachined RF filters- Micromachined antennas- Switched delay lines. Micromachined transmissionlines- RFMEMSbasedcircuitdesign andcasestudies UNIT 5 Designconsiderations, Mechanical Design, Process design, Realization of MEMS components using intellisuite. Microsystempackaging,PackingTechnologies,AssemblyofMicrosystems,ReliabilityinMEMS.
	SEC1633	AUTOMATIC SPEECH RECOGNITION	UNIT 4 Vector quantization,speechcoding UNIT 5 Adapting to variability in speech (DTW).	UNIT 2 Adaptation (Noise adaptation, Speaker adaptation/normalization, Language model adaptation), Qualityanalysisofspeechprocessingsystem UNIT 3 Speech Signal Representation- Short-time FourierAnalysis,ParametricRepresentationoftheSpectralAnalysis UNIT 5 Case study: Neural network-based acoustic modeling (Hybrid/Tandem/TDNN models), Convolutional Neural Networks in Speech, Speaker Adaptation.
	SEC1634	ADVANCED ELECTRONIC TEST ENGINEERING	UNIT 1 Electrical tests -Text fixtures - Bed of nails fixtures - Cross talk test - Mock up test - In circuit test – Burn-in-test - Fault diagnostic methods. UNIT 4 Digital Pin Electronics - Drive	UNIT 1 Digital and Analog VLSI Testing- VLSI Technology Trends Affecting Testing . Fault Modeling UNIT 2 FunctionalDSP-BasedTesting UNIT 3 AnalogandMixed-SignalCircuitTest

			data formats - Digital Highway - Analog Highway	UNIT 4 Advantest Model T6682 ATE Generic Test Automation Architecture - Overview of the Gtaa, Test Generation Layer-Test Definition Layer- Test Generation Layer-Test Definition Layer- Test Generation Layer-Test Definition Layer-Troubleshooting Biomedical Equipment- Defibrillators- ECG Systems- ECG Machine Maintenance- EEG, Machines, Troubleshooting and Preventive Maintenance, Hemodialysis Machines and Troubleshooting.
SEC1635	PATTERN RECOGNITION AND IMAGE VISION	UNIT 1 studyofshapebyregion analysis UNIT 4 FUZZY CLASSIFIERS- Fuzzy and crisp classification - Fuzzy clustering - Fuzzy pattern recognition -	UNIT 1 feature detection, Applicationsofpatternrecognition UNIT 2 Parzen-windowmethod. K-Nearest Neighbourmethod UNIT 4 Sequential pattern recognition- Hidden Markov models (HMMs)- Discrete HMMs, Continuous HMMs UNIT 5 AI in imaging system.	
SEC1636	MOBILE ADHOC NETWORKS	UNIT 3 Introduction- IssuesinDesigningaRoutingProto colforAdHocWirelessNetworks UNIT 4 Battery Management Schemes - Transmission Power Management Schemes - System Power Management Schemes	UNIT 2 Cross layer Design: need for cross layer design, cross layer optimization, parameter optimization techniques, cross layer cautionary perspective. Integration of adhoc with Mobile IP networks UNIT 4 Security in Ad-hoc Wireless Networks, Issues and Challenges inSecurityProvisioning,NetworkSecur ityAttacks,KeyManagementandSecureTo utingAd-hocWirelessNetworks	
SEC1637	NANO ELECTRONICS	UNIT 1 Quantumdot,currentflowintwoter minalQuantumdots,ballistictransp ort,SingleElectronTransistor	UNIT 1 Introduction to nanotechnology,Impacts, Limitationsofconventionalmicroelectr onics,Trendsinnanoelectronicsand optoelectronics Mesoscopic physics, trends in microelectronics and optoelectronics, characteristic lengths inmesoscopicsystems,Quantumme chanicalcoherence Nanomaterials: Preparation – Plasma Arcing – Chemical Vapor Deposition – Sol-Gels – Electrode Position – Ball Milling –Applications Of Nanomaterials	

				UNIT 4 Carbon Nanotube: Fullerenes - types of nanotubes – formation of nanotubes – assemblies – purification of carbon nanotubes – electronic properties – synthesis of carbon nanotubes UNIT 5 Introduction to characterization of nanostructures, tools used for nanomaterials characterization, microscope-optical, electron, and electron microscope, Micro Electronics.
	SEC1638	SPREAD SPECTRUM COMMUNICATION	UNIT 1 Basic digital communication concepts, Impact of wide band, Detection of binary signals in additive white Gaussian Noise, Differences between standard narrow-band communication systems and spread spectrum systems UNIT 4 Problem definition and the optimum synchronizer, serial search synchronization techniques, general analysis of average synchronization time, synchronization using a matched filter, synchronization by estimating the received spreading code, tracking loop pull-in, performance of spread spectrum system without coding, performance of spread spectrum system with forward error correction UNIT 5 Calculation of theoretical capacity of a CDMA system, coding and decoding processes in CDMA, effects of interference in CDMA, and synchronization in CDMA wireless communication systems. 3G wireless systems using CDMA technologies, Major factors influencing the capacity of CDMA wireless networks, Multicarrier CDMA, Rake receivers, wireless LAN applications, commercial and military applications	UNIT 1 Slow and fast frequency hopping, General mechanism of ML sequence, Power spectral density of ML sequence. General mechanism and properties of Walsh Hadamard Code, OVSF, Barker codes, Gold and Kasami codes UNIT 2 Systems communications models – Performance without coding under AWGN and different jamming environments – spread spectrum systems performances with forward error correction -Block coding – Convolutional coding and specific error correcting codes – Inter leaving – Random coding bounds UNIT 5 CDMA RF Propagation Principles, Antennas for Wireless Systems, CDMA Traffic Engineering, CDMA Air Interface Overview, Key CDMA Performance Parameters and their Significance, Call Processing from Perspective of the Subscriber Handset, CDMA Handoffs
	SEC1639	RADAR AND NAVIGATIONAL AIDS	UNIT 5 DME and TACAN-Distance Measuring Equipment-	UNIT 1 Maximum Unambiguous Range, Radar Waveforms,

			Operation of DME-TACAN- TACAN Equipment Aids to Approach and Landing- Instrument Landing System- Ground Controlled Approach System- Microwave Landing System (MLS) Doppler Navigation- The Doppler Effect- Beam Configuration- Doppler frequency Equation- Track Stabilization- Doppler Spectrum- Components of The Doppler Navigation System- Doppler Range Equation- Accuracy of Doppler Navigation System. Inertial Navigation- Principles of Operation- Navigation Over The Earth- Components of an Inertial Navigation System- Earth Coordinate Mechanization- Strapdown Systems- Accuracy of Inertial Navigation Systems. Satellite Navigation System- The Transit System- Navstar Global Positioning System (GPS)- Night Vision Systems	Modified Radar Range Equation UNIT 2 Tracking with Radar, Sequential Lobing, Conical Scan, Monopulse Tracking Radar – Amplitude Comparison Monopulse (one- and two-coordinates), Phase Comparison Monopulse. Target Reflection Characteristics and Angular Accuracy. Tracking in Range, Acquisition and Scanning Patterns. Comparison of Trackers., MTI Improvement Factor, N-Pulse Delay-Line Canceller UNIT 4 Instrument Landing System, Ground controlled Approach System UNIT 5 GPS principle of operation, Position location determination, principle of GPS receiver and applications, Brief note on : Global Satellite Navigation system, Maritime Satellite , Satellite Constellations , Navigation Satellites of different countries such as Glonass and Compass, GAGAN, IRNSS, NAVIC Receiver and applications
	SEC1640	INTEGRATED SERVICES DIGITAL NETWORKS		UNIT 1 review of switching technologies UNIT 3 Delay Analysis and Simulation, ISDN products, Switches, Multiplexers, Terminal adapters, ISDN chipsets. UNIT 4 ATM-Broadband Network Protocol, ATM Network Components, ATM Switches Terminal Equipment, Unique Benefits. UNIT 5 Potential B-ISDN Satellite Applications, General B-ISDN Service Requirements, Architecture, Terrestrial B-ISDN Support, System Concept Types of Services Supported, Private Based B-ISDN, System Concept, Types of Services Supported
	SECA1301	SIGNALS SYSTEMS AND		UNIT 4 Spectrum of DT signals, Discrete Time Fourier Transform (DTFT)- Properties of DTFT - z-transform - Basic properties of Z transform Properties of ROC - Inverse z-transform, Convolution method and Partial fraction expansion- Discrete time Systems- Classification of systems, Linear time Invariant System -

				Difference equation - Computation of Impulse response, Frequency response, step response, natural response, forced response and Transfer function using Z Transform, Convolution Sum using matrix, graphical and tabulation method-Properties of convolution sum. UNIT 5 Mathematical tools for the analysis of deterministic and random signals – Sampling theorem-Analysis and modeling of Signals -Speech, music, medical signals- Applications of Fourier Transform- Analysis and modeling of Systems- Systems that manipulate signals-analysis and synthesis of signals and their interaction with systems
SEC1319	DIGITAL SIGNAL PROCESSING	UNIT 1 Representation, Characterization and Classifications of Continuous Time (CT) & Discrete Time (DT) signals, Sampling, theorem - Aliasing effect, Operations on DT signals, Convolution, Advantages of DSP over ASP, Classification of CT & DT systems, properties of Discrete time systems- Linearity-Time invariance-causality –stability-Linear time Invariant systems, Difference equation representation of LTI systems-The Z transform-properties of Z transform-Inverse Z transform-System transfer Function	UNIT 5 Real Time DSP System Architecture and Functional Blocks, Analog Interface, Signal Conditioning, generation and detection for real time applications, - DSP Hardware (Digital Signal Processor, FPGA, ARM Processor with DSP Extension)& its applications - Speech Signal Processing, Enhancements, Coding & Transcoding Techniques (A-Law, U-Law, G.711, G.723, G.729, GSM) for IP and Mobile Telephone applications - High Definition Audio Signal Processing,	
SEC1402	PROGRAMMING IN HDL	UNIT 1 Digital system design process - Hardware simulation - Introduction to VHDL - Language elements of VHDL - Data objects - Datatypes-Operators- Signal assignments- Inertial delay mechanism- Transport delay mechanism - Variable assignments- Concurrent and Sequential assignments- Delta delay	UNIT 1 Introduction to VHDL - Language elements of VHDL - Concurrent and Sequential assignments Data flow modeling - Concurrent Signal Assignment statements- Structural modeling- Component declaration- Component Instantiation- Behavioral modeling- Process statement- Examples for VHDL modeling UNIT 5 FPGA Design Flow - Architecture of Xilinx Artix7 FPGA - Input/Output Blocks (IOB) - Configurable Logic Blocks (CLB)- Programmable Interconnect - Internal Hard macros - Realizing applications in FPGA - combinational functions - N-bit functions, Encoder, Decoders - Sequential functions - N-bit	

				register, shift registers, up/down counters- N-bit processor.
SECA7017	AI AND SOFT COMPUTING	UNIT 5 Communication - Communication as action, A formal grammar for a fragment of English, Syntactic analysis Augmented grammars, Semantic interpretation, Semantic interpretation, Ambiguity and disambiguation, Discourse understanding-Grammar induction, Probabilistic language processing - Probabilistic language models, Information Retrieval and implementation, Information Extraction, Machine translation systems	UNIT 5 Natural language processing – Text classification - Information Retrieval and Exatraction-AugmentatedGrammers and Semantic Interpretation - Speech Recognition-Image formation-Object Recognition from structural information – Robotics – Machine learning in Robotic Perception –Path planning.	
SECA7024	SCADA SYSTEMS APPLICATIONS	UNIT 2 SCADA Architectures - First generation - Monolithic, Second generation - Distributed, Third generation - Networked Architecture	UNIT 2 Remote Terminal Unit (RTU), Interface units, Human- Machine Interface Units (HMI), Display Monitors/Data Logger Systems, Intelligent Electronic Devices (IED), Communication Network, SCADA Server, SCADA Control systems and Control panels	

- Dr.N.M.Nandhitha informed the board that Dr.Krishnamoorthi of School of EE has developed software for Digital Logic Circuits Laboratory (virtual laboratory).
- Dr.R.Pandian proposed few additions in the course “Electrical and Electronic Measurements and Instrumentation”. He pointed out the topics which include Display devices, waveform generators and analyzers. Dr. Sivakumaran agreed and he suggested that it can be added in the syllabus. He also suggested to add polyphase metering.
- Dr.Lalithakumari presented the syllabus for an elective course ‘Automotive Instrumentation’. Dr.Sivakumaran suggested to include networks, Graphical User Interface in Automotive Instrumentation

COURSE CODE	COURSE NAME	DELETED TOPICS	INCLUDED TOPICS
SEIA1401	Electrical and Electronic Measurements and Instrumentation	--	Unit-5 DSO, DPO, MSO, Analog Recorders – Strip Chart and X-Y recorders, Digital Recorders Function generators, Signal generators, Waveform analyzers, Spectrum analyzers, Distortion analyzers

- Dr.V.Sivachidambaranathan, Prof. & Head, Dept. of Electrical and Electronics Engineering requested Dr. Vanitha, Faculty/EEE to present the curriculum revisions before the board.
- She has presented the old and new syllabus for Electrical Technology (theory and practical) before the board and discussed the valid additions made in the syllabus. Dr. Sivakumaran, Prof., NIT, Trichy gave suggestions to include the standards, tools and grounding procedures and case studies in the syllabus.
- Dr. M. D. Selvaraj insisted on the feasibility of conducting laboratory through Virtual Labs. Mr. J. Visweswaran, National Instruments also welcomed the idea of virtual laboratory.
- Dr. V. Sivachidambaranathan put forth the syllabus of the new courses, 'Industrial Drives and automation', 'Computer Control of Electric Drives' for the approval of the board. Dr. N. Sivakumaran approved the Syllabus for these new courses.

Name of the Course : Electrical Technology Course Code : SEEA1102		
UNIT	Content	Remarks
1	MAGNETIC CIRCUITS Definition of MMF, Flux and Reluctance - Leakage Factor - Reluctances in Series and Parallel (Series and Parallel Magnetic Circuits) – Electromagnetic Induction - Fleming's Rule - Lenz's Law - Faraday's laws - statically and dynamically induced EMF - Self and mutual inductance – Analogy of Electric and Magnetic circuit. INTRODUCTION OF ELECTRICAL STANDARDS Indian Standard Electricity Rules - Domestic Wiring - Wiring Materials and Accessories - Staircase Wiring – Fluorescent Tubes - Earthing – Types of Earthing – Benefits of Earthing.	Shifted Magnetic circuit to Unit 2 Inclusion

2	DCMACHINES Construction, Principles of operation of DC Machines - Types - EMF Equation - Performance Characteristics, of Series and Shunt Generators-DC Motor-Torque-Speed-Torque Characteristics of Series and Shunt Motors - Speed Control and Applications DC GENERATORS Construction, Principles and Working operation of DC Generators - EMF Equation - Types of Generators - Performance Characteristics of Series and Shunt Generators - Applications DC MOTORS Construction, Principles and Working operation of DC Motors - Torque Equation - Back EMF - Types of DC Motors - Torque - Speed Characteristics of Series and Shunt Motors - Speed Control of DC Motors - Applications	To give more exposure on DC Machines, this can be split in to DC Generators in Unit 3 and DC Motors in Unit 4.
3	TRANSFORMERS Constructional Details and Principle of operation of Single -Phase Transformer - EMF Equation - Phasor Diagram on No Load and Loaded Transformer - Equivalent Circuit - Open Circuit and Short Circuit Test on Transformer - Regulation and Efficiency- Auto Transformer	Content included in Unit 5
4	INDUCTION MOTORS (QUALITATIVE TREATMENT ONLY) Constructional Details of Three Phase Induction Motor - Slip Ring and Squirrel Cage Rotor- Principle of operation- Torque Equation - Torque / Slip Characteristics - Starters - Applications Introduction to Single Phase Induction Motors - Capacitor Start Capacitor Run Motor - Shaded Pole Motor.	Deletion DC Motor from Unit 2 has shifted to Unit 4 instead of Induction motors.
5	SYNCHRONOUS MACHINES AND SPECIAL MACHINES (QUALITATIVE TREATMENT ONLY) Principles of Alternator - Construction Details - Types Special Machines: Stepper motor- Permanent magnet Stepper motor-Variable reluctance stepper motor- AC and DC Servomotor - Stepper Motor Selection and Control : An Industrial Case Study. Universal Motor - Hysteresis Motor - Permanent Magnet Synchronous Motor - Switched Reluctance Motor - Brushless D.C Motor - Construction, Working and Applications.	Deletion Inclusion Transformers from Unit 3 has shifted in addition to special electrical machines

Name of the Course : ELECTRICAL ENGINEERING LAB Course Code : SEEA2102		
	List of Experiments	Remarks
	1. Wiring circuits for a. Calling bell. b. Staircase. c. Fluorescent lamp d. Basic house hold wiring using switches, fuses, Indicator-lamps etc. 2. Open circuit characteristics of separately excited dc	Theory related Experiments are executed

	shunt generator.	
3.	Load characteristics of self-excited dc shunt generator.	
4.	Load characteristics of dc Compound generator.	
5.	Load characteristics of dc shunt motor.	
6.	Speed control of dc shunt motor.	
7.	Load characteristics of dc series motor	
8.	Load test on single phase transformer	
9.	Open circuit and short circuit test on single phase transformer	
10.	Brake load test on three phase squirrel cage induction motor.	
11.	Load test on single phase Induction motor.	

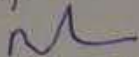
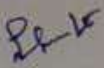
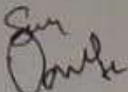
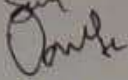
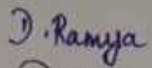
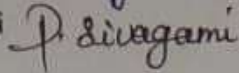
- BoS members are happy that the revised courses enhance employability/ Entrepreneurship/Skills of the students. The meeting ended with a vote of thanks by Dr.N.M.Nandhitha who expressed her sincere gratitude to both the external and internal members for joining the meeting.

EXTERNAL MEMBERS:

1. Dr.N.Sivakumaran
2. Dr.M.D.Selvaraj
3. Mr.J.Visweswaran

INTERNAL MEMBERS:

1. Dr.N.M.Nandhitha *me*
2. Dr.T.Ravi *oh*
3. Dr.P.Chitra *Purita*
4. Dr.S.Barani *Barani*
5. Dr.S.Poornapushpakala *S.Poornapushpakala*
6. Dr.M.Sumathi *Sum*
7. Dr.S.Lakshmi *lenu*
8. Dr.P.Kavipriya *P*
9. Mr M Sugadev *msv*
10. Ms.E.Anna Devi *E. Anna*
11. Ms.S.Yogalakshmi *yoga*
12. Dr.LalithaKumari.S *lenu*

13. Dr.Pandian.R 
14. Dr.Marshiana.D 
15. Dr.V.Sivachidambaranathan 
16. Dr.D.Susitra 
17. Dr.R.Vanitha 
18. Mrs.D.Ramya 
19. Mrs.P.Sivagami 

DEPARTMENT OF ELECTRONICS AND COMMUNICATION ENGINEERING

SYLLABUS REVISION

SL.NO	COURSE CODE	COURSE NAME
1.	SEC1631	SATELLITE COMMUNICATIONS
2.	SEC1632	MEMS AND ITS APPLICATIONS
3.	SEC1633	AUTOMATIC SPEECH RECOGNITION
4.	SEC1634	ADVANCED ELECTRONIC TEST ENGINEERING
5.	SEC1635	PATTERN RECOGNITION AND IMAGE VISION
6.	SEC1636	MOBILE ADHOC NETWORKS
7.	SEC1637	NANO ELECTRONICS
8.	SEC1638	SPREAD SPECTRUM COMMUNICATION
9.	SEC1639	RADAR AND NAVIGATIONAL AIDS
10.	SEC1640	INTEGRATED SERVICES DIGITAL NETWORKS
11.	SECA1301	SIGNALS AND SYSTEMS
12.	SEC1319	DIGITAL SIGNAL PROCESSING
13.	SEC1402	PROGRAMMING IN HDL

SEC1311 (old)	SATELLITE COMMUNICATIONS	L	T	P	Credits	Total Marks
		3	0	0	3	100

UNIT 1 SATELLITE ORBIT AND ACCESS**9 hrs**

Introduction Kepler's Laws, orbital parameters, orbital perturbations, station keeping, geo stationary and non Geo-stationary orbits – Look Angle Determination- Limits of visibility –eclipse-Sub satellite point –Sun transit outage-Launching Procedures -launch vehicles and propulsion. Interference between satellite circuits, **satellite access, single access, pre-assigned FDMA, SCPC (spade system), TDMA, pre-assigned TDMA, demand assigned TDMA**, down link analysis, and comparison of uplink power requirements for TDMA & FDMA, on board signal processing satellite switched TDMA.

UNIT 2 LINK CALCULATIONS AND DESIGN**9 hrs**

Space craft configuration, payload and supporting subsystems, satellite uplink – downlink power budget equation – System noise – Antenna noise – Amplifier noise temperature – Amplifiers in cascade – Noise factor – Noise temperature of absorptive networks – Overall system noise temperature – Carrier toNoise ratio – Uplink – Saturation flux density – Input back off – The earth station HPA – Downlink – Output back off – Satellite TWTA output **– Effects of rain – Uplink rain– Fade margin – Downlink rain** – Fade margin – Combined uplink and downlink C/N ratio – Inter modulation noise

UNIT 3 SATELLITE CONTROL**9 hrs**

Attitude control of satellites, Reaction wheel, Momentum wheel, Thrusters, Stabilization satellites, Spin stabilization, Gravity gradient stabilization, control moment gyros, orbit determination of satellites, sensors in satellite ADCS. Dual spinners, navigation of satellites, **ascent guidance, satellite rendezvous**. Tethered satellite systems, satellite services, space stations, docking of spacecrafts. Earth solution design, tracking, small earth station antennas, Equipment for the Earth station.

UNIT 4 SATELLITE INSTRUMENTATION**9 hrs**

Advanced very high resolution radiometer, Magnetometer, Torque coil, high-resolution infrared radiation sounder, Microwave sounding unit, stratospheric sounding unit, advanced microwave sounding unit, solar backscatter ultraviolet radiometer, GOES imager and sounder.

UNIT 5 SATELLITE APPLICATIONS & DIRECT BROADCAST SATELLITE SERVICES**9 hrs**

INTELSAT series, INSAT, VSAT, Remote sensing, Mobile satellite Service: GSM, GPS, INMARSAT,LEO,MEO, Satellite navigation system, Direct Broadcast satellites(DBS),Direct to home broad cast (DTH), Digital audio broadcast (DAB) , World space services , Business TV(BTV), GRAMSAT, **Specialized services – E-mail, Video conferencing and internet connectivity.**

COURSE OUTCOMES:

On completion of this course, student will be able to

CO1	Analyze the different terminologies used in satellite Communication
CO2	Design the operation of space segment, Antenna segment and Earth segment
CO3	Apply the corrective & controlling techniques to bring back the satellite in active mode
CO4	Analyze the losses in satellite communication and calculate the link budget equation
CO5	Analyze the different multiple access techniques used in satellite communication
CO6	Develop the applications of satellite in network environment

TEXT / REFERENCE BOOKS:

1. Dennis Roddy, "Satellite communication", 4th edition - Tata Mc Graw Hill Co. Special Indian print, 2009
2. Zhili Sun-John, "Satellite Networking Principles and Protocol", W.& Sons 2005
3. Timothy Pratt & C W. Bostain, "Satellite communication", Wiley 3rd Edition
4. K.N.Raja Rao, "Fundamentals of Satellite communication". PHI 2004

SEC1631 (revised)	SATELLITE COMMUNICATIONS	L	T	P	Credits	Total Marks
		3	0	0	3	100

UNIT 1 SATELLITE ORBIT AND ACCESS**9 hrs**

Introduction Kepler's Laws, orbital parameters, orbital perturbations, station keeping, geo stationary and non Geo-stationary orbits – Look Angle Determination- Limits of visibility –eclipse-Sub satellite point –Sun transit outage- Launching Procedures -launch vehicles and propulsion. Interference between satellite circuits, **Multiple Access Techniques: Introduction, FDMA , SCPC Systems, MCPC Systems, TDMA, CDMA, SDMA**, down link analysis, and comparison of uplink power requirements for TDMA & FDMA, on board signal processing satellite switched TDMA.

UNIT 2 LINK CALCULATIONS AND DESIGN**9 hrs**

Satellite Link Design Fundamentals: Transmission Equation, Satellite Link Parameters, Propagation considerations.

Space craft configuration, payload and supporting subsystems, satellite uplink – downlink power budget equation – System noise – Antenna noise – Amplifier noise temperature – Amplifiers in cascade – Noise factor – Noise temperature of absorptive networks – Overall system noise temperature – Carrier toNoise ratio – Uplink – Saturation flux density – Input back off – The earth station HPA – Downlink – Output back off – Satellite TWTA output – Fade margin – Combined uplink and downlink C/N ratio – Inter modulation noise

UNIT 3 SATELLITE CONTROL**9 hrs**

Satellite subsystem: Power supply subsystem, Attitude and Orbit control, Tracking, Telemetry and command subsystem, Payload. Attitude control of satellites, Reaction wheel, Momentum wheel, Thrusters, Stabilization satellites, Spin stabilization, Gravity gradient stabilization, control moment gyros, orbit determination of satellites, sensors in satellite ADCS. Dual spinners, navigation of satellites. Tethered satellite systems, satellite services, space stations, docking of spacecrafts. Earth solution design, tracking, small earth station antennas, Equipment for the Earth station.

UNIT 4 SATELLITE INSTRUMENTATION**9 hrs**

Satellite Instruments: Microwave Radiometer (MWR), Infra-red Camera (NIRST), High Sensitivity Camera (HSC),Data Collection System (DCS),Technological Demonstration Package (TDP). Magnetometer, Torque coil, high-resolution infrared radiation sounder, Microwave sounding unit, stratospheric sounding unit, advanced microwave sounding unit, solar backscatter ultraviolet radiometer, GOES imager and sounder.

UNIT 5 SATELLITE APPLICATIONS & DIRECT BROADCAST SATELLITE SERVICES**9 hrs**

INTELSAT series, INSAT, VSAT, Remote sensing, Mobile satellite Service: GSM, GPS, INMARSAT,LEO,MEO, Satellite navigation system, Direct Broadcast satellites(DBS),Direct to home broad cast (DTH), Digital audio broadcast (DAB) , World space services , Business TV(BTV), GRAMSAT **Case study: Weather Forecasting Satellites: Fundamentals, Images, Orbits, Payloads, Applications.**

COURSE OUTCOMES:

On completion of this course, student will be able to

CO1	Analyze the different terminologies used in satellite Communication
CO2	Analyze the operation of space segment, Antenna segment and Earth segment
CO3	Apply the corrective & controlling techniques to bring back the satellite in active mode
CO4	Analyze the losses in satellite communication and calculate the link budget equation
CO5	Analyze the different multiple access techniques used in satellite communication
CO6	Develop the applications of satellite in network environment

TEXT / REFERENCE BOOKS:

1. Dennis Roddy, "Satellite communication", 4th edition - Tata Mc Graw Hill Co. Special Indian print, 2009
2. Zhili Sun-John, "Satellite Networking Principles and Protocol", W.& Sons 2005
3. Timothy Pratt & C W. Bostain, "Satellite communication", Wiley 3rd Edition
4. K.N.Raja Rao, "Fundamentals of Satellite communication". PHI 2004

SEC1612 (old)	MEMS AND ITS APPLICATIONS	L	T	P	Credits	Total Marks
		3	0	0	3	100

UNIT 1 OVERVIEW OF MEMS AND MICROSYSTEMS**9 hrs**

Definition - Fundamentals - Properties, Introduction to MEMS and NEMS, Microsystems and miniaturization, Working principle of micro system - Micro sensors, Micro actuators, Micro accelerometers and Micro fluidics, MEMS materials: Silicon, silicon compounds, silicon Piezo- resistors, Gallium Arsenide, Quartz, Piezoelectric crystals, Polymers, Metals.

UNIT2 MEMS FABRICATION & PACKAGING**9 hrs**

Micro-system fabrication processes: Photolithography, Ion Implantation, Diffusion, and Oxidation. Thin film depositions: LPCVD, Sputtering, Evaporation, Electroplating; Etching techniques: Dry and wet etching, electrochemical etching; Micromachining: Bulk Micromachining, Surface Micromachining, LIGA Technology.

UNIT 3 MICRO SENSORS AND ACTUATORS**9 hrs**

Micro-sensing for MEMS: Piezo-resistive Pressure Sensor, Capacitive sensor, Piezoelectric sensing, Resonant sensing, Surface Acoustic Wave sensors-Electromechanical transducers: Piezoelectric transducers, Electrostrictive transducers, Magnetostrictive transducers- Electrostatic actuators, Electromagnetic transducers, Electro-dynamic transducers, Electro-thermal actuators, comparison of electro-thermal actuation process.

UNIT 4 MEMS DESIGN AND INTRODUCTION TO OPTICAL RF MEMS**9 hrs**

Micro system Design - Design consideration, process design, Mechanical design, Mechanical design using MEMS. Optical MEMS, System design basics - Gaussian optics, Matrix operations, Resolution. MEMS scanners and retinal scanning display, Digital Micro mirror devices. RF Mems - Design basics, case study - Capacitive RF MEMS switch, Performance issues.

UNIT5MEMS PACKAGING AND APPLICATIONS**9 hrs**

MEMS packaging: Role of MEMS packaging, Types of MEMS packaging, selection of packaging materials, flip-chip and multichip Unit packaging, RF MEMS packaging issues. Micro-machined transmission line and components, micro-machined RF Filters, Micro-machined Phase shifters, and Micro-machined antenna, Gyros and Bio-MEMS.

COURSE OUTCOMES:

On completion of this course, students are able to

CO1	Explain the operation of micro devices, micro systems and their applications
CO2	Design the micro devices, micro systems using the MEMS fabrication process
CO3	Analyze the approaches for various sensor design
CO4	Explain the approaches for various actuator design
CO5	Develop experience on micro/nano systems for computer-aided design
CO6	Discuss fabrication, analysis and characterization of nano-scale devices

TEXT / REFERENCE BOOKS:

1. Vijay K. Varadan, K. J. Vinoy and K. A. Jose , “RF MEMS & Their Applications”, John Wiley & Sons, 2003
2. Tai - Rai Hsu, “MEMS and Microsystems Design and Manufacturing”, Tata MC Graw Hill, New Delhi, Edition 2002
3. Gabriel M Rebeiz, “RF MEMS - Theory Design and Technology”, John Wiley and Sons, 2003
4. Nadim Maluf, “An introduction to Micro electro mechanical system design”, Artech House, 2000

SEC1632 (revised)	MEMS AND ITS APPLICATIONS	L	T	P	Credits	Total Marks
		3	0	0	3	100

UNIT 1 OVERVIEW OF MEMS AND MICROSYSTEMS**9 hrs**

Definition - Fundamentals - Properties, Introduction to MEMS and NEMS, Microsystems and miniaturization, MEMS materials: Silicon, silicon compounds, silicon Piezo- resistors, Gallium Arsenide, Quartz, Piezoelectric crystals, Polymers, Metals. Overview of microelectronics manufacture and Microsystems technology. Laws of scaling. The multi disciplinary nature of MEMS. Survey of materials central to micro engineering. Applications of MEMS in various industries.

UNIT2 MEMS FABRICATION & PACKAGING**9 hrs**

Micro-system fabrication processes: Photolithography, Ion Implantation, Diffusion, and Oxidation. Thin film depositions: LPCVD, Sputtering, Evaporation, Electroplating; Etching techniques: Dry and wet etching, electrochemical etching; Micromachining: Bulk Micromachining, Surface Micromachining, LIGA Technology. Packaging: Microsystems packaging, Essential packaging technologies, Selection of packaging materials.

UNIT 3 MICRO SENSORS AND ACTUATORS**9 hrs**

Micro-sensing for MEMS: Piezo-resistive Pressure Sensor, Capacitive sensor, Piezoelectric sensing, Resonant sensing, Surface Acoustic Wave sensors, - engineering mechanics behind these Microsensors, Electromechanical transducers: Piezoelectric transducers, Electrostrictive transducers, Magnetostrictive transducers, Actuation using Electrostatic forces (Parallel plate, Torsion bar, Comb drive actuators) Electrostatic actuators, Electromagnetic transducers, Electro-dynamic transducers, Electro-thermal actuators, comparison of electro-thermal actuation process. Case study: Comb drive actuators.

UNIT 4 MEMS DESIGN AND INTRODUCTION TO OPTICAL RF MEMS**9 hrs**

Micro system Design - Design consideration, process design, Mechanical design, Mechanical design using MEMS. Optical MEMS, System design basics - Gaussian optics, Matrix operations, Resolution. MEMS scanners and retinal scanning display, Digital Micro mirror devices. RF Mems - Design basics, Performance issues. RF MEMS relays and switches- Micromachined RF filters- Micromachined antennas- Switched delay lines. Micromachined transmission lines- RF MEMS based circuit design and case studies

UNIT5MEMS PACKAGING AND APPLICATIONS**9 hrs**

MEMS packaging: Role of MEMS packaging, Types of MEMS packaging, selection of packaging materials, flip-chip and multichip Unit packaging, RF MEMS packaging issues. Micro-machined transmission line and components, micro-machined RF Filters, Micro-machined Phase shifters, and Micro-machined antenna, Gyros and Bio-MEMS. Design considerations, Mechanical Design, Process design, Realization of MEMS components using intellisuite. Micro system packaging, Packing Technologies, Assembly of Microsystems, Reliability in MEMS.

COURSE OUTCOMES:

On completion of this course, students are able to

CO1	Analyze the operation of micro devices, micro systems and their applications
CO2	Design the micro devices, micro systems using the MEMS fabrication process
CO3	Apply the approaches for various sensor design
CO4	Apply the approaches for various actuator design
CO5	Develop experience on micro/nano systems for computer-aided design
CO6	Design nano scale devices by applying fabrication and analysis

TEXT / REFERENCE BOOKS:

1. Vijay K. Varadan, K. J. Vinoy and K. A. Jose , "RF MEMS & Their Applications", John Wiley & Sons, 2003
2. Tai - Rai Hsu, "MEMS and Microsystems Design and Manufacturing", Tata MC Graw Hill, New Delhi, Edition 2002
3. Gabriel M Rebeiz, "RF MEMS - Theory Design and Technology", John Wiley and Sons, 2003
4. Nadim Maluf, "An introduction to Micro electro mechanical system design", Artech House, 2000

SEC1603 (Old)	AUTOMATIC SPEECH RECOGNITION	L	T	P	Credits	Total Marks
		3	0	0	3	100

UNIT 1 FUNDAMENTALS OF SPEECH SIGNAL**9 hrs**

History of speech recognition research, The Speech Signal: Speech production mechanism, Classification of speech, sounds, nature of speech signal, models of speech production. Speech signal processing: purpose of speech processing, digital models for speech signal, Digital processing of speech signals, Significance, short time analysis

UNIT 2 TIME DOMAIN METHODS FOR SPEECH PROCESSING**9 hrs**

Time domain parameters of speech, methods for extracting the parameters, Zero crossings, Auto correlation function, pitch estimation

UNIT3 FREQUENCY DOMAIN METHODS FOR SPEECH PROCESSING**9 hrs**

Short time Fourier analysis, filter bank analysis, spectrographic analysis, Formant extraction, pitch extraction, Analysis - synthesis systems. Homomorphic Signal Processing

UNIT4 SPEECH ANALYSIS AND SPEECH RECOGNITION**9 hrs**

Cepstral analysis of speech, formant and pitch estimation, Mel frequency cepstrum computation, Applications of speech processing - Speech recognition, Speech synthesis and speaker verification, Basic pattern recognition approaches, Parametric representation of speech, Evaluating the similarity of speech patterns, Isolated digit Recognition System, Continuous digit Recognition System. **Vector quantization, speech coding**

UNIT5 HIDDEN MARKOV MODEL FOR SPEECH RECOGNITION**9 hrs**

Introduction to Hidden Markov Model (HMM), Types of HMM, Hidden Markov Model (HMM) for speech recognition, Viterbi algorithm, Training and testing using HMMs, **Adapting to variability in speech (DTW)**, Language models. Example of speech recognition project

Max. 45 hrs**COURSE OUTCOMES:**

On completion of the course, students are able to

CO1	Recognize and acquire knowledge about the fundamentals of speech production
CO2	Understand the application of Time domain analysis in speech signals
CO3	Comprehend the application of Time and frequency domain analysis in speech signals
CO4	Implement the analyses of speech signals in speech recognition applications
CO5	Representation of speech signals using the parametric methods of Hidden Markov model for speech recognition
CO6	Will be able to develop a speech processing and recognition system using various mathematical models and signal analysis tools

TEXT / REFERENCE BOOKS:

1. L. Rabiner and B.-H. Juang, "Fundamentals of Speech Recognition", Prentice Hall, 1995, ISBN 0-13-015157-2
2. L. R. Rabiner and R. W. Schafer, "Digital Processing of Speech Signals", Prentice-Hall, 1978, ISBN 0-13-213603-1
3. Douglas O'Shaughnessy, "Speech Communications: Human & Machine" -, 2nd ed., IEEE Press
4. Thomas F. Quateri, "Discrete Time Speech Signal Processing: Principles and Practice" - 1st Ed., PE
5. Claudio Becchetti and Lucio Prina Ricotti, "Speech Recognition", Wiley

SEC1633 (Revised)	AUTOMATIC SPEECH RECOGNITION	L	T	P	Credits	Total Marks
		3	0	0	3	100

UNIT 1 FUNDAMENTALS OF SPEECH SIGNAL**9 hrs**

History of speech recognition research, The Speech Signal: Speech production mechanism, Classification of speech, sounds, nature of speech signal, models of speech production. Speech signal processing: purpose of speech processing, digital models for speech signal, Digital processing of speech signals, Significance, short time analysis,

UNIT 2 TIME DOMAIN METHODS FOR SPEECH PROCESSING**9 hrs**

Time domain parameters of speech, methods for extracting the parameters, Zero crossings, Auto correlation function, pitch estimation, Adaptation (Noise adaptation, Speaker adaptation/normalization, Language model adaptation), Quality analysis of speech processing system

UNIT3 FREQUENCY DOMAIN METHODS FOR SPEECH PROCESSING**9 hrs**

Short time Fourier analysis, filter bank analysis, spectrographic analysis, Formant extraction, pitch extraction, Analysis - synthesis systems. Homomorphic Signal Processing, Speech Signal Representation- Short-time Fourier Analysis, Parametric Representation of the Spectral Analysis

UNIT4 SPEECH ANALYSIS AND SPEECH RECOGNITION**9 hrs**

Cepstral analysis of speech, formant and pitch estimation, Mel frequency cepstrum computation, Applications of speech processing - Speech recognition, Speech synthesis and speaker verification, Basic pattern recognition approaches, Parametric representation of speech, Evaluating the similarity of speech patterns, Isolated digit Recognition System, Continuous digit Recognition System. Vector quantization, speech coding

UNIT5 HIDDEN MARKOV MODEL FOR SPEECH RECOGNITION**9 hrs**

Introduction to Hidden Markov Model (HMM), Types of HMM, Hidden Markov Model (HMM) for speech recognition, Viterbi algorithm, Training and testing using HMMs, Adapting to variability in speech (DTW), Language models. Example of speech recognition project

Case study: Neural network-based acoustic modeling (Hybrid/Tandem/TDNN models), Convolutional Neural Networks in Speech, Speaker Adaptation.

Max. 45 hrs

COURSE OUTCOMES:

On completion of the course, students are able to

CO1	Analyze the knowledge about the fundamentals of speech production
CO2	Apply the application of Time domain analysis in speech signals
CO3	Apply the application of Time and frequency domain analysis in speech signals
CO4	Implement the analyses of speech signals in speech recognition applications
CO5	Analyze the speech signals using the parametric methods of Hidden Markov model for speech recognition
CO6	Develop a speech processing and recognition system using various mathematical models and signal analysis tools

TEXT / REFERENCE BOOKS:

1. L. Rabiner and B.-H. Juang, "Fundamentals of Speech Recognition", Prentice Hall, 1995, ISBN 0-13-05157-2
2. L. R. Rabiner and R. W. Schafer, "Digital Processing of Speech Signals", Prentice-Hall, 1978, ISBN 0-13-213603-1
3. Douglas O'Shaughnessy, "Speech Communications: Human & Machine" -, 2nd ed., IEEE Press
4. Thomas F. Quateri, "Discrete Time Speech Signal Processing: Principles and Practice" - 1st Ed., PE
5. Claudio Becchetti and Lucio Prina Ricotti, "Speech Recognition", Wiley

SEC1617 (Old)	ADVANCED ELECTRONIC TEST ENGINEERING	L	T	P	Credits	Total Marks
		3	0	0	3	100

UNIT1 INTRODUCTION TO PCB TECHNOLOGY**9hrs**

Printed Circuit Boards(PCB) - Construction - Types of PCB - Multilayer - Surface Mount technology – PCB Manufacturing process - PCB Inspection methods - Bare Board Testing - Optical and X-Ray Inspection - Electrical tests -Text fixtures - Bed of nails fixtures - Cross talk test - Mock up test - In circuit test – Burn-in-test - Fault diagnostic methods. Electromagnetic compatibility testing of electronic components, subassemblies, Measuring Instruments and systems

UNIT2 PCB TROUBLE SHOOTING PROCESS**9 hrs**

Symptom Recognition - Bracketing Technique - Component failure Analysis - Fault types and causes in circuits- during manufacturing - Manual trouble shooting technique - Tools and Instruments DMM - CRO - PCO - Logic probes- Logic pulsar - Logic Analyzer-

UNIT3 AUTOMATED TROUBLE SHOOTING TECHNIQUES**9 hrs**

ATE Techniques - CPU Emulator technique - ROM and ROM Emulators - In circuit Comparator - In Circuit Functional test - Trouble shooting digital gates - Testing Linear Integrated Circuits - Guarding Technique - VI trace Technique - Bus Cycle Signature System - Board functional test methods - Boundary scan test basics, ATE System Components - Digital Pin Electronics - Drive data formats - Digital High way - Analog Highway

UNIT4 ATE SYSTEM ARCHITECTURE**9 hrs**

ATE System Components - Digital Pin Electronics - Drive data formats - Digital High way - Analog Highway –. Test Vector Generation - Creating test patterns - Fault Simulations. Technique - Bus Cycle Signature System - Board functional test methods - Boundary scan test basics.

UNIT5 DESIGN FOR TESTABILITY (DFT)**9 hrs**

MDA test systems - Boundary scan test with I/O pin compatibility - Automatic optical inspection systems -Combinational ATE Systems - Design for testability - Observability and Controllability - Testing Flow diagram - Stuck at fault model - Fault simulation - Ad Hoc technique - Scan design technique - Basics of ATPG - BIST-Test pattern generation for built in self test - Exhaustive pattern generation and deterministic testing - Output response Analysis -Transition count syndrome checking - Signature Analysis - Circular BIST

Max. 45 hrs

COURSE OUTCOMES:

On completion of this course, students are able to

CO1	Identify various types of printed circuit boards and effectively use testing tools
CO2	Describe the working of automated test equipments
CO3	Identify faults in assembled PCBs using automated test equipments both at component level and board level
CO4	Design board fixtures to carry out customized board level testing
CO5	Develop test vectors and test patterns for fault identification in custom PCBs
CO6	Design and implement electronic systems with testability architectures

TEXT / REFERENCE BOOKS:

- 1 Michael L.Bushnell et al., "Essentials of Electronic testing for digital, memory and mixed signal VLSI circuit",1st edition, Academic Press, 2002
- 2 Parag.K.lala, "Digital circuit Testing and Testability", 1st edition, Academic press, 2001
- 3 Alfred L.Crouch, "Design for test for Digital ICs and Embedded core systems", 2nd edition, PHI, 1999
- 4 Sabapathy S.R., "Test Engineering for electronic hardware", Qmax publishers, 1st Edition, 2007

SEC1634 (Revised)	ADVANCED ELECTRONIC TEST ENGINEERING	L	T	P	Credits	Total Marks
		3	0	0	3	100

UNIT1 INTRODUCTION TO PCB TECHNOLOGY**9hrs**

Printed Circuit Boards(PCB) - Construction - Types of PCB - Multilayer - Surface Mount technology – PCB Manufacturing process - PCB Inspection methods - Bare Board Testing - Optical and X-Ray Inspection Electromagnetic compatibility testing of electronic components, subassemblies, Measuring Instruments and systems- Digital and Analog VLSI Testing- VLSI Technology Trends Affecting Testing . Fault Modeling

UNIT2 PCB TROUBLE SHOOTING PROCESS**9 hrs**

Symptom Recognition - Bracketing Technique - Component failure Analysis - Fault types and causes in circuits- during manufacturing - Manual trouble shooting technique - Tools and Instruments DMM - CRO - PCO - Logic probes- Logic pulsar - Logic Analyzer- Functional DSP-Based Testing

UNIT3 AUTOMATED TROUBLE SHOOTING TECHNIQUES**9 hrs**

ATE Techniques - CPU Emulator technique - ROM and ROM Emulators - In circuit Comparator - In Circuit Functional test - Trouble shooting digital gates - Testing Linear Integrated Circuits - Guarding Technique - VI trace Technique - Bus Cycle Signature System - Board functional test methods - Boundary scan test basics, ATE System Components - Digital Pin Electronics - Drive data formats - Digital High way - Analog Highway- Analog and Mixed-Signal Circuit Test

UNIT4 ATE SYSTEM ARCHITECTURE**9 hrs**

ATE System Components — Advantest Model T6682 ATE . Test Vector Generation - Creating test patterns - Fault Simulations. Technique - Bus Cycle Signature System - Board functional test methods - Boundary scan test basics.- The Generic Test Automation Architecture - Overview of the gTAA - Test Generation Layer-Test Definition Layer-Test Execution Layer- Configuration Management of a TAS- Troubleshooting Biomedical Equipment- Defibrillators- ECG Systems- ECG Machine Maintenance- EEG Machines, Troubleshooting and Preventive Maintenance- Hemodialysis Machines and Troubleshooting

UNIT5 DESIGN FOR TESTABILITY (DFT)**9 hrs**

MDA test systems - Boundary scan test with I/O pin compatibility - Automatic optical inspection systems -Combinational ATE Systems - Design for testability - Observability and Controllability - Testing Flow diagram - Stuck at fault model - Fault simulation - Ad Hoc technique - Scan design technique - Basics of ATPG - BIST-Test pattern generation for built in self test - Exhaustive pattern generation and deterministic testing - Output response Analysis -Transition count syndrome checking - Signature Analysis - Circular BIST

Max. 45 hrs

COURSE OUTCOMES:

On completion of this course, students are able to

CO1	Analyze various types of printed circuit boards and effectively use testing tools
CO2	Examine the working of automated test equipments
CO3	Identify faults in assembled PCBs using automated test equipments both at component level and board level
CO4	Design board fixtures to carry out customized board level testing
CO5	Develop test vectors and test patterns for fault identification in custom PCBs
CO6	Design and implement electronic systems with testability architectures

TEXT / REFERENCE BOOKS:

- 1 Michael L.Bushnell et al., "Essentials of Electronic testing for digital, memory and mixed signal VLSI circuit",1st edition, Academic Press, 2002
- 2 Parag.K.lala, "Digital circuit Testing and Testability", 1st edition, Academic press, 2001
- 3 Alfred L.Crouch, "Design for test for Digital ICs and Embedded core systems", 2nd edition, PHI, 1999
- 4 Sabapathy S.R., "Test Engineering for electronic hardware", Qmax publishers, 1st Edition, 2007

SEC1616	PATTERN RECOGNITION AND IMAGE VISION (Common to ETCE, E&C & EIE)	L	T	P	Credits	Total Marks
		3	0	0	3	100

UNIT 1 PRINCIPLES OF PATTERN RECOGNITION

9 hrs

Patterns and features, training and learning in pattern recognition approach, different types of pattern recognition. Statistical pattern recognition, feature selection, syntactic pattern recognition, clustering and non-supervised learning methods.

UNIT 2 OBJECT DETECTION METHODOLOGIES

9 hrs

Combined detection method, edge detection, edge linking, gradient. Laplacian, line detection, method based, point detection, snake methods. Boundary description detection, matching, merges segmentation, smoothing, splitting of boundaries syntactic, analysis of region boundaries, **study of shape by region analysis.**

UNIT 3 PATTERN CLASSIFICATION

9 hrs

DISTANCE FUNCTIONS - Pattern classification by distance functions - Minimum distance classification - Cluster and cluster seeking algorithms - Pattern classification by likelihood functions. Statistical Functions - Pattern classification using Statistical classifiers - Bayes' classifier - **Classification performance measures - Risk and error probabilities.**

UNIT 4 PATTERN RECOGNITION

9 hrs

FUZZY CLASSIFIERS- Fuzzy and crisp classification - Fuzzy clustering - Fuzzy pattern recognition - Syntactic pattern recognition- Selection of primitives - Syntax analysis for pattern recognition. NEURAL CLASSIFIERS- Introduction - Neural network structures for PR, Neural network based pattern associators - Feed forward networks trained by back propagation - ART networks.

UNIT 5 IMAGE EXTRACTION CONCEPTS

9 hrs

Introduction of Computer Vision, Computer Imaging System, Image Formation and sensing CVIP tools Software, Image representation. Area Extraction: Concepts, Data-structures, Edge, Line- Linking, Hough transform, Line fitting, Curve fitting.

Introduction BOUNDARY ANALYSIS AND MATCHING Region Analysis: Region properties, External points, spatial moments, mixed spatial gray-level moments, Boundary analysis: Signature properties, Shape numbers. General Frame Works for Matching: Distance relational approach.

COURSE OUTCOMES:

On completion of this course, students are able to

CO1	Understand the fundamentals of Pattern Recognition
CO2	Learn the various approaches to identify the patterns
CO3	Implement pattern classification
CO4	Analyze the fuzzy classifiers
CO5	Illustrate the concept of image extraction on computer vision
CO6	Apply the appropriate techniques on the real time application development

SEC1635 (Revised)	PATTERN RECOGNITION AND IMAGE VISION (Common to ETCE, E&C & EIE)	L	T	P	Credits	Total Marks
		3	0	0	3	100

UNIT 1 PRINCIPLES OF PATTERN RECOGNITION

9 hrs

Patterns and features, training and learning in pattern recognition approach, different types of pattern recognition. Statistical pattern recognition, feature selection, **feature detection**, syntactic pattern recognition, clustering and non-supervised learning methods. **Applications of pattern recognition.**

UNIT 2 OBJECT DETECTION METHODOLOGIES

9 hrs

Combined detection method, edge detection, edge linking, gradient. Laplacian, line detection, method based, point detection, snake methods. Boundary description detection, matching, merges segmentation, smoothing, splitting of boundaries syntactic, analysis of region boundaries, **Parzen-window method. K-Nearest Neighbour method.**

UNIT 3 PATTERN CLASSIFICATION

9 hrs

DISTANCE FUNCTIONS - Pattern classification by distance functions - Minimum distance classification - Cluster and cluster seeking algorithms - Pattern classification by likelihood functions. Statistical Functions - Pattern classification using Statistical classifiers - Bayes' classifier, **Non-metric methods for pattern classification, on- numeric data, Decision tress, Classification and Regression Trees (CART).**

UNIT 4 PATTERN RECOGNITION

9 hrs

Sequential pattern recognition-Hidden Markov models (HMMs)-Discrete HMMs, Continuous HMMs, - Syntactic pattern recognition- Selection of primitives - Syntax analysis for pattern recognition. NEURAL CLASSIFIERS- Introduction - Neural network structures for PR, Neural network based pattern associators - Feed forward networks trained by back propagation - ART networks.

UNIT 5 IMAGE EXTRACTION CONCEPTS

9 hrs

Introduction of Computer Vision, Computer Imaging System, Image Formation and sensing CVIP tools Software, Image representation. Area Extraction: Concepts, Data-structures, Edge, Line- Linking, Hough transform, Line fitting, Curve fitting.

Introduction BOUNDARY ANALYSIS AND MATCHING Region Analysis: Region properties, External points, spatial moments, mixed spatial gray-level moments, Boundary analysis: Signature properties, Shape numbers. General Frame Works for Matching: Distance relational approach. **AI in imaging system.**

COURSE OUTCOMES:

On completion of this course, students are able to

CO1	Illustrate the fundamentals of Pattern Recognition
CO2	Analyze the various approaches to identify the patterns
CO3	Implement pattern classification
CO4	Analyze the neural classifiers
CO5	Illustrate the concept of image extraction on computer vision
CO6	Apply the appropriate techniques on the real time application development

SEC1613 (Old)	MOBILE AD-HOC NETWORKS	L	T	P	Credits	Total Marks
		3	0	0	3	100

UNIT 1 INTRODUCTION

9hrs

Origin of Adhoc:Packet Radio Networks - Technical Challenges - Architecture of PRNETs - Components of Packet Radios - Introduction to Adhoc networks - Definition, characteristics features - Issues in Mobile Ad Hoc networks- Types of Ad hoc Mobile Communications

Types of Mobile Host Movements - Ad hoc wireless Internet. Characteristics of Wireless channel Mobility models - Indoor and Outdoor

UNIT2 MEDIUM ACCESS PROTOCOLS

9hrs

MAC protocols: design issues, goals and classification. Contention based protocols - With reservation, scheduling algorithms, protocols using direction antennas - Distributed packet reservation - Multiple access protocol, collision avoidance time allocation protocol. IEEE standards: 802.11 a, 802.11 b, 802.11g

UNIT3 ROUTING PROTOCOLS AND MULTICAST ROUTING IN ADHOC NETWORKS

9hrs

. Introduction - Issues in Designing a Routing Protocol for Ad Hoc Wireless Networks - Classifications of Routing Protocols Table Driven routing protocols: Destination Sequenced Distance Vector Routing Protocol - Cluster head Gateway switched routing protocol. On Demand routing protocol: Dynamic source routing protocol, AODV routing protocol, temporarily ordered routing algorithm. Hybrid routing protocols: Zone routing protocol, Zone based Hierarchical link state routing protocol. Architecture Model for Multicast Routing Protocols - Classifications of Multicast Routing Protocols - Tree Based Multicast Routing Protocols - Mesh-Based Multicast Routing Protocols - Energy-Efficient Multicasting - Comparisons of Multicast Routing Protocols

UNIT4 QOS AND ENERGY MANAGEMENT

9hrs

Issues and Challenges in Providing QoS in Ad Hoc Wireless Networks - Classifications of QoS Solutions - MAC Layer Solutions - Network Layer Solutions. Need for Energy Management in Ad Hoc Wireless Networks - Classification of Energy Management Schemes - Battery Management Schemes - Transmission Power Management Schemes - System Power Management Schemes

UNIT5 ADHOC NOMADIC MOBILE APPLICATIONS

9hrs

In the Office, While Traveling, Arriving Home, In the Car, Shopping Malls, The Modern battlefield, Car-to-Car Mobile Communications, Mobile Collaborative Applications - Location/context based mobile services - Introduction to wireless mesh networks and vehicular Adhoc networks

COURSE OUTCOMES:

On completion of this course, students are able to

CO1	Acquire knowledge about Adhoc networks and mobility models
CO2	Describe the design issues , classifications of MAC protocols
CO3	Explain the classifications of routing protocols
CO4	Analyze the QOS issues, Energy Management issues and challenges in Adhoc Networks
CO5	Develop Adhoc networks application
CO6	Explain the concepts of wireless mesh and vehicular networks

TEXT / REFERENCE BOOKS:

1. Toh.C.K, "Ad Hoc Mobile Wireless Networks: Protocols and Systems", Prentice Hall PTR, 2001
 2. Siva ram Murthy.C and B S Manoj, "Ad Hoc Wireless Networks: Architecture and Protocols", Prentice Hall PTR, 2004
 3. Charles E Perkins, Ad Hoc Networking", Addison Wesley, 2001
 4. Xiuzhen Cheng, Xiao Huang, Ding Zhu Du, "Ad Hoc Wireless Networking", Springer Netherlands, 2004 5. Tavli
 5. Bulent, Heinzelman, Wendi, "Mobile Ad Hoc Networks: Energy-Efficient Real-Time Data Communications", Springer, 2006
- Aggelou, George, "Mobile Ad Hoc Networks: From Wireless LANs to 4g Networks", McGraw-Hill Professional Engineering, 2004

SEC1636 (Revised)	MOBILE AD-HOC NETWORKS	L	T	P	Credits	Total Marks
		3	0	0	3	100

UNIT 1 INTRODUCTION

9hrs

Origin of Adhoc:Packet Radio Networks - Technical Challenges - Architecture of PRNETs - Components of Packet Radios - Introduction to Adhoc networks - Definition, characteristics features - Issues in Mobile Ad Hoc networks- Types of Ad hoc Mobile Communications

Types of Mobile Host Movements - Ad hoc wireless Internet. Characteristics of Wireless channel Mobility models - Indoor and Outdoor

UNIT2 MEDIUM ACCESS PROTOCOLS AND CROSS LAYER DESIGN

9hrs

MAC protocols: design issues, goals and classification. Contention based protocols - With reservation, scheduling algorithms, protocols using direction antennas - Distributed packet reservation - Multiple access protocol, collision avoidance time allocation protocol. IEEE standards: 802.11 a, 802.11 b, 802.11g

Cross layer Design: Need for cross layer design, cross layer optimization, parameter optimization techniques, cross layer cautionary perspective. Integration of adhoc with Mobile IP networks

UNIT3 ROUTING PROTOCOLS AND MULTICAST ROUTING IN ADHOC NETWORKS

9hrs

. Classifications of Routing Protocols Table Driven routing protocols: Destination Sequenced Distance Vector Routing Protocol - Cluster head Gateway switched routing protocol. On Demand routing protocol: Dynamic source routing protocol, AODV routing protocol, temporarily ordered routing algorithm. Hybrid routing protocols: Zone routing protocol, Zone based Hierarchical link state routing protocol. Architecture Model for Multicast Routing Protocols - Classifications of Multicast Routing Protocols - Tree Based Multicast Routing Protocols - Mesh-Based Multicast Routing Protocols - Energy-Efficient Multicasting - Comparisons of Multicast Routing Protocols

UNIT4 QOS AND ENERGY MANAGEMENT

9hrs

Issues and Challenges in Providing QoS in Ad Hoc Wireless Networks - Classifications of QoS Solutions - MAC Layer Solutions - Network Layer Solutions. Need for Energy Management in Ad Hoc Wireless Networks - Classification of Energy Management Schemes - Security in Ad-hoc Wireless Networks, Issues and Challenges in Security Provisioning, Network Security Attacks, Key Management and Secure Routing Ad-hoc Wireless Networks

UNIT5 ADHOC NOMADIC MOBILE APPLICATIONS

9hrs

In the Office, While Traveling, Arriving Home, In the Car, Shopping Malls, The Modern battlefield, Car-to-Car Mobile Communications, Mobile Collaborative Applications - Location/context based mobile services - Introduction to wireless mesh networks and vehicular Adhoc networks

COURSE OUTCOMES:

On completion of this course, students are able to

CO1	Acquire knowledge about Adhoc networks and mobility models
CO2	Describe the design issues , classifications of MAC protocols and Cross Layer Design
CO3	Explain the classifications of routing protocols
CO4	Analyze the QOS issues, Energy Management and Security issues in Adhoc Networks
CO5	Develop Adhoc networks application
CO6	Explain the concepts of wireless mesh and vehicular networks

TEXT / REFERENCE BOOKS:

1. Toh.C.K, "Ad Hoc Mobile Wireless Networks: Protocols and Systems", Prentice Hall PTR, 2001
 2. Siva ram Murthy.C and B S Manoj, "Ad Hoc Wireless Networks: Architecture and Protocols", Prentice Hall PTR, 2004
 3. Charles E Perkins, Ad Hoc Networking", Addison Wesley, 2001
 4. Xiuzhen Cheng, Xiao Huang, Ding Zhu Du, "Ad Hoc Wireless Networking", Springer Netherlands, 2004 5. Tavli
 5. Bulent, Heinzelman, Wendi, "Mobile Ad Hoc Networks: Energy-Efficient Real-Time Data Communications", Springer, 2006
- Aggelou, George, "Mobile Ad Hoc Networks: From Wireless LANs to 4g Networks", McGraw-Hill Professional Engineering, 2004

SEC1615 (Old)	NANOELECTRONICS	L	T	P	Credits	Total Marks
		3	0	0	3	100

UNIT 1 FUNDAMENTALS OF NANOELECTRONICS

9hrs

Moore's Law, Wave functions, wave packets, Schrodinger's wave equation, potential barriers and tunneling, Fermi-Dirac statistics, Density of states, Limitations of conventional FET in nanoscales, Quantum Well, Quantum wire, Quantum dot, current flow in two terminal Quantum dots, ballistic transport, Single Electron Transistor

UNIT 2 PHYSICAL DEPOSITION (THIN FILM) TECHNIQUES

9hrs

Basics of physical methods, Glow discharge DC Sputtering, Triode sputtering, Getter sputtering, Radio frequency sputtering, Magnetron sputtering, Ion beam sputtering, AC sputtering, Vacuum evaporation, Resistive heat Evaporation, Flash Evaporation, Electron Beam Evaporation, LASER evaporation

UNIT 3 CHEMICAL DEPOSITION (THIN FILM) TECHNIQUES

9hrs

Fundamentals of chemical methods, Chemical Vapour Deposition, LASER chemical Vapour Deposition, Photo Chemical Vapour Deposition, Plasma enhanced Vapour Deposition, Metal Organo Chemical Vapour Deposition, Chemical Bath Deposition, Electro less Deposition, Anodisation, Liquid Phase Epitaxy, Sol-Gel method, Spin Coating, Spray-Pyrolysis Technique, Polymer Assisted Deposition

UNIT 4 THIN FILM CHARACTERIZATION TECHNIQUES

9hrs

Cyclic Voltammetry and Linear Sweep Techniques, Thickness measurement Techniques, X-Ray Diffraction Technique, Raman Spectral Study, Scanning Electron Microscopy, Energy Dispersive Analysis by X-rays measurements, Atomic Force Microscopy

UNIT 5 NANOELECTRONIC DEVICES

9hrs

Digital and Switching abstraction, Quantum Cellular Automata (QCA), Realization of logic gates using QCA, Types and synthesis of molecular bundles, principle and types of spin wave devices, Array minimum/ maximum computation with spin wave devices

COURSE OUTCOMES:

On completion of the course, students are able to

CO1	Explain the evolution and basics of Nanoelectronics
CO2	Classify the different physical deposition techniques for thin film deposition
CO3	Discuss the different types of chemical vapour decomposition techniques for thin film techniques
CO4	Appraise the various thin film characterization techniques
CO5	Assemble the basics of elementary quantum devices
CO6	Implement the techniques in Quantum devices

TEXT / REFERENCE BOOKS:

1. George W Hanson, "Fundamentals of Nanoelectronics", Prentice Hall, 2008
2. Karl Goser, "Nanoelectronics and Nanosystems: From Transistors to Molecular and Quantum Devices", Springer, First edition, 2005
3. Rainer Waser (Ed), "Nanoelectronics and Information Technology", Second Edition, Wiley VCH, 2003
4. Mary Eshaghian-Wilner, "Bio inspired and Nano Scale Integrated Computing", Wiley, 2009

SEC1637 (Revised)	NANOELECTRONICS	L	T	P	Credits	Total Marks
		3	0	0	3	100

UNIT 1 FUNDAMENTALS OF NANOELECTRONICS

9hrs

Introduction to nanotechnology, Impacts, Limitations of conventional microelectronics, Trends in microelectronics and optoelectronics Mesoscopic physics, trends in microelectronics and optoelectronics, characteristic lengths in mesoscopic systems, Quantum mechanical coherence

Nanomaterials: Preparation –Plasma Arcing – Chemical Vapor Deposition – Sol-Gels – Electrode Position – Ball Milling –Applications Of Nanomaterials

Moore's Law, Wave functions, wave packets, Schrodinger's wave equation, potential barriers and tunneling, Fermi-Dirac statistics, Density of states, Limitations of conventional FET in nanoscales, Quantum Well, Quantum wire,

UNIT 2 PHYSICAL DEPOSITION (THIN FILM) TECHNIQUES

9hrs

Basics of physical methods, Glow discharge DC Sputtering, Triode sputtering, Getter sputtering, Radio frequency sputtering, Magnetron sputtering, Ion beam sputtering, AC sputtering, Vacuum evaporation, Resistive heat Evaporation, Flash Evaporation, Electron Beam Evaporation, LASER evaporation

UNIT 3 CHEMICAL DEPOSITION (THIN FILM) TECHNIQUES

9hrs

Fundamentals of chemical methods, Chemical Vapour Deposition, LASER chemical Vapour Deposition, Photo Chemical Vapour Deposition, Plasma enhanced Vapour Deposition, Metal Organo Chemical Vapour Deposition, Chemical Bath Deposition, Electro less Deposition, Anodisation, Liquid Phase Epitaxy, Sol-Gel method, Spin Coating, Spray-Pyrolysis Technique, Polymer Assisted Deposition

UNIT 4 THIN FILM CHARACTERIZATION TECHNIQUES AND CARBON NANO TUBES

9hrs

Cyclic Voltammetry and Linear Sweep Techniques, Thickness measurement Techniques, X-Ray Diffraction Technique, Raman Spectral Study, Scanning Electron Microscopy, Energy Dispersive Analysis by X-rays measurements, Atomic Force Microscopy

Carbon Nanotube: Fullerenes - types of nanotubes – formation of nanotubes – assemblies – purification of carbon nanotubes – electronic properties – synthesis of carbon nanotubes

UNIT 5 NANOELECTRONIC DEVICES

9hrs

Introduction to characterization of nanostructures, tools used for of nano materials characterization, microscope-optical, electron, and electron microscope

Digital and Switching abstraction, Quantum Cellular Automata (QCA), Realization of logic gates using QCA, Types and synthesis of molecular bundles, principle and types of spin wave devices, Array minimum/ maximum computation with spin wave device Micro Electronics:Future applications: MEMS – robots – random access memory – mass storage devices.

COURSE OUTCOMES:

On completion of the course, students are able to

CO1	Explain the evolution and basics of Nanoelectronics
CO2	Classify the different physical deposition techniques for thin film deposition
CO3	Discuss the different types of chemical vapour decomposition techniques for thin film techniques
CO4	Appraise the various thin film characterization techniques
CO5	Assemble the basics of elementary quantum devices
CO6	Implement the techniques in Quantum devices

TEXT / REFERENCE BOOKS:

1. George W Hanson, "Fundamentals of Nanoelectronics", Prentice Hall, 2008
2. Karl Goser, "Nanoelectronics and Nanosystems: From Transistors to Molecular and Quantum Devices", Springer, First edition, 2005
3. Rainer Waser (Ed), "Nanoelectronics and Information Technology", Second Edition, Wiley VCH, 2003
4. Mary Eshaghian-Wilner, "Bio inspired and Nano Scale Integrated Computing", Wiley, 2009

SEC1621 (Old)	SPREAD SPECTRUM COMMUNICATION	L	T	P	Credits	Total Marks
		3	0	0	3	100

UNIT 1 INTRODUCTION

9hrs

Basic digital communication concepts, Impact of wide band, Detection of binary signals in additive white Gaussian Noise, Differences between standard narrow-band communication systems and spread spectrum systems. Spread-spectrum waveforms & its characteristics, spread spectrum communication system model, Techniques for reducing the impact of interference on spread spectrum signals, Jamming considerations

UNIT 2 BINARY SHIFT-REGISTER SEQUENCES AND CODE TRACKING LOOPS

9hrs

Definitions , mathematical Background and Sequence generator fundamentals, Maximal-length Sequences, Direct Sequence and Spreading Codes Walsh Code, Pseudo Random Code, Mean and Variance of Random Codes Gold codes, Nonlinear code generators. Optimum tracking of wideband signals, Baseband Delay-lock Tracking Loop, Non-coherent Delay-lock Tracking loop, Tau-Dither non-coherent tracking loop, Double-Dither Non-coherent Tracking loop, Non-coherent Delay-Lock Tracking loop with arbitrary data and spreading modulation, Code tracking loops for Frequency-Hop systems

UNIT 3 DIRECT-SEQUENCE AND FREQUENCY- HOPPED SPREAD SPECTRUM

9hrs

Types and advantages of spread spectrum modulation formats- BPSK, QPSK, MSK Direct -Sequence spread spectrum, coherent slow- Frequency hopped spread spectrum, non-coherent slow and fast Frequency hopped spread spectrum Hybrid Direct-sequence/Frequency-Hop spread spectrum, Complex-Envelop Representation of spread spectrum systems

UNIT 4 SYNCHRONIZATION AND PERFORMANCE ANALYSIS

9hrs

Problem definition and the optimum synchronizer, serial search synchronization techniques, general analysis of average synchronization time, synchronization using a matched filter, synchronization by estimating the received spreading code, tracking loop pull-in, performance of spread spectrum system without coding, performance of spread spectrum system with forward error correction

UNIT 5 CODE DIVISION MULTIPLE ACCESS

9Hrs

Cellular radio concept, CDMA digital cellular systems, examples of CDMA digital cellular systems, cellular CDMA applications, Analyze the performance of spread spectrum signals in the presence of multiple access interference (CDMA context), Calculation of theoretical capacity of a CDMA system, coding and decoding processes in CDMA, effects of interference in CDMA, and synchronization in CDMA wireless communication systems. 3G wireless systems using CDMA technologies, Major factors influencing the capacity of CDMA wireless networks, Multicarrier CDMA, Rake receivers wireless LAN applications, commercial and military applications

COURSE OUTCOMES:

On completion of this course, students are able to

CO1	Explain the features of Direct sequence spread spectrum
CO2	Classify the various jammer systems
CO3	Compare FH/QPSK and FH/DPSK
CO4	Demonstrate BPSK and QPSK
CO5	Describe the Matched Filter techniques
CO6	Create a simple CDMA based Spread spectrum

TEXT / REFERENCE BOOKS:

1. R. L. Peterson, R. E. Ziemer, and D. E. Borth, "Introduction to Spread Spectrum Communications", Prentice Hall, 2005 (ISBN 81-297-0973-2)
2. R. C. Dixon, "Spread Spectrum Systems", John Wiley & Sons, 1994, ISBN: 0471593427
3. D R Kamilo Feher, "Wireless digital communications Modulation & Spread Spectrum Applications", Prentice Hall of India, 1999, ISBN 81-203-1472-7
4. Andreas F.Molisch, "Wideband Wireless Digital Communications", Pearson Education, ISBN 81-7808-301-9, 2003
5. A. J. Viterbi, "CDMA: Principles of Spread Spectrum Communication", Addison-Wesley, 1995, ISBN: 0201633744
6. Bernard Sklar, Pabitra Kumar Ray, "Digital Communications", Pearson, ISBN 978-81 -31 7-2092-9, 2009

SEC1638 (Revised)	SPREAD SPECTRUM COMMUNICATION	L	T	P	Credits	Total Marks
		3	0	0	3	100

UNIT 1 INTRODUCTION

9hrs

Spread-spectrum waveforms & its characteristics, spread spectrum communication system model, Techniques for reducing the impact of interference on spread spectrum signals, Jamming considerations. Slow and fast frequency hopping. General mechanism of ML sequence. Power spectral density of ML sequence. General mechanism and properties of Walsh Hadamard Code, OVFSF, Barker codes, Gold and Kasami codes

UNIT 2 BINARY SHIFT-REGISTER SEQUENCES AND CODE TRACKING LOOPS

9hrs

Definitions, mathematical Background and Sequence generator fundamentals, Maximal-length Sequences, Direct Sequence and Spreading Codes Walsh Code, Pseudo Random Code, Mean and Variance of Random Codes Gold codes, Nonlinear code generators. Optimum tracking of wideband signals, Baseband Delay-lock Tracking Loop, Non-coherent Delay-lock Tracking loop, Tau-Dither non-coherent tracking loop, Double-Dither Non-coherent Tracking loop, Non-coherent Delay-Lock Tracking loop with arbitrary data and spreading modulation, Code tracking loops for Frequency-Hop systems

UNIT 3 DIRECT-SEQUENCE AND FREQUENCY- HOPPED SPREAD SPECTRUM

9hrs

Types and advantages of spread spectrum modulation formats- BPSK, QPSK, MSK Direct -Sequence spread spectrum, coherent slow- Frequency hopped spread spectrum, non-coherent slow and fast Frequency hopped spread spectrum Hybrid Direct-sequence/Frequency-Hop spread spectrum, Complex-Envelope Representation of spread spectrum systems

UNIT 4 Performance of Spread Spectrum System

9hrs

Systems communications models – Performance without coding under AWGN and different jamming environments – spread spectrum systems performances with forward error correction -Block coding – Convolutional coding and specific error correcting codes – Inter leaving – Random coding bounds

UNIT 5 CODE DIVISION MULTIPLE ACCESS

9hrs

Cellular radio concept, CDMA digital cellular systems, examples of CDMA digital cellular systems, cellular CDMA applications, Analyze the performance of spread spectrum signals in the presence of multiple access interference (CDMA context), CDMA RF Propagation Principles, Antennas for Wireless Systems, CDMA Traffic Engineering, CDMA Air Interface Overview, Key CDMA Performance Parameters and their Significance, Call Processing from Perspective of the Subscriber Handset, CDMA Handoffs

COURSE OUTCOMES:

On completion of this course, students are able to

CO1	Explain the features of Direct sequence spread spectrum
CO2	Classify the various jammer systems
CO3	Compare FH/QPSK and FH/DPSK
CO4	Demonstrate BPSK and QPSK
CO5	Describe the Matched Filter techniques
CO6	Create a simple CDMA based Spread spectrum for different application

TEXT / REFERENCE BOOKS:

1. R. L. Peterson, R. E. Ziemer, and D. E. Borth, "Introduction to Spread Spectrum Communications", Prentice Hall, 2005 (ISBN 81-297-0973-2)
2. R. C. Dixon, "Spread Spectrum Systems", John Wiley & Sons, 1994, ISBN: 0471593427
3. D R Kamilo Feher, "Wireless digital communications Modulation & Spread Spectrum Applications", Prentice Hall Of India, 1999, ISBN 81-203-1472-7
4. A. J. Viterbi, "CDMA: Principles of Spread Spectrum Communication", Addison-Wesley, 1995, ISBN: 0201633744
5. Bernard Sklar, Pabitra Kumar Ray, "Digital Communications", Pearson, ISBN 978-81 -31 7-2092-9, 2009
6. Andreas F.Molisch, "Wideband Wireless Digital Communications", Pearson Education, ISBN 81-7808-301-9,2003

SEC1060 (old)	RADAR AND NAVIGATIONAL AIDS	L	T	P	Credits	Total Marks
		3	0	0	3	100

UNIT1 INTRODUCTION TO RADAR**9 hrs**

Basic Radar-The Origins of Radar, Simple form of Radar Equation-Radar Block Diagram-Radar Frequencies-Application of Radar. The Radar Equation: Introduction-Detection of Signals in noise-Receiver noise and the Signal-to-Noise Ratio-Probability Density Function-Probabilities of Detection and False Alarm-Integration of Radar pulses-Radar Cross Section of Targets-Radar Cross Section Fluctuations-Transmitter Power-Pulse Repetition Frequency-Antenna Parameters-System Losses-Other Radar Equation Considerations

UNIT2 BASIC AND MTI RADAR, TRACKING**9 hrs**

Introduction To Doppler and MTI Radar-Delay- Line Cancellers-Staggered Pulse Repetition Frequencies-Doppler Filter Banks-Digital MTI Processing-Moving Target Detector-Limitation of MTI Performance-Pulse Doppler Radar- Other Doppler Radar Topics-Tracking with Radar-Monopulse Tracking-Conical Scan and Sequential Lobing- Limitation to Tracking Accuracy-Low-Angle Tracking-Tracking in Range-other Tracking Radar Topics-Comparison of Trackers-Automatic Tracking with Surveillance Radars(ADT)

UNIT3 RADAR TRANSMITTERS AND RECEIVERS**9 hrs**

Detection of Signals in Noise: Introduction-Matched-Filter Receiver-Detection Criteria-Detectors-Automatic Detector-Integrators-Constant-False-Alarm Rate Receivers-The Radar Operator-Signal Management-Propagation Radar waves-Atmospheric Refraction-Standard Propagation-Non Standard Propagation. The Radar Antennas: Reflector Antennas-Electronically Steered Phased Array Antennas-Phase Shifter-Frequency-Scan Arrays Radar Transmitters: Introduction-Linear Beam Power Tubes-Solid State RF Power Sources-Magnetron-Crossed Field Amplifier-Other RF Power Sources-Other aspects of Radar Transmitter. Radar Receivers: The Radar Receiver-Receiver Noise Figure-Super heterodyne Receiver-Duplexers and Receivers Protectors-Radar Displays

UNIT4 DETECTION OF SIGNALS IN NOISE**9 hrs**

Introduction-Four Method of Navigation-Radio Direction Finding-The Loop Antenna-Loop Input Circuits-An Aural Null Direction Finder-The Goniometer-Error In Direction Finding-Adcock Direction Finders-Direction Finding at very High Frequencies-Automatic Direction Finders-The Commutated Aerial Direction Finders-Range and Accuracy of Direction Finders Radio Ranges-The LF/MF Four Course Radio Range-VHF Omni directional Range (VOR)-VOR Receiving Equipment-Range and accuracy of VOR-Recent Development Hyperbolic System of Navigation (Loran and Decca)-Loran-A-Loran-A Equipment-Range and Precision of Standard Loran-Loran-C-The Decca Navigation System-Decca Receiver-Range and Accuracy of Decca-The Omega System

UNIT5 ADVANCED RADARS AND RADAR NAVIGATION**9 hrs**

DME and TACAN-Distance Measuring Equipment-Operation of DME-TACAN-TACAN Equipment Aids to Approach and Landing-Instrument Landing System-Ground Controlled Approach System-Microwave Landing System(MLS) Doppler Navigation-The Doppler Effect-Beam Configuration-Doppler frequency Equation-Track Stabilization-Doppler Spectrum-Components of The Doppler Navigation System-Doppler Range Equation-Accuracy of Doppler Navigation System. Inertial Navigation-Principles of Operation-Navigation Over The Earth-Components of an inertial Navigation System-Earth Coordinate Mechanization-Strapped-Down Systems-Accuracy of Inertial Navigation Systems. Satellite Navigation System-The Transit System-Navstar Global Positioning System (GPS)-Night vision systems

COURSE OUTCOMES:

On completion of the course, student will be able to–

CO1	Explain the basic knowledge of Radar and Detection of Signals in noise
CO2	Describe the features of Doppler and MTI Radar
CO3	Classify various types of the Radar Antennas
CO4	Describe the methods of Navigation
CO5	Explain the Microwave Landing System
CO6	Implement Doppler Navigation

TEXT / REFERENCE BOOKS:

1. George W Hanson, "Fundamentals of Nanoelectronics", Prentice Hall, 2008.
2. Karl Goser, "Nanoelectronics and Nanosystems: From Transistors to Molecular and Quantum Devices", Springer, First edition, 2005.
3. Rainer Waser (Ed), "Nanoelectronics and Information Technology", Second Edition, Wiley VCH, 200
4. Mary Eshaghian-Wilner, "Bio inspired and Nano Scale Integrated Computing", Wiley, 2009

SEC1640 (Revised)	RADAR AND NAVIGATIONAL AIDS	L	T	P	Credits	Total Marks
		3	0	0	3	100

UNIT1 INTRODUCTION TO RADAR**9 hrs**

Basic Radar-The Origins of Radar, Simple form of Radar Equation-Radar Block Diagram-Radar Frequencies-Application of Radar. The Radar Equation: Introduction-Detection of Signals in noise-Receiver noise and the Signal-to-Noise Ratio-Probability Density Function-Probabilities of Detection and False Alarm-Integration of Radar pulses-Radar Cross Section of Targets-Radar Cross Section Fluctuations-Transmitter Power-Pulse Repetition Frequency-Antenna Parameters-System Losses-Other Radar Equation Considerations, **Maximum Unambiguous Range, Radar Waveforms, Modified Radar Range Equation**

UNIT2 BASIC AND MTI RADAR, TRACKING**9 hrs**

Introduction To Doppler and MTI Radar-Delay- Line Cancellers-Staggered Pulse Repetition Frequencies-Doppler Filter Banks-Digital MTI Processing-Moving Target Detector-Limitation of MTI Performance-Pulse Doppler Radar-Other Doppler Radar Topics-**Tracking with Radar, Sequential Lobing, Conical Scan, Monopulse Tracking Radar – Amplitude Comparison Monopulse (one- and two- coordinates), Phase Comparison Monopulse. Target Reflection Characteristics and Angular Accuracy. Tracking in Range, Acquisition and Scanning Patterns. Comparison of Trackers., MTI Improvement Factor, N- Pulse Delay-Line Canceler**

UNIT3 RADAR TRANSMITTERS AND RECEIVERS**9 hrs**

Detection of Signals in Noise: Introduction-Matched-Filter Receiver-Detection Criteria-Detectors-Automatic Detector-Integrators-Constant-False-Alarm Rate Receivers-The Radar Operator-Signal Management-Propagation Radar waves-Atmospheric Refraction-Standard Propagation-Non Standard Propagation. The Radar Antennas: Reflector Antennas-Electronically Steered Phased Array Antennas-Phase Shifter-Frequency-Scan Arrays Radar Transmitters: Introduction-Linear Beam Power Tubes-Solid State RF Power Sources-Magnetron-Crossed Field Amplifier-Other RF Power Sources-Other aspects of Radar Transmitter. Radar Receivers: The Radar Receiver-Receiver Noise Figure-Super heterodyne Receiver-Duplexers and Receivers Protectors-Radar Displays

UNIT4 DETECTION OF SIGNALS IN NOISE**9 hrs**

Introduction-Four Method of Navigation-Radio Direction Finding-The Loop Antenna-Loop Input Circuits-An Aural Null Direction Finder-The Goniometer-Error In Direction Finding-Adcock Direction Finders-Direction Finding at very High Frequencies-Automatic Direction Finders-The Commutated Aerial Direction Finders-Range and Accuracy of Direction Finders Radio Ranges-The LF/MF Four Course Radio Range-VHF Omni directional Range (VOR)-VOR Receiving Equipment-Range and accuracy of VOR-Recent Development Hyperbolic System of Navigation (Loran and Decca)-Loran-A-Loran-A Equipment-Range and Precision of Standard Loran-Loran-C-The Decca Navigation System-Decca Receiver-Range and Accuracy of Decca-The Omega System, **Instrument Landing System, Ground controlled Approach System**

Color red indicates the deleted portion. Color yellow indicates the added portion

UNIT5 ADVANCED RADARS AND RADAR NAVIGATION**9 hrs**

GPS principle of operation, Position location determination, principle of GPS receiver and applications, Brief note on :Global Satellite Navigation system, Maritime Satellite ,Satellite Constellations ,Navigation Satellites of different countries such as Glonass and Compass, GAGAN,IRNSS, NAVIC Receiver and applications

COURSE OUTCOMES:

On completion of the course, student will be able to–

CO1	Explain the basic knowledge of Radar and Detection of Signals in noise
CO2	Describe the features of Doppler and MTI Radar
CO3	Classify various types of the Radar Antennas
CO4	Describe the methods of Navigation
CO5	Explain the Microwave Landing System
CO6	Implement Doppler Navigation

TEXT / REFERENCE BOOKS:

1. George W Hanson, "Fundamentals of Nanoelectronics", Prentice Hall, 2008.
2. Karl Goser, "Nanoelectronics and Nanosystems: From Transistors to Molecular and Quantum Devices", Springer, First edition, 2005.
3. Rainer Waser (Ed), "Nanoelectronics and Information Technology", Second Edition, Wiley VCH, 200
4. Mary Eshaghian-Wilner, "Bio inspired and Nano Scale Integrated Computing", Wiley, 2009

END SEMESTER EXAMINATION QUESTION PAPER PATTERN

SEC1611 (old)	INTEGRATED SERVICES DIGITAL NETWORKS	L	T	P	Credits	Total Marks
		3	0	0	3	100

UNIT 1 ISDN BASICS**9 hrs**

Evolution of ISDN - Definition of ISDN- ISDN System Architecture- ISDN integrated access- ISDN Digital Services- Digital Telephones - Types of switched networks - OSI reference model- ISDN channels-Access interfaces- Functional Devices and reference points

UNIT 2 ISDN SERVICES**9 hrs**

Standard Organization- Services Requirement- ISDN Services- bear services-Teleservices- Broadband Services- Service attributes- Packeted frame - mode bearer Services

UNIT 3 ISDN PROTOCOL AND SIGNALING SCHEMES**9 hrs**

Protocol Architecture - Physical layer protocol - D-Channel - Data link and layer 3 protocols - Numbers and Address. Signaling System No.7 – SS7 protocol and Services

UNIT 4 ATM**9 hrs**

Broadband Services and Call Relay switching – ATM Overview – BISDN Architecture – BISDN Protocol- ATM layer – ATM Adopter layer

UNIT 5 ISDN APPLICATION AND IMPLEMENTATIONS**9 hrs**

ISDN Centrax configuration – ISDN and LANs – Metropolitan Area Network.- TCP/IP and Interworks – Application – Video conferencing , Telemedicine – User configuration – Intention ISDN Activities

COURSE OUTCOMES:

On completion of the course, student will be able to

CO1	Discuss the evolution and architecture of ISDN
CO2	Identify various switching network and SS7 Protocol
CO3	Define the various OSI reference model
CO4	Classify broadband services and call relay
CO5	Examine the various layers of ATM
CO6	Apply the concepts of ISDN, LANs, TCP/IP networks in real time applications

TEXT / REFERENCE BOOKS:

1. Gray.C.Kessler, ISDN, McGraw Hill, International 4th Edition, 2007 Reprint
2. William Stallings, ISDN and Broadband ISDN with frame relay and ATM, 4th edition, Prentice Hall Inc, U.K, 2005 Reprint
3. John Ranayne, ISDN, Wheels Publication, India, 2007 reprint.
4. Andrew S.Tanenbaum, Computer network, 2nd Edition, 2004 reprint.
5. Gray.C.Kessler, ISDN, McGraw Hill, International 4th Edition, 2007 Reprint
6. William Stallings, ISDN and Broadband ISDN with frame relay and ATM, 4th edition, Prentice Hall Inc, U.K, 2005 Reprint
7. John Ranayne, ISDN, Wheels Publication, India, 2007 reprint.
8. Andrew S.Tanenbaum, Computer network, 2nd Edition, 2004 reprint.

END SEMESTER EXAMINATION QUESTION PAPER PATTERN**Max. Marks: 100****Part A:** 10 questions of 2 marks each -No choice**Part B:** 5 questions from each unit with internal choice, each carrying 16 marks**Exam Duration: 3 hrs****20 Marks****80 Marks**

SEC1640 (Revised)	INTEGRATED SERVICES DIGITAL NETWORKS	L	T	P	Credits	Total Marks
		3	0	0	3	100

UNIT 1 ISDN BASICS**9 hrs**

Evolution of ISDN - Definition of ISDN- ISDN System Architecture- ISDN integrated access- ISDN Digital Services- Digital Telephones - Types of switched networks - OSI reference model- ISDN channels-Access interfaces- Functional Devices and reference points, review of switching technologies

UNIT 2 ISDN SERVICES**9 hrs**

Standard Organization- Services Requirement- ISDN Services- bear services-Teleservices- Broadband Services- Service attributes- Packeted frame - mode bearer Services

UNIT 3 ISDN PROTOCOL AND SIGNALING SCHEMES**9 hrs**

Protocol Architecture - Physical layer protocol - D-Channel Delay Analysis and Simulation- Data link and layer 3 protocols - Numbers and Address. Signaling System No.7 – SS7 protocol and Services, ISDN products, Switches, Multiplexers, Terminal adapters, ISDN chip sets.

UNIT 4 ATM**9 hrs**

Broadband Services and Call Relay switching – ATM Overview – BISDN Architecture – BISDN Protocol- ATM layer – ATM Adopter layer, ATM-Broadband Network Protocol, ATM Network Components, ATM Switches Terminal Equipment, Unique Benefits.

UNIT 5 ISDN APPLICATION AND IMPLEMENTATIONS**9 hrs**

ISDN Centrax configuration – ISDN and LANs – Metropolitan Area Network- TCP/IP and Interworks –Application – Video conferencing, Telemedicine – User configuration – Intention ISDN Activities- Potential B-ISDN Satellite Applications, General B-ISDN Service Requirements, Architecture, Terrestrial B-ISDN Support, System Concept Types of Services Supported, Private Based B-ISDN, System Concept, Types of Services Supported .

COURSE OUTCOMES:

On completion of the course, student will be able to

CO1	Discuss the evolution and architecture of ISDN
CO2	Identify various switching network and SS7 Protocol
CO3	Define the various OSI reference model
CO4	Classify broadband services and call relay
CO5	Examine the various layers of ATM
CO6	Apply the concepts of ISDN, LANs, TCP/IP networks in real time applications

TEXT / REFERENCE BOOKS:

- 1 Gray.C.Kessler, ISDN, McGraw Hill, International 4th Edition, 2007 Reprint
- 2 William Stallings, ISDN and Broadband ISDN with frame relay and ATM, 4th edition, Prentice Hall Inc, U.K, 2005
- 3 Reprint
- 4 John Ranayne, ISDN, Wheels Publication, India, 2007 reprint.
- 5 Andrew S.Tanenbaum, Computer network, 2nd Edition, 2004 reprint.

END SEMESTER EXAMINATION QUESTION PAPER PATTERN**Max. Marks: 100****Exam Duration: 3 hrs****Part A:** 10 questions of 2 marks each -No choice**20 Marks****Part B:** 5 questions from each unit with internal choice, each carrying 16 marks **80 Marks**

SEC1208 (Old)	SIGNALS AND SYSTEMS	L	T	P	Credits	Total Marks
		3	0	0	3	100

UNIT 1 CLASSIFICATION OF SIGNALS**9 hrs**

Continuous time signals(CT signals)and Discrete time signals(DT signals)-Basic operations on signals-elementary signals- Step, Ramp, Pulse, Impulse, Exponential-Classification of CT and DT systems-Periodic and Random signals, Real and complex signals-Energy and Power signals.

UNIT 2 ANALYSIS OF CONTINUOUS TIME SIGNALS**9 hrs**

Continuous time Fourier Transform –Properties of CTFT-Inverse Fourier Transform-Unilateral and bilateral Laplace Transform analysis with examples-Basic properties-Parseval's relation-Convolution in time and frequency domain-Relation between Fourier transform and Laplace transform-Fourier series analysis.

UNIT 3 LINEAR TIME INVARIANT CONTINUOUS TIME SYSTEM**9 hrs**

Concept of CT systems-Linear time invariant Systems-Basic properties of continuous systems-Linearity,Causality,Time invariance, Stability-Frequency response of LTI systems-Analysis and characterization of LTI systems using Laplace transform- Differential equation -Computation of impulse response ,step response, natural response, forced response, frequency response and transfer function --Convolution integral-Properties of Convolution Integral.

UNIT 4 ANALYSIS OF DISCRETE TIME SIGNALS**9hrs**

Spectrum of DT signals, Discrete Time Fourier Transform(DTFT)-Properties of DTFT-z transform-Basic Properties of Z transform -Region of Convergence-Properties of ROC- -Poles and Zeros-Inverse z transform using contour integration-Residue theorem, power series expansion and partial fraction expansion method-Relation between Z-transform and DTFT.

UNIT 5 LINEAR TIME INVARIANT DISCRETE TIME SYSTEMS

Concept of LTI-DT Systems-Properties and types of LTI DT systems-Causality, stability,invertibility,time invariant, linearity-interconnection of LTI Systems-Difference equation- Computation of impulse response ,step response, natural response ,forced response, frequency response and transfer function –Convolution sum using matrix, graphical and tabulation method-properties of convolution sum.

COURSE OUTCOMES:

On completion of this course, student will be able to

CO1	Explain the basic concept of signals and systems, the basic mathematical operations on Continuous Time (CT) and Discrete Time (DT) signals
CO2	Analyze the suitability of Laplace transform and Fourier transform in CT signals
CO3	Evaluate the response of Linear Time invariant systems
CO4	Examine the suitability of Z transform, DTFT in DT signals
CO5	Categorize the different domain transformation and evaluate the various system responses
CO6	Development of the mathematical skills to solve problems involving convolution, filtering, modulation and sampling

TEXT / REFERENCE BOOKS:

1. Allen V.Oppenheim et al," Signals and Systems", 2nd Edition, Prentice Hall of India. Ltd, 1997
2. P.Ramesh Babu et al. "Signals and Systems, 4th Edition, SciTech Publishers, 2010
3. Haykin. S and Van Been.B. "Signals and Systems", 2nd Edition, John Wiley & Sons, 2003
4. Rao.P, "Signals and Systems", 1st Edition, Tata McGraw Hill, 2008
5. Mrinal Mendal,Amir Asif, "Continuous and Discrete Time signals", Cambridge University Press 2007
6. Roberts, M.J. "Fundamentals of Signals and Systems", 1st Edition, Tata McGraw Hill 2007
7. S.Salivahanan et al, "Digital Signal Processing", 2nd Edition Tata McGraw Hill, 2009
8. H P Hsu, "Signals and Systems", 2nd Edition, Tata McGraw Hill,2008
9. B. P. Lathi, "Principles of Linear Systems and Signals", Second Edition, Oxford University Press, 2009

END SEMESTER EXAMINATION QUESTION PAPER PATTERN**Max. Marks: 100****Exam Duration: 3 hrs****Part A:** 10 questions of 2 marks each -No choice**20 Marks****Part B:** 5 questions from each unit with internal choice, each carrying 16 marks**80 Marks**

SECA1301 (Revised)	SIGNALS AND SYSTEMS	L	T	P	Credits	Total Marks
		3	0	0	3	100

COURSE OBJECTIVES

- To introduce the fundamental signals like Step, Ramp, Pulse, Impulse, Exponential, Sinusoidal Signals and its various operation.
- To analyze the continuous time signals by applying the knowledge of Fourier series, Fourier transform and Laplace transform.
- To study the characteristics of continuous time systems and analyze the properties using Fourier series, Fourier transform and Laplace transform.
- To analyze the discrete time signals and characteristics of discrete time systems by applying the knowledge of Discrete Fourier transform and Z transform.
- To study the characteristics of discrete time systems and analyze the properties using Discrete Fourier transform and Z transform.

UNIT 1 INTRODUCTION TO SIGNALS**9 Hrs.**

Signals- Continuous time signals (CT signals) and Discrete time signals (DT signals) -Step, Ramp, Pulse, Impulse, Exponential and Sinusoidal Signal – Basic Operations on signals -Amplitude Scaling, Time Scaling, Time Reversal, Time Shifting, Signal Addition, Subtraction-classification of CT and DT signals-Deterministic and Non-deterministic Signals, Even and Odd Signals, Periodic and Aperiodic Signals, Energy and Power Signals, Real and Imaginary Signals

UNIT 2 ANALYSIS OF CONTINUOUS TIME SIGNALS**9 Hrs.**

Fourier series analysis –Continuous Time Fourier Transform -Properties of CTFT-Inverse Fourier transform- unilateral and bilateral Laplace Transform analysis with examples - Basic properties – Parseval' s relation - Convolution in time and frequency domain-Inverse Laplace transform using partial fraction expansion method - Relation between Fourier transform and Laplace transform

UNIT 3 LINEAR TIME INVARIANT CONTINUOUS TIME SYSTEMS**9 Hrs.**

Continuous time Systems- Classification of systems - Static and dynamic, Linear and non-linear, Time-variant and time- invariant, Causal and non-causal, Stable and unstable -Linear time Invariant System- Frequency response of LTI systems - Analysis and characterization of LTI systems using Laplace transform - Differential equation- Computation of impulse response, step response, natural response ,forced response and transfer function using Laplace transform - Convolution integral -Properties of convolution integral.

UNIT 4 ANALYSIS OF DISCRETE TIME SIGNALS AND LTI DISCRETE TIME SYSTEMS**9 Hrs.**

Spectrum of DT signals, Discrete Time Fourier Transform (DTFT)- Properties of DTFT - z-transform -Basic properties of Z transform Properties of ROC - Inverse z-transform, Convolution method and Partial fraction expansion- Discrete time Systems- Classification of systems,Linear time Invariant System - Difference equation - Computation of Impulse response, Frequency response, step response, natural response, forced response and Transfer function using Z Transform, Convolution Sum using matrix, graphical and tabulation method-Properties of convolution sum.

UNIT 5 REAL TIME APPLICATIONS OF SIGNALS AND SYSTEMS**9 Hrs.**

Mathematical tools for the analysis of deterministic and random signals –Sampling theorem-Analysis and modeling of Signals -Speech, music, medical signals- Applications of Fourier Transform- Analysis and modeling of Systems- Systems that manipulate signals-analysis and synthesis of signals and their interaction with systems Speech signal processing

COURSE OUTCOMES**Max. 45 Hrs.**

On completion of the course, student will be able to

CO1 - Understand mathematical description and representation of continuous and discrete time signals and systems. CO2

- Analyse the spectral characteristics of continuous-time periodic and a periodic signals using Fourier analysis. CO3 -

Classify systems based on their properties and determine the response of LSI system using convolution.

CO4 - Analyze system properties based on impulse response and Fourier analysis.

CO5 - Apply the Laplace transform and Z- transform for analyze of continuous-time and discrete-time signals and systems.

CO6 - Build and analyze real time system for various real time signals

Color red indicates the deleted portion. Color yellow indicates the added portion

TEXT / REFERENCE BOOKS:

1. Allen V.Oppenheim et al," Signals and Systems", 2nd Edition, Prentice Hall of India. Ltd, 1997
2. P.Ramesh Babu et al. "Signals and Systems, 4th Edition, SciTech Publishers, 2010
3. Haykin. S and Van Been.B. "Signals and Systems", 2nd Edition, John Wiley & Sons, 2003
4. Rao.P, "Signals and Systems", 1st Edition, Tata McGraw Hill, 2008
5. Mrinal Mendal,Amir Asif, "Continuous and Discrete Time signals", Cambridge University Press 2007
6. Roberts, M.J. "Fundamentals of Signals and Systems", 1st Edition, Tata McGraw Hill 2007
7. S.Salivahanan et al, "Digital Signal Processing", 2nd Edition Tata McGraw Hill, 2009
8. H P Hsu, "Signals and Systems", 2nd Edition, Tata McGraw Hill,2008
9. B. P. Lathi, "Principles of Linear Systems and Signals", Second Edition, Oxford University Press, 2009

END SEMESTER EXAMINATION QUESTION PAPER PATTERN**Max. Marks: 100****Exam Duration: 3 hrs****Part A:** 10 questions of 2 marks each -No choice**20 Marks****Part B:** 5 questions from each unit with internal choice, each carrying 16 marks**80 Marks**

SEC1314 (Old)	DIGITAL SIGNAL PROCESSING	L	T	P	Credits	Total Marks
		3	1	0	4	100

UNIT1 INTRODUCTION TO SIGNALS AND SYSTEMS**12 hrs**

Representation, Characterization and Classifications of Continuous Time (CT) & Discrete Time (DT) signals, Sampling theorem - Aliasing effect, Operations on DT signals, Convolution, Advantages of DSP over ASP, Classification of CT & DT systems, properties of Discrete time systems-Linearity-Time invariance- causality -stability-Linear time Invariant systems, Difference equation representation of LTI systems-The Z transform- properties of Z transform- Inverse Z transform-System transfer Function

UNIT2 DISCRETE FOURIER TRANSFORM (DFT) AND FAST FOURIER TRANSFORM (FFT)**12 hrs**

DFT and its properties, Relation between DTFT and DFT, FFT computations using Decimation in time (DIT) algorithms and Decimation in frequency (DIF) algorithms, Auto correlation, Cross correlation, and their properties. Realization of Discrete Time System: introduction, Basic Realization block diagram and the signal flow graph, Realization of recursive and non recursive systems - Direct Form I and Form II - Cascade and parallel realization

UNIT3 DIGITAL FILTER DESIGN**12 hrs**

Design of Digital Filters: General considerations: causality and its implications, characteristics of practical frequency selective filter. Design of FIR filter using window method - Rectangular, Hanning and Hamming Windows. Design of IIR filters using Impulse invariant and Bilinear transformation method. Review of Butterworth and Chebyshev approximations, Frequency selective filters: Ideal filter characteristics, low pass, high pass and band pass filters, Properties of IIR and FIR filters

UNIT4 FINITE WORD LENGTH EFFECTS**12 hrs**

Fixed point and floating point number representations - Comparison - Truncation and Rounding errors - Quantization noise - derivation for quantization noise power -coefficient quantization error - Product quantization error - Overflow error - Round off noise power - limit cycle oscillations due to product round off and overflow errors -signal scaling

UNIT5 MULTIRATE SIGNAL PROCESSING**12 hrs**

Introduction to Multirate signal processing-Decimation-Interpolation- Poly phase implementation of FIR filters for interpolator and decimator -Multistage implementation of sampling rate conversion- Design of narrow band filters-Applications of Multirate signal processing, Speech compression, Adaptive filter, Musical sound processing, Image enhancement.

COURSE OUTCOMES:

On completion of this course, students are able to

CO1	Describe the various types of signals and systems and its operations
CO2	Apply various transforms for different types of signals
CO3	Design IIR & FIR filter using various filter approximations
CO4	Make use of the concept of finite word length effects and its applications in signal processing
CO5	Elaborate the concept of Multirate signal processing
CO6	Explain the perception of Multirate signal processing in real time applications

TEXT / REFERENCE BOOKS:

1. John G. Proakis & Dimitris G. Manolakis, "Digital Signal Processing - Principles, Algorithms & Applications", Fourth Edition, Pearson education / Prentice Hall, 2009
2. Sanjit K. Mitra, Digital Signal Processing: A Computer - Based Approach, McGraw-Hill Education, 4th edition, 2013
3. B.P. Lathi, "Signal Processing & Linear systems", Oxford University Press, 2nd edition, 2009
4. Lyons, "Understanding Digital Signal Processing", Prentice Hall, 3rd edition, 2010
5. Johny R. Johnson, "Introduction to Digital Signal Processing", PHI, 2006
6. Alan V. Oppenheim, Ronald W. Schaffer, Discrete-Time Signal Processing, Pearson, 3rd Edition, 2010
7. Salivahanan, "Digital Signal Processing, 2nd Edition, TMH, 2010

END SEMESTER EXAMINATION QUESTION PAPER PATTERN**Max. Marks: 100****Exam Duration: 3 hrs****Part A:** 10 questions of 2 marks each -No choice**20 Marks****Part B:** 5 questions from each unit with internal choice, each carrying 16 marks**80 Marks**

SEC1319 (Revised)	DIGITAL SIGNAL PROCESSING	L	T	P	Credits	Total Marks
		3	1	0	4	100

UNIT 1 DISCRETE FOURIER TRANSFORM (DFT) AND FAST FOURIER TRANSFORM (FFT) 12 hrs

Review of Signals and Systems, DFT and its properties, Relation between DTFT and DFT, FFT computations using Decimation in time (DIT) algorithms and Decimation in frequency (DIF) algorithms, Auto correlation, Cross correlation, and their properties. Realization of Discrete Time System: introduction, Basic Realization block diagram and the signal flow graph, Realization of recursive and nonrecursive systems - Direct Form I and Form II - Cascade and parallel realization

UNIT 2 DIGITAL FILTER DESIGN**12 hrs**

Design of Digital Filters: General considerations: causality and its implications, characteristics of practical frequency selective filter. Design of FIR filter using window method - Rectangular, Hanning and Hamming Windows. Design of IIR filters using Impulse invariant and Bilinear transformation method. Review of Butterworth and Chebyshev approximations, Frequency selective filters: Ideal filter characteristics, low pass, high pass and band pass filters, Properties of IIR and FIR filters

UNIT 3 FINITE WORD LENGTH EFFECTS**12 hrs**

Fixed point and floating point number representations - Comparison - Truncation and Rounding errors - Quantization noise - derivation for quantization noise power - coefficient quantization error - Product quantization error - Overflow error - Round off noise power - limit cycle oscillations due to product round off and overflow errors - signal scaling

UNIT 4 MULTIRATE SIGNAL PROCESSING**12 hrs**

Introduction to Multirate signal processing - Decimation - Interpolation - Poly phase implementation of FIR filters for interpolator and decimator - Multistage implementation of sampling rate conversion - Design of narrow band filters - Applications of Multirate signal processing, Speech compression, Adaptive filter, Musical sound processing, Image enhancement.

UNIT 5 REAL TIME DIGITAL SIGNAL PROCESSING**12 hrs**

Real Time DSP System Architecture and Functional Blocks, Analog Interface, Signal Conditioning, generation and detection for real time applications, - DSP Hardware (Digital Signal Processor, FPGA, ARM Processor with DSP Extension) & its applications - Speech Signal Processing, Enhancements, Coding & Transcoding Techniques (A-Law, U-Law, G.711, G.723, G.729, GSM) for IP and Mobile Telephone applications - High Definition Audio Signal Processing, Audio Coding Techniques and Comparison Analysis, Transcoding

COURSE OUTCOMES:

On completion of this course, students are able to

CO1	Apply various transforms for different types of signals
CO2	Design IIR & FIR filter using various filter approximations
CO3	Make use of the concept of finite word length effects and its applications in signal processing
CO4	Elaborate the concept of Multirate signal processing
CO5	Explain the perception of Multirate signal processing in real time applications
CO6	Develop real time applications with DSP hardware

TEXT / REFERENCE BOOKS:

1. John G. Proakis & Dimitris G. Manolakis, "Digital Signal Processing - Principles, Algorithms & Applications", Fourth Edition, Pearson education / Prentice Hall, 2009
2. Sanjit K. Mitra, Digital Signal Processing: A Computer - Based Approach, McGraw-Hill Education, 4th edition, 2013
3. B.P. Lathi, "Signal Processing & Linear systems", Oxford University Press, 2nd edition, 2009
4. Lyons, "Understanding Digital Signal Processing", Prentice Hall, 3rd edition, 2010
5. Johny R. Johnson, "Introduction to Digital Signal Processing", PHI, 2006
6. Alan V. Oppenheim, Ronald W. Schaffer, Discrete-Time Signal Processing, Pearson, 3rd Edition, 2010
7. Salivahanan, "Digital Signal Processing, 2nd Edition, TMH, 2010

END SEMESTER EXAMINATION QUESTION PAPER PATTERN**Max. Marks: 100****Exam Duration: 3 hrs****Part A:** 10 questions of 2 marks each -No choice**20 Marks****Part B:** 5 questions from each unit with internal choice, each carrying 16 marks**80 Marks**

SEC1402 (Old)	PROGRAMMING IN HDL (For ECE and EEE)	L	T	P	Credits	Total Marks
		3	0	0	3	100

UNIT1 BASIC CONCEPTS IN VHDL**9 hrs**

Digital system design process - Hardware simulation - Introduction to VHDL - Language elements of VHDL - Data objects - Data types - Operators - Signal assignments - Inertial delay mechanism - Transport delay mechanism - Variable assignments - Concurrent and Sequential assignments- Delta delay.

UNIT2 MODELING IN VHDL**9 hrs**

Data flow modeling - Concurrent Signal Assignment statements - Structural modeling - Component declaration - Component Instantiation - Behavioral modeling - Process statement - wait statement - Conditional and loop statements - Generics and configurations - Examples for modeling.

UNIT3 INTRODUCTION TO VERILOG HDL**9 hrs**

Basic concepts - Levels for design description - Module - Delays - Language elements - Compiler directives - value set - data types - Parameters - Expressions - Operands - operators in Verilog HDL.

UNIT4 STYLES OF MODELING**9 hrs**

Gate level modeling -Primitive Gates- Multiple input and multiple output gates - User Defined Primitives -Combination UDP - Sequential UDP- Data flow modeling - Behavioral modeling - procedural constructs - procedural assignments - conditional and loop statements - Structural Modeling - Examples for modeling.

UNIT5 FEATURES IN VERILOG HDL**9 hrs**

Tasks- Functions -systems tasks and functions - Verification - Modeling a test bench - timing and delays -Switch level modeling - state machine modeling - Moore FSM – Melay FSM - Design of memories - Design of microcontroller CPUs.

Max. 45 hrs**COURSE OUTCOMES:**

On completion of this course, students are able to

CO1	Identify the use of HDL language in constructing digital logic circuits
CO2	Analyze the combinational sequential logic circuit in gate and switch level modeling
CO3	Conceptualize the system through design and modeling various architectures
CO4	Develop any design based upon the system requirements for solving real time problems
CO5	Validate and Verify the system design
CO6	Design a test bench for any logic circuit

TEXT / REFERENCE BOOKS:

1. J.Bhaskar, "A VHDL Primer", Pearson. 3rd edition, 2013
2. Douglas L. Perry, "VHDL Programming by Example", McGraw Hill, 4th edition, 2012
3. J.Bhaskar, "A Verilog HDL Primer", Star Galaxy Publishing. 3rd edition, 2011
4. Stephen Brown, "Fundamental of Digital logic with VHDL Design", Tata McGraw Hill, 3rd edition, 2012

END SEMESTER EXAMINATION QUESTION PAPER PATTERN**Max. Marks: 100****Exam Duration: 3 hrs****Part A:** 10 questions of 2 marks each -No choice**20 Marks****Part B:** 5 questions from each unit with internal choice, each carrying 16 marks**80 Marks**

Color red indicates the deleted portion. Color yellow indicates the added portion

Sathyabama Institute of Science and Technology

Department of Electronics and Communication Engineering

SEC1406 (Revised)	PROGRAMMING IN HDL (For ECE and EEE)	L	T	P	Credits	Total Marks
		3	0	0	3	100

UNIT 1 CONCEPTS IN VHDL 9 hrs

Introduction to VHDL - Language elements of VHDL -Concurrent and Sequential assignments -Data flow modeling - Concurrent Signal

Assignment statements - Structural modeling - Component declaration - Component Instantiation - Behavioral modeling - Process statement - Examples for VHDL modeling

UNIT2 INTRODUCTION TO VERILOG HDL 9 hrs

Basic concepts - Levels for design description - Module - Delays - Language elements - Compiler directives – value set - data types - Parameters - Expressions - Operands - operators in verilog HDL

UNIT3 STYLES OF MODELING 9 hrs

Gate level modeling -Primitive Gates- Multiple input and multiple output gates - User Defined Primitives - Combination UDP - Sequential UDP- Data flow modeling - Behavioral modeling - procedural constructs – procedural assignments - conditional and loop statements - Structural Modeling - Examples for modeling.

UNIT4 FEATURES IN VERILOG HDL 9 hrs

Tasks- Functions -systems tasks and functions - Verification - Modeling a test bench - timing and delays -Switch level modeling - state machine modeling - Moore FSM - Melay FSM - Design of RAM, ROM.

UNIT5 REALIZING APPLICATIONS IN FPGA 9 hrs

FPGA Design Flow - Architecture of Xilinx Artix7 FPGA - Input/Output Blocks (IOB) - Configurable Logic Blocks (CLB)- Programmable Interconnect - Internal Hard macros - Realizing applications in FPGA - combinational functions - N-bit functions, Encoder, Decoders - Sequential functions - N-bit register, shift registers, up/down counters- N-bit processor. Case Study: study of protocols I2C, SPI, UART and APB.

Max. 45 hrs

COURSE OUTCOMES:

On completion of this course, students are able to

CO1	Identify any design requirements to solve problems in various domains.
CO2	Analyse the sequential logic both in synchronous and Asynchronous modes for various complex logic and switching devices and validate the outputs.
CO3	Conceptualize the system through design and modeling various architectures.
CO4	Develop any design based upon the system requirements for solving real time problems.
CO5	Validate and Verify the system design
CO6	Design a test bench for any logic circuit

TEXT / REFERENCE BOOKS:

1. J.Bhaskar, "A VHDL Primer", Pearson. 3rd edition, 2013
2. Douglas L. Perry, "VHDL Programming by Example", McGraw Hill, 4th edition, 2012
3. J.Bhaskar, "A Verilog HDL Primer", Star Galaxy Publishing. 3rd edition, 2011
4. Stephen Brown, "Fundamental of Digital logic with VHDL Design", Tata McGraw Hill, 3rd edition, 2012

END SEMESTER EXAMINATION QUESTION PAPER PATTERN

Max. Marks: 100

Exam Duration: 3 hrs

Part A: 10 questions of 2 marks each -No choice

20 Marks

Part B: 5 questions from each unit with internal choice, each carrying 16 marks

80 Marks

Color red indicates the deleted portion. Color yellow indicates the added portion



SATHYABAMA

INSTITUTE OF SCIENCE AND TECHNOLOGY

(DEEMED TO BE UNIVERSITY)

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SCHOOL OF ELECTRICAL AND ELECTRONICS

Minutes of Board of Studies Meeting held on 28th NOVEMBER 2020

(Virtual Meeting conducted on Zoom Platform (Time: 10.30 a.m. to 12 noon))

- Dr.N.M.Nandhitha, Prof. & Dean School of Electrical and Electronics started the meeting by welcoming both the external and the internal members to the Board of Studies meeting (28.11.2020, 10.00 a.m. to 12.00 noon)
- Dr.T.Ravi, Head, Dept. of Electronics and Communication Engineering informed the board that core competencies are identified from the feedback obtained from the students, faculty, Alumni and employers.
- Dr.P.Kavipriya proposed to remove the following topics in Electronic Circuits I (3rd Semester) course: 'Approximate Model- Analysis of CE, CC and CB amplifiers using Approximate model equivalent circuits to obtain gain, input impedance and output impedance'. Dr.M.D.Selvaraj, Associate Professor, IIITDM accepted the changes and suggested to include Frequency response of the Differential amplifier in unit V instead of power supply and amplifiers.
- Dr.S.Lakshmi suggested to introduce 'Antenna for 5G application and Software Tools for Antenna Design and Analysis' in the course Antenna and Wave Propagation. Dr.N.Sivakumaran, Prof.,NIT, Trichy accepted the inclusion and also suggested to introduce simulation through HFSS in the class.
- Dr.M.Sumathi suggested to include the topics Li-Fi in the course Optical Communications. Dr.N.Shivakumaran accepted and suggested to remove WDM, SONET/SDH, ATM,IP over WDM.
- Dr.Sugadev presented the syllabus revision for 'Embedded Processors'.Board accepted the change and Mr.J.Visweswaran suggested to include System on Chip concept in the syllabus.
- Syllabus revision proposed in 'High Performance Computing' by Dr.Dr.S.Poorna Pushpa Kala was accepted by Dr.M.D.Selvaraj.
- Dr.S.Barani suggested to remove 'Basics of Spark-Programming in Scala'for the course 'Real Time Data Analytics'. Mr.J.Visweswaran accepted the changes and

suggested to include function programming in Scala. Dr.N.Sivakumaran suggested to include Case studies on influx and Grafana.

- Having discussed the revisions in the existing courses, faculty then presented the syllabus for the new courses. Dr.P.Chitra presented the syllabus for Digital Image Processing for Real Time Applications and Deep Learning Neural Networks. Dr.M.D.Selvaraj accepted the syllabus for both the courses.
- Dr.M.Sugadev presented the syllabus for 5G communication. Dr.N.Sivakumaran suggested to include mmWave communication in the syllabus.
- Dr,S.Poornapushpakala presented the syllabus for Machine Learning using Python. Mr.Visweswaran suggested that Least Squares Optimization, Collaborative Filtering and related topics can be included.
- Dr.S.Barani presented the syllabus for IoT for Real time Applications. Dr.N.Sivakumaran accepted the syllabus and he suggested that students can be made to do miniprojects in this course.
- Dr.M.Sugadev presented the syllabus for Drone Electronics. Syllabus was accepted by the board and Dr.M.D.Selvaraj suggested that this course can be offered to all branches of Engineering.
- Dr.P.Kavipriya presented the syllabus for Industrial Internet of Things. Mr.Visweswaran suggested that Middleware Software protocol can be included.
- Dr.S.lakshmi presented the syllabus for eHealth and Dr.N.Sivakumaran suggested that mobile application development for biomedical applications can be included as part of the syllabus.
- Dr.N.M.Nandhitha informed the Board that part of the syllabus in SEC1320 Embedded Systems will be delivered by the industry expert so as to make the students understand the applications of embedded systems in industries. Mr.J.Visweswaran appreciated the initiative and suggested that at least one course in each semester can be identified for partial delivery of syllabus by expert from industry.

Table 1. Revision Carried out in the courses

SL NO	COURSE CODE	COURSE NAME	DELETED TOPICS	ADDED TOPICS
1	SECA1307	ELECTRONIC CIRCUITS I	UNIT 5 Linear mode power supply - Rectifiers - Half-Wave Rectifier - Full-Wave Rectifier - Filters-L,C, LC, CLC Filter-Regulators -Zener Diode regulator- Linear series, shunt voltage Regulators - Switched mode power supply (SMPS) - Large Signal Amplifiers - Class A, Class B, Class C, Class D- Distortion	UNIT 5 Current sources for biasing - Current steering circuits - Current mirror with improved performance (Cascode mirror, Wilson, Widlar). Large and small signal operation of Differential pair circuit Differential pair with active load

			in power amplifiers	
2	SECA1505	ANTENNA AND WAVE PROGRAGATION	UNIT 5 Anechoic Chamber-Radiation Pattern Measurement-Gain measurement-Beamwidth and Directivity Measurement-Impedance Measurement - Measurement of radiation efficiency-Ionospheric measurements - Vertical incidence measurements of the ionosphere - Relation between oblique and vertical incidence transmission - System Issues - antenna noise.	UNIT 5 Concepts and Benefits of Smart antennas - Fixed weight beamforming- Adaptive beamforming - Design of Planar array antennas for Beamforming applications - Feed techniques for Planar arrays - Role of Smart Antennas in Green Communications and 5G wireless communications - Software Tools for Antenna Design and Analysis
3	SEC1407	OPTICAL COMMUNICATIONS	UNIT 5 Applications- Military	UNIT 3 Vertical cavity surface emitting laser, Resonant cavity enhancement UNIT 5 Optical OFDM, High-speed Light-Waveguides, Reconfigurable optical add/drop multiplexer, Light-Fidelity (Li-Fi) Technology- Introduction, working principle, Comparison of Li-Fi and Wi-Fi, Li-Fi networks, Applications. Case study: Evaluation of building a Fiber Optic network
4	SECA3019	EMBEDDED PROCESSORS	UNIT 5 Introduction - fixed and floating point -Core architecture of ADSP218X- Arithmetic Logic Unit (ALU) - Multiplier and Accumulator (MAC) Unit- Barrel Shifter- Data Address Generator (DAG)- Program Sequencer- Functional Diagram of TMS320C54XX	UNIT 5 Introduction to ARM CORTEX series, improvement over classical series and advantages for embedded system design. CORTEX A, CORTEX M, CORTEX R processors series, versions, features and applications, need of operating system in developing complex applications in embedded system, Firmware development for ARM Cortex, Survey of CORTEX M3 based controllers, its features and comparison
5	SECA7020	HIGH PERFORMANCE COMPUTING	UNIT 4 Intrusion Detection and Prevention, Intrusion Risks, Security Policy, Monitoring and Reporting of Traffics, Traffic Shaping, Investigating and Verifying Detected Intrusions.	UNIT 4 Scheduling Parallel Jobs on Clusters, Parallel Programming Models, Parallel and High Performance programming

			Reporting and Documenting Intrusions. UNIT- 5 Define the Types of Intrusion Prevention Systems, Intrusion Prevention System Basics, and Limitations of Intrusion Prevention System, Spoof Prevention, Denial of Service (DoS), and Quality of Service (QoS) Policy, Web Application Firewall, Packet Signature and Analysis.	languages, Dependence Analysis of Data arrays UNIT- 5 Quantum computing and its issues
6	SECA7023	REAL TIME DATA ANALYTICS	UNIT 1 Basics of Spark-Programming in Scala	UNIT 1 Expressions-Functions – Classes- File I/O – Exceptions – Combining UNIT-2 Distributed Storage- Parallelism, Regression. Classification and Clustering with Spark UNIT-4 Kafka Architecture and Components, Kafka Cluster, Kafka Producer, Kafka Consumer

- Dr.Lalithakumari.S, suggested few modifications in the course ‘Industrial Unit Operations’. She proposed the inclusion of topics leaching and extraction. It has been accepted by Dr.Sivakumaran, and he suggested to include the same along with mixing and separation unit operations. Dr. D.Marshiana suggested that ‘Humidification, de-humidification’ can be added. Dr. Sivakumaran agreed for the inclusion.
- Dr.Lalithakumari presented the syllabus for an elective course ‘Optimal Control Systems’. Dr.Sivakumaran accepted the syllabus change suggested that students may be asked to do mini projects in this course.

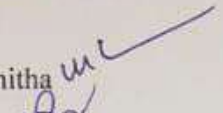
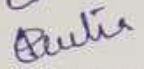
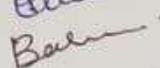
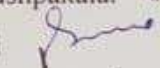
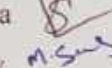
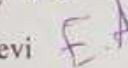
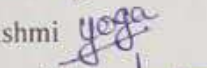
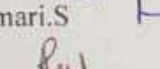
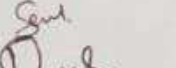
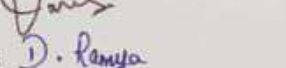
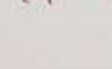
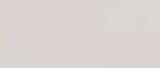
COURSE CODE	COURSE NAME	DELETED TOPICS	INCLUDED TOPICS
SEIA1402	Industrial Unit Operations	--	Unit-4 Humidification, De-humidification Unit-2 Leaching and extraction

- Dr.V.Sivachidambaranathan, Prof.& Head, Dept. of Electrical and Electronics Engineering requested the board to shift the course "Applied Thermodynamics" to elective. Dr.M.D.Selvaraj accepted the suggestions.
- Dr.A.Ramesh babu and Dr.S.D.Sundar Singh Jebaseelan put forth the syllabus of the new courses, 'Modern Power Converters' and 'Distributed Generation and Microgridss' for the approval of the board. Dr N Sivakumaran approved the Syllabus for these new courses.
- BoS members are happy that the new and the revised courses enhance employability/ Entrepreneurship/Skills of the students.

EXTERNAL MEMBERS:

1. Dr.N.Sivakumaran
2. Dr.M.D.Selvaraj
3. Mr.J.Visweswaran

INTERNAL MEMBERS:

1. Dr.N.M.Nandhitha 
2. Dr.T.Ravi 
3. Dr.P.Chitra 
4. Dr.S.Barani 
5. Dr.S.Poornapushpakala 
6. Dr.M.Sumathi 
7. Dr.S.Lakshmi 
8. Dr.P.Kavipriya 
9. Dr M Sugadev 
10. Dr .E. Anna Devi 
11. Ms.S.Yogalakshmi 
12. Dr.LalithaKumari.S 
13. Dr.Pandian.R 
14. Dr.Marshiana.D 
15. Dr.V.Sivachidambaranathan 
16. Dr.D.Susitra 
17. Dr.R.Vanitha 
18. Mrs.D.Ramya 
19. Mrs.P.Sivagami 

DEPARTMENT OF ELECTRONICS AND COMMUNICATION ENGINEERING
SYLLABUS REVISION

SL.NO	COURSE CODE	COURSENAME
1	SECA1307	ELECTRONIC CIRCUITS I
2	SECA1505	ANTENNA AND WAVEPROGRAGATION
3	SEC1407	OPTICALCOMMUNICATIONS
4	SECA3019	EMBEDDEDPROCESSORS

SECA1302	ELECTRONIC CIRCUITS - I	L	T	P	Credits	Total Marks
		3	*	0	3	1

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Signal

UNIT 5 POWER SUPPLIES AND POWER AMPLIFIERS 9 Hrs.

Linear mode power supply - Rectifiers - Half-Wave Rectifier - Full-Wave Rectifier - Filters-L, C, LC, CLC Filter- Regulators - Zener Diode regulator- Linear series, shunt voltage Regulators - Switched mode power supply (SMPS) – Large Signal Amplifiers – Class A, Class B, Class C, Class D- Distortion in power amplifiers.

Max. 45 Hrs.

COURSE OUTCOMES

On completion of the course, student will be able to

CO1 - Acquire knowledge of simple BJT circuits design and implement circuits with transistor biasing design.

CO2 - Draw the equivalent circuits of BJT and FET.

CO3 - Understand the working principles, Frequency response characteristics of BJT and FET.

CO4 - Compare the frequency response characteristics of BJT and FET amplifiers.

CO5 - Design and troubleshoot simple power supplies and Analyse the performance parameters of power supplies.

CO6 - Understand and identify the performance level in power amplifiers and checking its distortion levels.

1

Max. Marks:

20 Marks

80 Marks

PART A: 10 Questions of 2 marks each-No choice

TION

PART B: 2 Questions from each unit of internal choice; each carrying 16 marks

Color red indicates the deleted portion. Color yellow indicates the added portion

SECA1307 (Revised)	ELECTRONIC CIRCUITS-I	L	T	P	Credit s	Total mark s
		3	0	0	3	100
Prerequisite: Electron Devices		CoRequisite: Electronic Circuits I Lab				
Course Objectives • To understand the method of biasing transistors. • To acquire the knowledge of equivalent circuits. • To understand the frequency response of amplifiers. • To provide foundation and confidence to the student to troubleshoot and fault analysis of power supplies and power amplifiers. • To develop current mirrors and differential operations.						
UNIT	CONTENTS					HOURS
I	Biasing of BJT and FET BJT– Need for biasing – Various biasing methods of BJT- Bias Circuit Design- DC Load Line – DC analysis of Transistor circuits- AC Load Line- AC analysis of Transistor Circuits- Quiescent Point – Thermal stability - Stability factors - Biasing of JFET- Various biasing methods of JFET- JFET Bias Circuit Design- MOSFET Biasing- Two port network.					9
II	EQUIVALENT MODELS OF BJT AND FET AMPLIFIERS Hybrid model- Analysis of CE, CC and CB amplifiers using Hybrid equivalent circuit to obtain gain, input impedance and output impedance--Small Signal Amplifiers –Analysis of CE, CC and CB amplifiers using small signal equivalent circuits to obtain gain, input impedance and output impedance. Small Signal equivalent circuit of FET and MOSFET - Analysis of CS, CD and CG JFET amplifiers using small signal equivalent circuits- Analysis of CS, CD and CG MOSFET amplifiers using small signal equivalent circuits					9
III	MULTISTAGE AMPLIFIERS AND FREQUENCY RESPONSE OF BJT AND FET AMPLIFIERS Multistage Amplifiers- Methods of Coupling- RC Coupled- Transformer Coupled –Direct Coupled Amplifiers- Amplifier frequency response – Miller effect- Frequency response of transistor amplifiers with circuit capacitors – BJT frequency response – Low and High frequency analysis of CE, CB, CC-					9

Color red indicates the deleted portion. Color yellow indicates the added portion

	Frequency response of FET - Low and High frequency analysis of CS, CG, CD JFET & MOSFET.	
IV	POWER SUPPLIES AND POWER AMPLIFIERS Linear mode power supply - Rectifiers - Half-Wave Rectifier - Full-Wave Rectifier - Filters - L, C, LC, CLC Filter - Regulators - Zener Diode regulator - Linear series, shunt voltage Regulators - Switched mode power supply (SMPS) - Large Signal Amplifiers - Class A, Class B, Class C, Class D - Distortion in power amplifiers.	9

V	CURRENT MIRRORS AND DIFFERENTIAL AMPLIFIERS Current sources for biasing – Current steering circuits – Current mirror with improved performance (Cascode mirror, Wilson, Widlar). Large and small signal operation of Differential pair circuit Differential pair with active load - Frequency response of the Differential amplifier	9
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Maximum Hours: 45

Course Outcomes

On completion of the course, the students should be able to

CO1–Design biasing circuits for BJT and FET.

CO2–Analyze BJT and FET amplifiers using equivalent circuit models.

CO3–

Evaluate frequency response of BJT and FET amplifiers in different configurations.

CO4–Design multistage amplifiers using BJT

CO5–

Analyze the performance of power supplies and power amplifiers.

CO6–Design current mirrors and differential amplifiers

TEXT/REFERENCE BOOKS

1. Millman J and Halkias C., "Integrated Electronics", TMH, 2nd Edition, 2017.
2. S. Salivahanan, N. Suresh Kumar and A. Vallavaraj, "Electronic Devices and Circuits", TMH, 2nd Edition, 2017.
3. Adel S. Sedra and Kenneth C. Smith, "Microelectronic Circuits", Oxford University Press, Sixth Edition, 2009.
4. Behzad Razavi, "Fundamentals of Microelectronics", 1st edition, Wiley publication, 2008.
5. Donald A. Neamen, "Electronic Circuits Analysis and Design", McGraw Hill Education (India) Private Ltd., 3rd Edition, 2010.
6. Robert L. Boylestad and Louis Nashersky, "Electronic Devices and Circuit Theory", Pearson Education, 11th Edition, 2013.
7. Floyd, "Electronic Devices", Pearson Education, 9th Edition, 2012.

SECA1504	ANTENNAS AND WAVE PROPAGATION	L	T	P	Credits	TotalMarks
		3	*	0	3	1

COURSE OBJECTIVES

- To learn the basic antenna parameters.
- To understand the radiation mechanism from the dipole antennas.
- To explore the various antenna arrays and calculate the maxima, minima and half power directions.
- To discuss the characteristics of travelling wave radiators and high frequency antennas.
- To study antenna measurements techniques.

UNIT 1 ANTENNA FUNDAMENTALS AND WIRE ANTENNAS 9 Hrs.

Basic Antenna elements-properties of antenna-Isotropic radiator- Antenna parameters(definition only): Radiation Intensity,Radiation pattern, Gain and Directivity, FBR, Effective Length, Effective Aperture, Radiation Resistance, Antenna Terminal(self and mutual) Impedance, Polarization, Beam width, Bandwidth, Antenna temperature, Friis transmission formula. WireAntennas: Retarded Potentials, Short Electric Dipole, Radiation from an alternating current element, Half wave Dipole,quarter wave monopole - Fields, Power radiated and Radiation Resistance.

UNIT 2 ANTENNA ARRAYS 9 Hrs.

Types of arrays - Broad side, End fire, Collinear, Parasitic arrays.-Arrays of two point sources. N element of uniform lineararrays –Array of N elements with equal spacing and currents equal in magnitude and spacing (broad side array)- Array of Nelements with equal spacing and currents equal in magnitude but with progressive phase shift(end fire array)-Hansenwoodyard array -Pattern Multiplication - Binomial arrays.

UNIT 3 TRAVELLING WAVE AND BROADBAND ANTENNAS 9 Hrs.

Effect of ground on ungrounded antenna-Methods of excitation-Travelling wave radiators: basic concepts, Long wireantennas-field strength calculations and patterns- V-antennas, Rhombic Antennas, Small Loop antennas- Concept of shortmagnetic dipole, Helical Antennas, Folded Dipole Yagi-Uda Arrays, Log periodic antennas. Reflector Antennas: Huygens'principle-Flat Sheet and Corner Reflectors, Paraboloidal Reflectors, Cassegrain Feeds. Slot antennas-Babinets principle,Horn antennas, Lens antennas, Microstrip antennas.

UNIT 4 PROPOGATION 9 Hrs.

Factors involved in the propagation of Radio Waves- Ground wave propogation, Structure of Ionosphere and its effects onradio waves- Refraction and Reflection of sky wave by the ionosphere, Ray paths-Measures of Ionosphere propagation:critical frequency, skip distance, virtual height, Maximum usable frequency, Fading of signals: Selective fading – Diversityreception, Space wave propagation-Considerations in space wave propagation, Atmospheric effects in space wavepropagation, Super Refraction - Duct Wave Propagation.

UNIT 5 ANTENNA MEASUREMENT 9 Hrs.

Anechoic Chamber-Radiation Pattern Measurement-Gain measurement-Beamwidth and Directivity Measurement-Impedance Measurement - Measurement of radiation efficiency- Ionospheric measurements - Vertical incidence measurements of the ionosphere - Relation between oblique and

Max. 45 Hrs.

COURSE OUTCOMES

On completion of the course, student will be able to

CO1 - Define the antenna basic parameters.

CO2 - Explain the radiation mechanism from the dipole elements.

CO3 - Classify antenna arrays and infer their significance.

CO4 - Analyze the characteristics of low and high frequency antennas.

CO5 - Compare the properties and measures of various radio wave propagation.

CO6 - Perform antenna measurements and analyze the parameters and develop the basic skills for designing practical antennas.

TEXT / REFERENCE BOOK

1. K.D.Prasad, "Antennas and Wave Propagation", 3rd Edition, Satya Prakasan, New Delhi, 2003.
2. R.L. Yadava, "Antennas and Wave Propagation", 2nd Edition, PHI Learning Private Limited, New Delhi, 2011.
3. Balanis, C.A., "Antenna Theory and Design", 4th Edition, John Wiley and Sons, 2016.
4. Jordan, E.C. and Balmain, K.G., "Electromagnetic Waves and Radiating Systems", 2nd Edition, Prentice Hall of India, 2006.
5. Collin, R.E., "Antennas and Radio Wave Propagation", McGraw Hill, 1985.

END SEMESTER EXAMINATION QUESTION PAPER PATTERN

Max. Marks: 100 Exam Duration: 3 Hrs.

PART A: 10 Questions of 2 marks each – No choice 20 Marks

PART B: 2 Questions from each unit of internal choice; each carrying 16 marks 80 Marks

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DenartmentofElectronicsandCommunicationEngi

SECA1505 (revised)	ANTENNA AND WAVE PROPAGATION	L	T	P	Credits	Total marks
		2	0	2	3	100
Prerequisite: Electromagnetic Theory		CoRequisite: NIL				
Course Objectives						
To understand the radiation mechanism of different antennas, their parameters and design aspects. To learn about antenna arrays and their radiation pattern. To learn about travelling wave and broadband antennas. To understand electromagnetic wave propagation over ground and through different layers of atmosphere. To learn about Smart Antennas						
UNIT	CONTENTS					HOURS
I	ANTENNA FUNDAMENTALS AND WIRE ANTENNAS Antenna Radiation Mechanism - Isotropic radiator- Antenna parameters : Radiation Intensity, Radiation pattern, Gain and Directivity, FBR, Effective Length, Radiation Resistance, Antenna Impedance, Polarization, Beam width, Bandwidth, Antenna temperature- Friis transmission formula. Retarded Potential - Wire Antennas: Short Electric Dipole, Radiation from an alternating current element, Half-wave Dipole, quarter wave monopole-Fields, Power radiated and Radiation Resistance.					9
II	ANTENNA ARRAYS Types of arrays - Broad side, End fire, Collinear, Parasitic arrays. - Arrays of two point sources - N-element of uniform linear arrays – Array of N elements with equal spacing and currents equal in magnitude and spacing (broad side array)- Array of N elements with equal spacing and current equal in magnitude but with progressive phase shift (end fire array)- Hansen-Woodyard array- Pattern Multiplication- Binomial arrays.					9
III	TRAVELLING WAVE AND BROADBAND ANTENNAS Travelling wave radiators: basic concepts, Long wire antennas - field strength calculations and patterns - V-antennas, Rhombic Antennas, Small Loop antennas-Concept of short magnetic dipole, Helical Antennas, Folded Dipole Yagi-Uda Arrays, Log periodic antennas. Reflector Antennas: Huygens' principle - Flat Sheet and Corner Reflectors, Paraboloid Reflectors, Cassegrain Feeds. Slot antenna s-Babinet's					9

	principle, Horn antennas, Lens antennas, Microstrip antennas.	
IV	WAVE PROPAGATION Factors involved in the propagation of Radio Waves - Ground wave propagation, Structure of Ionosphere and its effects on radio waves - Refraction and Reflection of sky wave by the ionosphere, Ray paths - Measures of Ionosphere propagation: critical frequency, skip distance, virtual height, Maximum usable frequency, Fading of signals: Selective fading - Diversity reception, Space wave propagation - Considerations in	9

	space wave propagation, Atmospheric effects in space wave propagation, Super Refraction-Duct Wave Propagation.	
V	SMART ANTENNAS Concepts and Benefits of Smart antennas - Fixed weight beamforming- Adaptive beamforming – Design of Planar array antennas for Beamforming applications – Feed techniques for Planar arrays- Role of Smart Antennas in Green Communications and 5G wireless communications – Software Tools for Antenna Design and Analysis	9

Maximum Hours: 45

Course Outcomes

On completion of the course, students should be able to

CO1-

Design linear wire antennas for given specifications.

CO2- Design linear and non-

linear antenna arrays for given beam width and gain. CO3-

Analyze the performance of Aperture and Reflector Antennas

CO4- Design microstrip antennas for given specifications.

CO5-

Analyze the problems associated with radio wave propagation in the atmosphere

CO6- Design planar antenna arrays for beamforming applications.

TEXT/REFERENCE BOOKS

1. John D. Kraus, Ronald J. Marhefka and Ahmad S. Khan, "Antennas and Wave Propagation", 5th Edition, McGraw Hill, 2017.
2. Balanis, C.A., "Antenna Theory and Design", 4th Edition, John Wiley and Sons, 2016.
3. Mohammad Abdul Matin, "Wideband, Multiband and Smart Antenna Systems", 1st Edition, Springer, 2021.
4. R.L. Yadava, "Antennas and Wave Propagation", 2nd Edition, PHI Learning Private Limited, New Delhi, 2011.
5. Jordan, E.C. and Balmain, K.G., "Electromagnetic Waves and Radiating Systems", 2nd Edition, Prentice Hall of India, 2006.
6. K.D. Prasad and Satya Prakashan, "Antennas and Wave Propagation", 3rd Edition, Tech India, New Delhi, 2003.

Color red indicates the deleted portion. Color yellow indicates the added portion

SEC1403	OPTICAL COMMUNICATIONS (For ECE and ETCE)	L	T	P	Credits	Total Marks
		3	0	0	3	100

COURSE OBJECTIVES

To

introduce the principle of light propagation through optical fibers. To understand signal distortion mechanisms in the fiber.

To introduce optical transmitters and receivers for fiber/freespace links and the fiber optic couplers, connectors involved.

To introduce optical network concepts and components involved and its Applications.

UNIT1 INTRODUCTION TO OPTICAL FIBERS**9Hrs.**

Basics of optical communication system, light propagation in optical fibers, Optical spectral bands, Advantages of optical fiber communication over other communication systems, Ray theory and mode theory. Total internal reflection, Acceptance angle, Numerical aperture, phase and group velocity, cutoff wavelength & group delay. Different types of optical fibers, refractive index profiles & mode transmission.

UNIT2 TRANSMISSION CHARACTERISTICS AND OPTICAL AMPLIFIERS**9Hrs.**

Characteristics of optical fibers: Attenuation due to absorption, scattering & bending, core and cladding losses, Signal Distortion in optical fibers: Intra modal Dispersion: Material & Waveguide dispersion; Intermodal dispersion: MMSI, MMGI & modal noise.

Optical Amplifiers: Basic concepts, Erbium-Doped Fiber Amplifier, Raman amplifier -principles of operation, amplifier noise, signal to noise ratio, gain, gain bandwidth, intermodulation effects and wavelength range of operation.

UNIT3 OPTICAL TRANSMITTERS AND RECEIVERS**9Hrs.**

Fiber optic Transmitter module. Optical sources-LEDs, LASER diodes-Principles of operation: concepts of linewidth, phase noise, Optical detectors- P-I-N, Avalanche photodiodes : Principles of operation: concepts of responsivity, sensitivity and quantum efficiency, noise in detection. Fiber optic Receiver module.

UNIT4 COUPLERS, CONNECTORS AND OPTICAL LINK**9Hrs.**

Couplers: 2x2 coupler, Tap coupler, star coupler, Connectors: Cylindrical ferrule, Biconical Ferrule, Double eccentric, Splices: Fusion splices, Mechanical splices, Multiple splices. Design considerations in optical links, Point to point Links: Link Power budget, Rise Time budget, Analog Links: CNR, Multichannel transmission techniques- Multichannel Frequency Modulation, Subcarrier multiplexing.

UNIT5 OPTICAL NETWORKING PRINCIPLES AND APPLICATIONS.**9Hrs.**

FDDI, WDM, SONET/SDH, ATM, IP over WDM, Optical LAN Standards-IEEE 802.3, Applications-Military

Max. 45 Hours**TEXT/REFERENCE BOOKS**

1. Gerd Kaiser, "Optical Fiber Communications", 4th edition, Sixth reprint, Tata McGraw Hill, New Delhi, 2009.
2. John M. Senior, "Optical Fiber Communications-Principles And Practice", Third Edition, Pearson Education, 2010.
3. Gerd Keiser, "Optical communications Essentials", Special Indian Edition, Tata McGraw Hill, New Delhi, 2008.
4. Govind P. Agrawal, "Fiber-Optic Communication Systems", Third Edition, John Wiley & Sons, 2004.
5. Rajiv Ramasamy & Kumar N. Sivarajan, "Optical Networks-A Practical Perspective", 2nd Ed, Morgan Kaufman 2002.

END SEMESTER EXAM QUESTION PAPER PATTERN**Max. Marks: 100****Exam Duration: 3Hrs.****PART A:** 10 Questions of 2 marks each- No choice**20 Marks****PART B:** 2 Questions from each unit of internal choice, each carrying 16 marks**80 Marks**

SEC1407 (Revised)	OPTICAL COMMUNICATIONS	L	T	P	Credits	Total marks
		3	0	0		
Pre requisite: NIL		Co Requisite: NIL				
Course Objectives • To introduce the principles of light propagation through optical fibers. • To understand signal distortion mechanisms in the fiber. • To introduce optical transmitters and receivers for fiber /free space links and the fiber optic couplers, connectors involved. • To introduce optical network concepts and components involved and its applications.						
UNIT	CONTENTS					HOURS
I	INTRODUCTION TO OPTICAL FIBERS Basics of optical communication system, light propagation in optical fibers, Optical spectral bands, Advantages of optical fiber communication over other communication systems, Ray theory and mode theory. Total internal reflection, Acceptance angle, Numerical aperture, phase and group velocity, cutoff wavelength & group delay. Different types of optical fibers, refractive index profiles & mode transmission.					9
II	TRANSMISSION CHARACTERISTICS AND OPTICAL AMPLIFIERS Characteristics of optical fibers: Attenuation due to absorption, scattering & bending, core and cladding loses, Signal Distortion in optical fibers: Intra modal Dispersion: Material & Waveguide dispersion; Intermodal dispersion: MMSI, MMGI & modal noise. Optical Amplifiers: Basic concepts, Erbium-Doped Fiber Amplifier, Raman amplifier -principles of operation, amplifier noise, signal to noise ratio, gain, gain bandwidth, intermodulation effects and wavelength range of operation.					9
III	OPTICAL TRANSMITTERS AND RECEIVERS Fiber optic Transmitter module. Optical sources- LEDs, LASER diodes- Principles of operation: concepts of line width, phase noise, Vertical cavity surface emitting laser. Optical detectors-P-I-N, Avalanche photodiodes, Resonant cavity enhancement ,Photodetector : Principles of operation: concepts of responsivity, sensitivity and quantum efficiency, noise in detection. Fiber optic Receiver module.					9
IV	COUPLERS, CONNECTORS AND OPTICAL LINK Couplers: 2x2 coupler, Tap coupler, star coupler, Connectors: Cylindrical ferrule, Biconical Ferrule, Double eccentric, Splices: Fusion splices, Mechanical splices, Multiple splices. Design considerations in optical links, Point to point Links: Link Power budget, Rise Time budget, Analog Links: CNR, Multichannel transmission techniques-Multichannel Frequency Modulation, Subcarrier multiplexing.					9
V	OPTICAL NETWORKS, COMPONENTS AND APPLICATIONS Optical LAN Standards-IEEE802.3, Optical OFDM, High-speed Light-Waveguides, Reconfigurable optical add/drop multiplexer, Light-Fidelity (Li-Fi)					9

Color red indicates the deleted portion. Color yellow indicates the added portion

	Technology-Introduction, working principle, Comparison of Li-Fi and Wi-Fi, Li-Fi networks, Applications.Case study: Evaluation of building a Fiber Optic network	
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Maximum Hours: 45

Course Outcomes

On completion of the course, the student should be able to

CO1-Apply the mathematical concepts to compare different types of optical fibers, modes and configuration

CO2-Analyze the transmission characteristics of optical fibers

CO3-Examine the optical sources and detectors for use in optical communication system

CO4-Construct launching and coupling of optical fibers

CO5-Design high speed optical communication networks

CO6-Design wireless communication system using Li-Fi

TEXT / REFERENCE BOOKS

1. Gerd Kaiser, "Optical Fiber Communications", 4th edition, Sixth reprint, Tata Mc Graw Hill, New Delhi, 2009.
2. John M. Senior, "Optical Fiber Communications- Principles And Practice", Third Edition, Pearson Education, 2010.
3. Govind P. Agrawal, "Fiber-Optic Communication Systems", Third Edition, John Wiley & Sons, 2004.
4. Rajiv Ramasamy & Kumar N. Sivarajan, "Optical Networks - A Practical Perspective", 2nd Ed, Morgan Kaufman 2002.
5. Svilen Dimitrov & Harald Haas, "Principles of LED Light Communications: Towards Networked Li-Fi", Cambridge University Press, 2015

SECA3003	EMBEDDED PROCESSORS	L	T	P	Credits	Total Marks
		3	0	0	3	100

COURSE OBJECTIVES

- To understand the architecture of PIC, ARM and DSP processor.
- To familiarise the students in writing assembly programming and interfacing with Peripherals using PIC Microcontroller.
- To understand the difference between Microcontroller and DSP processor.

UNIT1 INTRODUCTION TO PIC MICROCONTROLLERS**9Hrs.**

Introduction to PIC – Compare Von Neumann architecture and Harvard architecture, RISC Vs CISC - Features of PIC - Architecture of PIC16F8XX - Pin Configuration - Addressing modes - Instruction set - Simple Programs.

UNIT2 PIC ON CHIP PERIPHERALS**9Hrs.**

Memory - Core SFR - Interrupts - I/O Ports - Timers - CCP modules - Capture Mode - Compare Mode - PWM Mode - Serial communication module - USART - SPI interface - I2C interface - Analog Comparator, ADC.

UNIT3 APPLICATIONS USING PIC**9Hrs.**

Programming Languages - Compilers - Assemblers - Directives - MPLAB IDE - Interfacing - Switches & Push buttons - LEDs - seven segment displays - LCD - Keypad Interfacing, Timer applications - Case study Temperature monitoring System - Case study Digital Clock.

UNIT4 ARM PROCESSOR**9Hrs.**

Architecture of ARM Controller - Registers, Pipeline organization 3 stage & 5 stage, Thumb mode of operation - D/A and A/D converter, sensors, actuators and their interfacing - Case study - Temperature sensing, Light sensing, Introduction to Internet of Things, smart home concepts.

UNIT5 DSP PROCESSORS**9Hrs.**

Introduction - fixed and floating point - Core architecture of ADSP218X - Arithmetic Logic Unit (ALU) - Multiplier and Accumulator (MAC) Unit - Barrel Shifter - Data Address Generator (DAG) - Program Sequencer - Functional Diagram of TMS320C54XX.

Max: 45Hrs.**COURSE OUTCOME**

On completion of the course, student will be able to

CO1- Understanding architecture and function of PIC microcontrollers.

CO2- Explain the discussion of on-chip peripherals of PIC microcontrollers.

CO3- Do assembly and C program exercises with various I/O modules.

CO4- Understand the architecture of ARM.

CO5-

Understand the need of DSP processor for signal processing applications and its architecture. CO

6- Design real-time application using PIC Microcontroller.

TEXT/REFERENCE BOOKS

1. Danny Causey, Rolin McKinlay, Muhammad Ali Mazidi, "PIC Microcontroller and Embedded Systems: Using assembly and C for PIC18", 1st Edition, Micro Digital Edition; 2nd Edition, 2016.
2. Andrew Sloss, Dominic Symes, Chris Wright, "ARM System Developer's Guide: Designing and Optimizing System Software", Elsevier, 1st Edition, 2004.
3. F. Vahid and T. Givargis, "Embedded System Design: A Unified Hardware/Software Introduction", Wiley India Pvt. Ltd., 2002.
4. B Venkataramani MBhaskar, "Digital Signal processors Architecture, Programming and Applications", Tata McGraw Hill, 2nd Edition, 2002.

Color red indicates the deleted portion. Color yellow indicates the added portion

USEFULLINKS

1. <https://www.mikroe.com/ebooks/pic-microcontrollers-programming-in-c>
2. www.analog.com.
3. www.ti.com.
4. www.dspguide.com.
5. <https://swayam.gov.in/courses/5424-jan-2019-embedded-system-design-with-arm>

ENDSEMESTEREXAMINATIONQUESTIONPAPERPATTERN

SECA3019	EMBEDDED PROCESSORS	L	T	P	Credits	Total marks
		3	0	0	3	100
Pre requisite: Nil		Co Requisite: Nil				
Course Objectives ● To analyze the features of various embedded processors ● To analyze the On-chip peripherals ● To develop ARM processor-based applications ● To design innovative applications by interfacing the processors with real world ● To analyze various ARM cortex processors ● To develop firmware for ARM cortex processors						
UNIT	CONTENTS					HOURS
I	INTRODUCTION TO EMBEDDED PROCESSORS Introduction to embedded processors– Compare Von Neumann architecture and Harvard architecture, RISC Vs CISC – System on Chip (SoC)-Introduction to SoC Architecture, An approach for SOC Design, System Architecture and Complexity. Processor Selection for SOC, Basic concepts in Processor Architecture, Overview of SOC external memory, Internal Memory, Scratchpads and Cache memory, SOC Memory System, Models of Simple Processor – memory interaction, SOC Standard Buses					9
II	EMBEDDED PROCESSORS ON CHIP PERIPHERALS Memory - Interrupts - I/O Ports-Timers & Real Time Clock (RTC), Watch dog timer - CCP modules - Capture Mode - Compare Mode-PWM Mode - Serial communication module - USART - SPI interface - I2C interface, Analog Comparator, Analog interfacing and data acquisition.					9
III	ARM PROCESSOR Architecture of ARM Controller – Registers, Pipeline organization 3 stage & 5 stage, Thumb mode of operation - D/A and A/D converter, sensors, actuators and their interfacing – Case study- Digital clock, Temperature sensing, Light sensing, Introduction to Internet of Things, smart home concepts					9
IV	REAL WORLD INTERFACING USING ARM PROCESSOR Interfacing the peripherals to LPC2148: GSM and GPS using UART, on-chip ADC using interrupt (VIC), EEPROM using I2C, SD card interface using SPI, on-chip DAC for waveform generation.					9
V	ARM CORTEX PROCESSORS Introduction to ARM CORTEX series, improvement over classical series and advantages for embedded system design. CORTEX A, CORTEX M, CORTEX R processors series, versions, features and applications, need of operating system in developing complex applications in embedded system, Firmware development for ARM Cortex, Survey of CORTEX M3 based controllers, its features and comparison					9

Maximum Hours: 45

Color red indicates the deleted portion. Color yellow indicates the added portion

Course Outcomes

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

CO1-Analyze the architectures of different Embedded Processors

CO2-Identify an appropriate on chip peripherals for serial and parallel communication

CO3-Examine the functions of ARM processors

CO4-Develop real time applications using ARM processors

CO5-Develop a firmware for embedded applications

CO6-Develop innovative products using Embedded processors

TEXT / REFERENCE BOOKS

1. F. Vahid and T. Givargis, "Embedded System Design: A Unified Hardware/Software Introduction", Wiley India Pvt. Ltd., 2002.
2. Michael J. Flynn and Wayne Luk, "Computer System Design System-on-Chip", Wiley India Pvt. Ltd.
3. Steve Furber, "ARM System on Chip Architecture ", 2nd Edition, 2000, Addison Wesley Professional.
4. S. Pasricha and N. Dutt, Morgan Kaufmann, On-Chip Communication Architectures, System on Chip Interconnect, -Elsevier Publishers 2008
5. Mark Fisher, "ARM Cortex M4 Cookbook", Packt Publishing, 2016.
6. Lyla B. Das, "Architecture, Programming and Interfacing of Low-power Processors ARM 7, Cortex-M", Cengage, 1st Edition, 2017.
7. Joseph Yiu, "The Definitive Guide to the ARM Cortex-M3", Newness, 2nd Edition, 2009



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BOARD OF STUDIES

DEPARTMENT OF ELECTRONICS AND COMMUNICATION ENGINEERING

VENUE: CENTRE FOR EXCELLENCE IN EMBEDDED AND IoT

Date: 30.03.2019

Time: 3.30 PM

Minutes of Meeting

Dr. N. M. Nandhitha, Dean, School of EEE welcomed all members of Board of Studies. On the suggestions of various Experts, the contents are designed by the Board of Studies Members considering the various aspects and need of the society.

- Dr.T,Ravi, Head Department of Electronics and Communication started the meeting by welcoming both the external and the internal numbers to the Board of Studies meeting.
- The guidelines of the syllabus given by the management were explained by HOD to all the members of the BOS.
- The external members also ratified the decision to revise the syllabus under the mentioned guidelines.
- Initial discussion was started with course outcome and it has been assessed that COs could be modified slightly and need not be confined to six in number. It can also be reduced as per the content of syllabus. All the framed COs has to be matched with the PO for attainment. Engineering Graphics, Indian culture related more courses have to be included. Reference text books and edition has to be modified. It is decided to have the electives exclusively for school of EEE. Curriculum could be restricted to 3 pages. Include standard authors in references.
- Dr.M.Sumathi presented the changes incorporated in 'Digital Logic Circuits'. Dr M D Selvaraj. Professor, IIITDM accepted the changes suggested.
- Dr.Sivakumaran, Prof., NIT, Trichy accepted the changes proposed in 'Analog Communication' suggested by Dr.P.Chitra.



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4 units and 5th unit may be taken as case studies related to the course. This would enhance the student community to have a clear picture about the course opted.

- Dr.Sivakumaran suggested that have Machine learning technique could be added as replacement of Neural and Fuzzy Logic Systems and Deep Learning algorithms as replacement of Artificial Intelligence . Dr.T.Ravi putforth the introduction of new courses such as Machine Learning, Wireless sensor network, MEMS and its Applications, Optical Networks, Python Programing and Biomedical Signal Processing.
- Dr.T.Ravi also presented the new course introduced for PG courses are Industry 4.0 and Gateway Design for IoT Devices. The Syllabus Revision carried out in PG courses is Network Oriented OS.
- Dr.Sivakumaran also suggested that replacement of Fundamentals of Fuzzy logic and neural networks for EIE and also discussed to have two units of neural network, two units of Fuzzy logic and one unit of Genetic Algorithm. Followed by his suggestion Dr.R.Ramadevi suggested the course as Soft computing Techniques.
- Dr.V.Sivachidambaranathan, Prof.& Head, Dept. of Electrical and Electronics Engineering put forth about the Breakup of credits (15) for Project and Professional Training before the board of members.
- Professional Training 1, which is to be taken up at the end of 4th semester and before commencement of 5th semester would be allotted 2 credits. This credit would be reflected in 5th sem mark sheet.
- The Professional Training 2 as per Regulations 2015 would be modified as Minor Project, should be carried out during 6th semester. This would carry a credit of 3, which would be reflected in 6th semester mark sheet.
- The Phase 2 would be carried out in 8th semester, allotted a credit of 7, to be reflected in 8th semester marks sheet.



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- The Phase 2 would be carried out in 8th semester, allotted a credit of 7, to be reflected in 8th semester marks sheet.
- The students would have to take seminar on a turn basis every week. The seminar would be evaluated and added with CAE1 and CAE2 marks. No credits for Placement training
- The board of members appreciated the breakup credits given for professional training and Project phase
- Dr.V.Sivachidambaranathan, Prof.& Head, Dept. of Electrical and Electronics Engineering requested Mr.Barnabas, Faculty/EEE to put revision of the courses Basic Electrical and Electronics Engineering, Circuit Theory & Network Analysis. Dr.G.T.Sundar Rajan, Faculty /EEE proposed the revision of PG "Power Electronics and Drives" courses "Embedded Systems, Power Electronics in Power Systems, Special Machines and Their controller, & Modeling and Simulation in power Electronics Systems". The new syllabus presented before the board and discussed the valid additions made in the syllabus.
- Dr.V.Sivachidambaranathan, Prof.& Head, Dept. of Electrical and Electronics Engineering requested Dr.Rameshbabu, Faculty/EEE to put forth the syllabus of the new courses, 'Embedded Systems and IoT' for the approval of the board. Dr. A. Amalin Prince approved the Syllabus for this new course.

The following internal members were present in the meeting.

INTERNAL MEMBERS

SIGNATURE

1. Dr.N.M.Nandhitha

2. Dr.T.Ravi

3. Dr.V.Sivachidambaranathan

4. Dr.V.Vijaya Baskar

5. Dr.M.Sumathy



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6. Dr.S.Lakshmi *S. Lakshmi*
7. Dr.P.Chitra *P. Chitra*
8. Dr. P. Kavipriya *P. Kavipriya*
9. Dr.S.Barani *S. Barani*
10. Mrs.K.Srilatha *K. Srilatha*
11. Mrs.L.Magthelin Therase *L. Magthelin Therase*
12. Mrs.S.Yogalakshmi *S. Yogalakshmi*
13. Mrs.K.Sujatha *K. Sujatha*
14. Dr.R.Ramadevi *R. Ramadevi*
15. Dr.Susitra *Susitra*

External Members

Dr.N.Shivakumaran

Professor
Dept. of I& C
NIT, Trichy.

[Signature]
30/3/19.

Dr.M.D.Selvaraj

Associate Professor
IIITDM, kancheepuram.

[Signature]
30/3/19.



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BOARD OF STUDIES

DEPARTMENT OF ELECTRONICS AND COMMUNICATION ENGINEERING

VENUE: CENTRE FOR EXCELLENCE IN EMBEDDED AND IoT

Date: 30.11.2019

Time: 3.30 PM

Minutes of Meeting

- Dr. N. M. Nandhitha, Dean, School of EEE welcomed all members of Board of Studies. On the suggestions of various Experts, the contents are designed by the Board of Studies Members considering the various aspects and need of the society. The meeting was convened by the Dr.N.Shivakumaran, Prof / NIT, Trichy. The guidelines of the syllabus given by the management were explained by HOD to all the members of the BOS. The external members also ratified the decision to revise the syllabus under the mentioned guidelines. The Board discussed the matters as per the agenda.
- Dr M D Selvaraj. Professor, IIITDM accepted the changes suggested by Dr P.Chitra in the subject' Digital communication. Dr.N.Shivakumaran also accepted the inclusion of error control coding in the course.
- Dr.T.Ravi discusses the syllabus of Machine learning, Industry 4.0 are discussed with the members.
- Dr.N.Shivakumaran Suggested to include the following topics in Signal and System course such as modelling of signal, speech signal processing, analysis and modelling of system and application of Fourier Transform.
- Dr.T.Ravi also presented the new course introduced for PG courses are Advanced Wireless Sensor Networks and Security in IoT.
- The Syllabus Revision carried out in PG courses is SCADA System Application.
- Dr M D Selvaraj suggested to Remove first unit in Digital Signal Processing course and include DSP processor in the fifth unit. Since first unit is the review of signals and system and to include industrial topic. Include Signal Conditioning, generation and detection for real time applications, DSP Hardwares, FPGA, ARM Processor with DSP Extension in Digital Signal Processing.

- Dr M D Selvaraj Suggested to update the fifth unit of programming in HDL with FPGA Design Flow , Architecture of Xilinx Artix7 FPGA , Configurable Logic Blocks (CLB),
- Dr.N.Shivakumaran Suggested to include applications in FPGA and Case Study: study of protocols I2C, SPI and UART in microprocessor and microcontroller course.
- Dr.T.Ravi put forth the new courses introduced such as Artificial Intelligence, Rf IC Design, Soft Computing Techniques and Cryptography and Network security
- Dr.R.Ramadevi proposed the introduction of new Elective 'Instrumentation in Aerospace and Navigation'. Dr.Sivakumaran suggested to incorporate more topics related to instrumentation.
- Dr.V.Sivachidambaranathan, Prof.& Head, Dept. of Electrical and Electronics Engineering requested Dr.Susitra, Faculty/EEE to put forth revision of the course DC Machines and Transformer and Digital Signal Processing and its Applications. The new syllabus presented before the board and discussed the valid additions made in the syllabus.
- Dr.V.Sivachidambaranathan, Prof.& Head, Dept. of Electrical and Electronics Engineering requested Dr.Rameshbabu, Faculty/EEE to put forth the syllabus of the new courses, 'Computer Aided Electrical Drawing' for the approval of the board. Dr. A. Amalin Prince approved the Syllabus for this new course.

The next BOS meeting may be scheduled on April 2020 to review and finalize the syllabus revision process.

Faculty Head, Dr. T.Ravi proposed vote of thanks and the Board of Meeting ended by 4.30 PM on 30.11.2019.

The following internal members were present in the meeting.

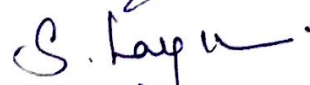
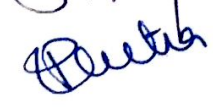
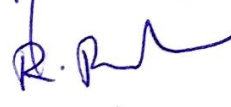
INTERNAL MEMBERS

1. Dr.N.M.Nandhitha

2. Dr.T.Ravi

SIGNATURE




3. Dr.V.Sivachidambaranathan 
4. Dr.V.Vijaya Baskar 
5. Dr.M.Sumathy 
6. Dr.S.Lakshmi 
7. Dr.P.Chitra 
8. Dr. P. Kavipriya 
9. Dr.S.Barani 
10. Mrs.K.Srilatha 
11. Mrs.L.Magthelin Therase 
12. Mrs.S.Yogalakshmi 
13. Mrs.K.Sujatha 
14. Dr.R.Ramadevi 
15. Dr.Susitra 

External Members

Dr.N.Shivakumaran
Professor
Dept. of I& C
NIT, Trichy.


30/11/19

Dr.M.D.Selvaraj
Associate Professor
IIITDM, kancheepuram.


30/11/19.

Sathyabama Institute of Science and Technology

Department of Electronics and Communication Engineering

DEPARTMENT OF ELECTRONICS AND COMMUNICATION ENGINEERING

SYLLABUS REVISION(2019-2020)

SL.NO	COURSE CODE	COURSENAME
1	SECA1201	DIGITAL LOGIC CIRCUITS
2	SECA1303	ANALOG COMMUNICATION SYSTEMS
3	SECA1403	DIGITAL COMMUNICATION

SEC1207 (OLD)	DIGITAL LOGIC CIRCUITS (For ECE, EEE, EIE, ETCE and E&C)	L	T	P	Credits	Total Marks
		3	0	0	3	100

UNIT 1 BOOLEAN ALGEBRA AND LOGIC GATES

9 hrs

Review of number systems - Binary arithmetic – Binary codes – Boolean algebra and theorems - Boolean functions–Minimization of Boolean functions-Sum of Products(SOP)-Product of Sums(POS)-Simplifications of Boolean functions using Karnaugh map and tabulation methods – Logic gates- NAND and NOR implementation

UNIT 2 DESIGN OF COMBINATIONAL CIRCUITS

9 hrs

Introduction to Combinational circuits – Analysis and design procedures – Half Adder, Full Adder-Half Subtractor, Full Subtractor- Parallel binary Adder, Parallel binary Subtractor- Carry look ahead Adder- BCD Adder- Decoders- Encoders- Priority Encoder- Multiplexers- MUX as universal combinational modules- Demultiplexers- Code convertors- Magnitude Comparator

UNIT 3 DESIGN OF SEQUENTIAL CIRCUITS

9 hrs

Introduction to Sequential circuits – Flip flops – SR, JK, D and T flip flops, Master Slave flip flops, Characteristic and excitation table – Realization of one flip flop with other flip flops – Registers – Shift registers – Counters – Synchronous and Asynchronous counters – Modulus counters, Up/Down counters – Ring Counter – Johnson Counter – State diagram, State table, State minimization – Hazards

UNIT 4 DIGITAL LOGIC FAMILIES

9 hrs

Classification and characteristics of logic family – Bipolar logic family – Saturated logic family – RTL, DTL,DCTL, I²L,TTL, HTL – Non saturated family – Schottky TTL, ECL – Unipolar family – MOS, CMOS logic families. Tristate logic Interfacing of CMOS and TTL families. Comparison of logic families

UNIT 5 MEMORIES AND PROGRAMMABLE LOGIC DEVICES

9 hrs

Classification of memories – ROM – ROM organization – PROM – EPROM – EEPROM – RAM – RAM organization– Write operation – Read operation – Memory decoding – Memory expansion – Static RAM – Dynamic RAM – Programmable Logic Devices – Programmable Logic Array (PLA) – Programmable Array Logic (PAL) – Field Programmable Gate Arrays (FPGA) – Implementation of combinational logic circuits using ROM, PLA, PAL.

COURSE OUTCOMES:

On completion of this course, students are able to

CO1	Describe the procedure of Number systems, binary codes , binary arithmetic, Boolean algebra and Logic gates
CO2	Apply the concepts of Combination circuits for their implementation
CO3	Design the various types of sequential logic circuits
CO4	Analyze the different types of Digital Logic families
CO5	Investigate the behavior and characteristics of digital logic families , PLDs
CO6	Create the structures of SRAM and DRAM

Sathyabama Institute of Science and Technology
Department of Electronics and Communication Engineering

TEXT / REFERENCE BOOKS:

1. Milos Ercegovac, Jomas Lang, "Introduction to Digital Systems", Wiley publications, 1998
2. John M. Yarbrough, "Digital logic: Applications and Design", Thomas - Vikas Publishing House, 2002
3. R.P.Jain, "Modern digital Electronics", 3rd Edition, TMH, 2003
4. Morris Mano, "Digital design", 3rd Edition, Prentice Hall of India, 2008
5. Floyd and Jain, " Digital fundamentals", 10th Edition 2009, Pearson Publishers
6. Charles H.Roth. "Fundamentals of Logic Design", 6th Edition, Thomson Learning, 2013

END SEMESTER EXAMINATION QUESTION PAPER PATTERN

Max. Marks: 100

Exam Duration: 3 hrs

Part A: 10 questions of 2 marks each -No choice

20 Marks

Part B: 5 questions from each unit with internal choice, each carrying 16 marks

80 Marks

SECA1201 NEW	DIGITAL LOGIC CIRCUITS	L	T	P	Credits	Total Marks
		3	0	0	3	100

COURSE OBJECTIVES

- To impart knowledge on various types of Binary logics.
- To design a binary logic circuit for an arithmetic expressions.
- To understand the usage of registers and counters used in various digital circuits.
- To understand the design of memory devices used.
- To get an exposure about the electronics behind design of Basic digital logical elements.

UNIT 1 NUMBER SYSTEMS, LOGIC FUNCTIONS AND BOOLEAN ALGEBRA

9 Hrs.

Number systems – Number systems conversions - Binary arithmetic – Binary codes – Logic functions-Universal gate functions - Boolean algebra – Functionally complete operation sets, **Reduction of switching equations using Boolean algebra, Realization of switching function.**

UNIT 2 DESIGN OF COMBINATIONAL LOGIC

9 Hrs.

Design procedure of Combinational Logic – Design of two level gate networks -Sum of Products (SOP) - Product of Sums(POS) - **Canonical SOP - Canonical POS** - Karnaugh Map - Simplifications of Boolean functions using Karnaugh Map and implementation using Logic function – **Advantages and limitations of K-Map** - Tabulation method - Simplifications of Boolean functions using Tabulation method.

UNIT 3 COMBINATIONAL CIRCUITS

9 Hrs.

Introduction to Combinational circuits – Half Adder, Full Adder - Half Subtractor, Full Subtractor- Parallel binary Adder, Parallel binary Subtractor - Carry look ahead Adder- BCD Adder- Decoders- Encoders - Priority Encoder- Multiplexers- MUX as universal combinational modules- Demultiplexers- Code convertors- Magnitude Comparator.

UNIT 4 SEQUENTIAL CIRCUITS

9 Hrs.

Introduction to Sequential circuits – Flip flops – SR, JK, D and T flip flops, Master Slave flip flop, Characteristic and excitation table – Realization of one flip flop with other flip flops – Registers – Shift registers – Counters – Synchronous and Asynchronous counters – Modulus counters – Ring Counter – Johnson Counter – State diagram, State table, State minimization – Hazards.

UNIT 5 DIGITAL LOGIC FAMILIES, MEMORIES AND PROGRAMMABLE DEVICES

9 Hrs.

Classification and characteristics of logic family – Bipolar logic family – Saturated logic family – Non saturated family – Unipolar family – MOS, CMOS logic families. Classification and Organization of memories – Programmable Logic Devices – Programmable Logic Array(PLA) – Programmable Array Logic (PAL) – Field Programmable Gate Arrays (FPGA) .

Max. 45 Hrs.

COURSE OUTCOMES

On completion of the course, student will be able to

CO1 - Classify various types of Digital Number systems and Boolean algebra.

CO2 - Illustrate Combinational logic.

CO3 - Design and implement the digital circuit using combinational logic.

CO4 - Design and implement the digital circuit using sequential logic.

CO5 - Illustrate the digital logic families.

CO6 - Solve the arithmetic expressions using memories and programable logic devices and implement memory units with Programmable logic devices.

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TEXT / REFERENCE BOOKS

1. John M. Yarbrough, "Digital logic: Applications and Design", Thomas - Vikas Publishing House, 2002.
2. Morris Mano, "Digital design-With an Introduction to the Verilog HDL", 5th Edition, Pearson, 2013.
3. R.P.Jain, "Modern Digital Electronics", 4th Edition, TMH, 2010.
4. Thomas L Floyd, " Digital Fundamentals", 11th Edition, Pearson, 2015
5. William H. Gothmann, "Digital Electronics", Prentice Hall, 2001.
6. Tutorial Website: https://www.tutorialspoint.com/digital_circuits/index.htm.

END SEMESTER EXAMINATION QUESTION PAPER PATTERN

Max. Marks: 100

Exam Duration: 3 Hrs.

PART A: 10 Questions of 2marks each-No choice

20 Marks

PART B: 2 Questions from each unit of internal choice; each carrying 16 marks

80 Marks

SEC1209	ANALOG COMMUNICATIONS	L	T	P	Credits	Total Marks
		3	0	0	3	100

UNIT1	BASICS OF ELECTRONIC COMMUNICATION AND NOISE THEORY Review of time and frequency domain description of signals - Communication system: point to point and broad cast - Basic model of a communication system: transmitter, receiver and channel - Fundamental limitations: Technological, Physical; Noise, bandwidth (signal and channel) and information capacity - Need for modulation and types - classification of communication based on modulation and channel - Base band and Pass band transmission - Electromagnetic spectrum allocation for various communication systems. Noise in Communication systems: Types and sources of noise; Atmospheric Noise, Thermal Noise, Shot noise, Partition noise, Flicker noise, Transit time noise - noise factor, noise factor for cascaded amplifier (Friss formula) -Noise figure - Equivalent noise temperature and bandwidth - Signal to Noise Ratio	9 hrs
UNIT 2	AMPLITUDE MODULATION AND DEMODULATION STD-AM (DSB-FC) Mathematical representation - waveform, frequency spectrum, bandwidth, power relations and Modulation index - Multi tone modulation - Limitations and Modifications in STD-AM: DSB-SC, SSB-SC and VSB, AM Generation (Modulators): DSB-FC; square law modulator, Collector and base modulator circuits - DSB- SC; Balanced modulator circuit using BJT/FET - SSB: Phase shift method and Filter method - VSB; Filter method- Application and Comparison of various AM schemes - AM transmitter: Low and high level Modulation. AM Detection (Demodulators) - Envelope detector, Significance of RC time constant - Square law detector - Costa's PLL detector	9 hrs
UNIT 3	ANGLE (FM & PM) MODULATION AND DEMODULATION Single tone FM: Mathematical representation, waveform, frequency spectrum, modulation index, bandwidth and power - Multi-tone FM - Types and comparison of FM: Narrowband and Wideband - Compare FM and AM Phase modulation (PM): Mathematical representation and waveform - Relation between FM and PM - Conversion: FM to PM and PM to FM - Application of FM and PM. FM Generation: Direct method using Varactor diode and indirect method (Armstrong modulator) - Pre-emphasis - FM stereo broadcast transmitter. FM Detector: Balanced slope detector, Foster seelay frequency discriminator and Ratio detector - De- emphasis	9 hrs
UNIT 4	ANALOG PULSE MODULATION, DEMODULATION AND MULTIPLEXING Analog pulse modulation - Sampling theorem - Nyquist rate - Concepts of PAM, PWM (PDM) and PPM - Modulators and demodulators. Multiplexing- classifications: Frequency Division Multiplexing, Time Division Multiplexing and Quadrature Multiplexing - Comparison of multiplexing	9 hrs
UNIT 5	RECEIVERS AND SYSTEMS AM Receivers: TRF receivers -Super heterodyne receivers: choice of IF, double conversion technique, tracking, AGC- characteristics of receiver - noise in AM receiver. FM Receivers: FM stereo broadcast receivers - AFC - Noise in FM - Capture effect, FM threshold effect. Communication Receivers: Sensitivity, fidelity and selectivity - Squelch circuit - Beat frequency Oscillator- Overview of Telephony, Telegraphy, Television, CCTV and Cable television	9 hrs

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COURSE OUTCOMES:

On completion of this course, students are able to

CO1	Describe the functional blocks of communication system, noise sources and types
CO2	Derive the mathematical equations and demonstrate the generation & detection of AM, FM, PM, PAM, PDM and PPM
CO3	Design AM and FM transmitters
CO4	Apply sampling theorem and demonstrate the significance of various multiplexing techniques
CO5	Analyze the TRF and Super heterodyne receivers and concepts of Telephony, Telegraphy, Television, CCTV and Cable television
CO6	Develop appropriate modulation technique for real time applications

TEXT / REFERENCE BOOKS:

1. Dennis Roody and John Coolen, Electronic Communication, Pearson, 4/e, 2011
2. Tomasi, Electronic Communications System, Pearson, 5/e, 2011
3. Simon Haykin, —Communication Systemsll, Wiley Publication, New Delhi, 2011
4. Kennedy G, - Electronic Communication systems, Tata McGraw Hill, New Delhi, 2009
5. Sanjay Sharma, “Analog Communication Systems”, 2009
6. B. P. Lathi, Modern digital and analog Communication systems, Oxford University Press., 4th edition, 2010

END SEMESTER EXAMINATION QUESTION PAPER PATTERN

**Max. Marks: 100
hrs**

Exam Duration: 3

Part A: 10 questions of 2 marks each -No choice
Marks

20

Part B: 5 questions from each unit with internal choice, each carrying 16 marks

80 Marks

SECA130 (Revised)	ANALOG COMMUNICATION SYSTEMS (For ECE)	L	T	P	Credits	Total Marks
		3	0	0	3	100

COURSE OBJECTIVES

- To discuss and understand fundamental concepts of amplitude modulation and demodulation techniques.
- To understand the concepts of Frequency Modulation and De-Modulation techniques and compare with AM and PM.
- To understand the concepts of Analog Pulse modulation and De-Modulation techniques (PAM, PDM/PWM and PPM) & Multiplexing techniques and classifications.
- To apply different multiplexing techniques for AM, FM, PAM, PWM and PPM systems.
- To understand the various noises and their effect on Analog modulation systems.
- To discuss the working of Analog Communication Receivers and Telephone and Television Systems.

UNIT 1 AMPLITUDE MODULATION AND DEMODULATION

9 Hrs.

Need for modulation– Model of communication system and classification, Representation of AM – Modulation index and power calculation –Types of AM;DSB-FC: Collector and base modulation circuits, square law modulator- DSB-SC: Balanced modulator circuit using FET – SSB: Filter method and phase shift method – VSB, Comparison of various AM schemes-AM transmitter: Low level and high level Modulation. Demodulation –Envelope detector, Significance of RC time constant- Square law detector.

UNIT 2 ANGLE (FM AND PM) MODULATION AND DEMODULATION

9 Hrs.

Single tone FM: Mathematical representation, frequency spectrum and bandwidth- Multi-tone FM - NBFM and WBFM - Phase modulation (PM): Mathematical representation - Conversion: FM to PM and PM to FM – Comparison of AM, FM and PM- FM Generation: Direct method using Varactor diode and indirect method (Armstrong modulator) - Pre-emphasis - FM transmitter. FM Detector: Balanced slope detector, Foster seeley frequency discriminator and Ratio detector - De- emphasis.

UNIT 3 ANALOG PULSE MODULATION AND MULTIPLEXING

9 Hrs.

Sampling theorem – Types of sampling-Concepts of PAM, PWM, PPM and PCM- Modulators and demodulators. Types of Multiplexing- Frequency Division Multiplexing, Time Division Multiplexing and Quadrature Multiplexing - Comparison of multiplexing.

UNIT 4 ANALOG RECEIVERS AND NOISE

9 Hrs.

AM Receivers: TRF receivers -Super heterodyne receivers - FM Receivers: FM stereo broadcast receivers - AFC - Capture effect, FM threshold effect. Communication Receivers: Sensitivity, fidelity and selectivity - Squelch circuit - Beat frequency Oscillator-Types of Noise- Noise factor and noise temperature for cascaded amplifier (Friis formula)- Noise in AM and FM systems.

UNIT 5 COMMUNICATION SYSTEMS

9 Hrs.

Telephone Systems-Electronics Telephone and cellular Telephone System - Fax-Television Systems-Scanning-camera tube and Transmitter, Picture tube and Receiver, CCTV and Set top box.

Max. 45 Hrs.

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Department of Electronics and Communication Engineering

COURSE OUTCOMES

On completion of the course, student will be able to

- CO1 - Explain the Functional blocks of communication system, modulation techniques and Various noise sources and types.
- CO2 - Analyse AM, FM, PM, PAM, PDM, PPM and PCM using mathematical equations and demonstrate their modulation and demodulation techniques.
- CO3 - Illustrate sampling theorem and explain the importance of various multiplexing techniques.
- CO4 - Demonstrate the working of AM and FM transmitters, Receivers and communication Systems.
- CO5 - Performance evaluation and selection of appropriate modulation technique for real time applications.
- CO6 - Working of Analog Communication Receivers and Telephone and Television Systems.

TEXT/REFERENCE BOOKS

- 1. R.P Singh Sanjay Sharma, "Analog Communication Systems", 2009.
- 2. B.P.Lathi, "Modern Digital and Analog Communication Systems", 3rd Edition, Oxford University Press, 2007.
- 3. Deshpande, N.D, "Communication Electronics", Tata McGraw Hill Publishers,1989.
- 4. Louis. E. Frenzel, "Communication Electronics Principles and applications", 3rd Edition, Tata Mc.Graw Hill, 2002.
- 5. Dennis Reddy and John Coolen, "Electronic Communications", 4th Edition, Prentice Hall Publishers,1995.
- 6. Kennedy, "Electronic Communications Systems", 4th Edition, McGraw-Hill Publishers,1992.
- 7. R.Gulati, "Monochrome and colour television", 2nd Edition, New age international 2005.

END SEMESTER EXAMINATION QUESTION PAPER PATTERN

Max. Marks: 100

Exam Duration: 3 Hrs.

PART A: 10 Questions of 2 marks each - No choice

20 Marks

PART B: 2 Questions from each unit of internal choice; each carrying 16 marks

80 Marks

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Department of Electronics and Communication Engineering

SEC1313 (Old)	DIGITAL COMMUNICATIONS (For ECE and ETCE)	L	T	P	Credits	Total Marks
		3	0	0	3	100

UNIT 1 SAMPLING AND QUANTIZATION

9 hrs

Review of Sampling process -Natural Sampling-Flat Sampling - Aliasing - Signal Reconstruction-Quantization - Uniform & non-uniform quantization - quantization noise Bandwidth -Noise trade off-PCM- Noise considerations in PCM- differential pulse code modulation - Delta modulation -Linear prediction - Adaptive Delta Modulation

UNIT 2 BASEBAND PULSE TRANSMISSION

9 hrs

Base band transmission - Wave form representation of binary digits -Matched filter- error rate due to noise -- Nyquist's criterion for distortion less base band binary transmission- Inter symbol interference - ideal Nyquist channel - Raised cosine channels- correlative level coding - Baseband M-ary pam transmission- equalization - Eye patterns- companding - A law and μ law- Correlation receiver

UNIT 3 DIGITAL MODULATION TECHNIQUES

9hrs

Introduction - ASK- FSK - PSK- coherent modulation techniques-BFSK-BPSK-signal space diagram-robability of error- coherent quadrature modulation techniques- QPSK-signal space diagram-probability of error- non coherent modulation techniques-M-ary modulation techniques - Vectorial view of MPSK and MFSK - error performance

UNIT 4 SYNCHRONIZATION

9 hrs

Synchronization: Receiver synchronization - Coherent systems - Symbol and frame synchronization - Network synchronization - Open and closed loop transmitter synchronization - Tracking and acquisition in spread spectrum system

UNIT 5 SPREAD SPECTRUM MODULATION

9 hrs

Pseudo- noise sequences - a notion of spread spectrum - Direct sequence spread spectrum with coherent binary phase shift keying - Signal space Dimensionality and processing gain -Probability of error - Frequency -hop spread spectrum- Use of spread spectrum with code division multiple access

Max. 45 hrs

COURSE OUTCOMES:

On completion of this course, students are able to

CO1	Describe the working of digital communication systems and different source encoding schemes
CO2	Analyze the degradation in Baseband Pulse Transmission and techniques to overcome it
CO3	Compare the performance of different digital modulation techniques with different modulation schemes in the presence of noise

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CO4	Analyze the performance of various synchronization schemes in digital communication receivers
CO5	Evaluate the performance of spread spectrum based digital communications systems
CO6	Design modulator and demodulator for digital communication systems

TEXT / REFERENCE BOOKS:

1. Simon Haykin, Michael Moher, "Communication Systems" John Wiley, 5th Edition, March 2009
2. Herbut Taub, Donald L. Schilling , Goutam Saha , "Principles of Communication",4thMcGraw Hill edition,2013
3. John G. Proakis, Masoud Salehi, "Digital Communication", McGraw Hill 5th edition, 2014
4. Bernard Sklar, "Digital Communication, Fundamentals and Application", Pearson Education Asia, 3rd Edition, 2013

END SEMESTER EXAMINATION QUESTION PAPER PATTERN

Max. Marks: 100

Exam Duration: 3 hrs

Part A: 10 questions of 2 marks each -No choice

20 Marks

Part B: 5 questions from each unit with internal choice, each carrying 16 marks

80 Marks

SECA1403 (Revised)	DIGITAL COMMUNICATION	L	T	P	Credits	Total Marks
		3	0	0	3	100

COURSE OBJECTIVES

- To know the principles of sampling & quantization.
- To understand the various Base Band signaling schemes.
- To introduce the basic concepts of digital modulation of baseband signals.
- To get introduced to the basics of source and channel coding/decoding.
- To understand the basics of spread spectrum modulation schemes.

UNIT 1 SAMPLING AND QUANTIZATION

9 Hrs.

Digital communication systems: performance metrics and specifications -Review of Sampling process -Natural Sampling-Flat Sampling - Aliasing - Signal Reconstruction-Quantization- Uniform & non-uniform quantization - quantization noise - PCM- Noise considerations in PCM- differential pulse code modulation - Delta modulation - Adaptive Delta Modulation.

UNIT 2 BASEBAND PULSE TRANSMISSION

9 Hrs.

Base band transmission - Wave form representation of binary digits -Matched Filter- Error Rate due to noise - Nyquist's criterion for Distortion less Base band Binary Transmission- Inter symbol Interference - Ideal Nyquist channel - Raised cosine channels- Correlative level coding - Equalization- Adaptive Equalization – Eye patterns- Companding - correlation receiver.

UNIT 3 DIGITAL MODULATION TECHNIQUES

9 Hrs.

Introduction - ASK- FSK - PSK- coherent modulation techniques-BFSK-BPSK-signal space diagram-probability of error- Coherent Quadrature modulation techniques- QPSK-signal space diagram-probability of error- Non coherent modulation techniques- DPSK-M-ary modulation techniques - Vectorial view of MPSK.

UNIT 4 ERROR CONTROL CODING

9 Hrs.

Discrete memoryless channels – Linear block codes - Cyclic codes - Convolutional codes – Maximum likelihood decoding of convolutional codes-Viterbi Algorithm, Trellis coded Modulation, Turbo codes.

UNIT 5 SPREAD SPECTRUM MODULATION

9 Hrs.

Pseudo- noise sequences - a notion of spread spectrum - Direct sequence spread spectrum with coherent binary phase shift keying - Signal space Dimensionality and processing gain -Probability of error - Frequency –hop spread spectrum- Synchronization and its types.

Max. 45 Hrs.

COURSE OUTCOMES

On completion of the course, student will be able to

CO1 - Design PCM systems.

CO2 - Apply the knowledge of signals and system and evaluate the performance of digital communication system in the presence of noise.

CO3 - Design and implement band pass signaling schemes and analyze the spectral characteristics of band pass signaling schemes.

CO4 - Design encoder and decoder for the error control codes like block code, cyclic code.

CO5 - Analyze the digital communication system with spread spectrum modulation.

CO6 - Examine the theoretical concepts through laboratory experiments, analyze and interpret the results to provide valid conclusions.

TEXT/REFERENCE BOOKS

1. Simon Haykins, "Communication Systems" John Wiley, 5th Edition, March 2009.
2. Taub. HDL Schilling, G Saha, "Principles of Communication", 5th Edition, 2009.
3. John G. Proakis, Masoud Salehi, "Digital Communication", McGraw Hill, 5th Edition, 2007.
4. Bernard Sklar, "Digital Communication, Fundamentals and Application", Pearson Education Asia, 2nd Edition, 2009

END SEMESTER EXAMINATION QUESTION PAPER PATTERN

Max. Marks: 100

Exam Duration: 3 Hrs.

PART A: 10 Questions of 2 marks each – No choice

20 Marks.

PART B: 2 Questions from each unit of internal choice; each carrying 16 marks

80 Marks.

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Department of Electronics and Communication Engineering

SECA7025	NETWORK ORIENTED OS	L	T	P	Credits	Total Marks
		3	0	0	3	100

COURSE OBJECTIVES

- To introduce students to the state of the art in wireless sensor actuator networks.
- To provide hands on training in programming these networks and several applications such as environmental monitoring, perimeter security, structural control, asset tracking and personal health care systems.

UNIT 1 OVERVIEW OF IOT CONTIKI OS

9Hrs.

Internet of Things: current solutions and an outlook on future evolutions of current technologies - Basic introduction to Contiki OS: Basic operations, proto-threads, timers, event management

UNIT 2 COOJA SIMULATOR AND 6LOWPAN

9Hrs.

Introduction to the Cooja emulator. Introduction to 6LoWPAN. 6LoWPAN architecture: simple, extended and ad-hoc networks. Issues in determining IPv6 links in LLNs and illustration of the undetermined link addressing model-IPv6 addressing in 6LoWPAN. 6LoWPAN forwarding: route-over and mesh under approaches.

UNIT 3 ROUTING IN LOSSY NETWORK

9Hrs.

Routing in low power and Lossy networks: pros and cons of the mesh-under and route-over solutions.

UNIT 4 INTRODUCTION TO RPL

9Hrs.

Introduction to RPL: the IPv6 Routing Protocol for LLNs. RPL: multi-point to point routing with destination oriented directed acyclic graphs.

UNIT 5 RPL CONSTRAINT AND CONFIGURATION

9Hrs.

RPL instances, routing metrics and constraints. Introduce 6LBR. RPL protocol configuration in Contiki.- Overview of the general configuration parameters.

Max. 45Hrs.

COURSE OUTCOMES

On completion of the course, student will be able to

- CO1 - Identify suitable light weight operating system for a specific IoT based applications.
- CO2 - Apply right IoT communication stack for given application requirements.
- CO3 - Develop IoT applications using Contiki Operating System.
- CO4 - Design a Low power PAN and analyze its performance using Cooja emulator.
- CO5 - Analyze the performance of various routing protocols for low power and lossy wireless sensor networks.
- CO6 - Evaluate the performance metrics of LoWPAN and MicroIP stack using an IoT operating system.

TEXT / REFERENCE BOOKS

1. Tanenbaum, "Computer Networks", PHI, 5th Edition, 2015. Andrew S.
2. Daniel Minoli, Taieb Znati, "Wireless Sensor Network", Wiley, 1st Edition, 2007. Kazem Sohraby,
3. C. Siva Ram Murthy and B. S. Manoj, "AdHoc Wireless Networks: Architectures and Protocols", Prentice Hall, 1st Edition, 2004.
4. Andreas Willig, "Protocols and Architectures for Wireless Sensor Networks", Wiley, 1st Edition, 2007. Holger Karl and
5. Leonidas J. Guibas, "Wireless Sensor Networks: An Information Processing Approach", Morgan Kaufmann, 1st Edition, 2004. Feng Zhao and

END SEMESTER EXAMINATION QUESTION PAPER PATTERN

Max. Marks: 100
Hrs.

Exam Duration: 3

PART A: 5 Questions of 6 Marks each – No choice

30 Marks

PART B: 2 Questions from each unit of internal choice, each carrying 14 Marks

70 Marks

Sathyabama Institute of Science and Technology
Department of Electronics and Communication Engineering

SECA7025 (Revised)	NETWORK ORIENTED OS	L	T	P	Credits	Total Marks
		3	0	0	3	100

COURSE OBJECTIVES

- To introduce students to the state of the art in wireless sensor actuator networks.
- To provide hands on training in programming these networks and several applications such as environmental monitoring, perimeter security, structural control, asset tracking and personal health care systems.
- To introduce students to network oriented operating systems.

UNIT 1 OVERVIEW OF IOT CONTIKI OS

9Hrs.

Need for light weight operating systems for IoT - Open Source Operating Systems for IoT - Basic introduction to Contiki OS: Basic operations, proto-threads, timers, event management - Contiki Communication components: MicroIP, uIP6 and RIME, 6LoWPAN

UNIT 2 COOJA SIMULATOR AND 6LOWPAN

9Hrs.

Introduction to the Cooja emulator. Introduction to 6LoWPAN. 6LoWPAN architecture: simple, extended and ad-hoc networks. Issues in determining IPv6 links in LLNs and illustration of the undetermined link addressing model-IPv6 addressing in 6LoWPAN. 6LoWPAN forwarding: route-over and mesh under approaches.

UNIT 3 ROUTING IN LOSSY NETWORK

9Hrs.

Heterogeneous Traffic Networks - Routing in low power and Lossy networks: pros and cons of the mesh-under and route-over solutions.

UNIT 4 INTRODUCTION TO RPL

9Hrs.

Introduction to RPL: the IPv6 Routing Protocol for LLNs. RPL: multi-point to point routing with destination oriented directed acyclic graphs.

UNIT 5 RPL CONSTRAINT AND CONFIGURATION

9Hrs.

RPL instances, routing metrics and constraints. Introduce 6LBR. RPL protocol configuration in Contiki.- Overview of the general configuration parameters.

Max. 45Hrs.

COURSE OUTCOMES

On completion of the course, student will be able to

- CO1 - Identify suitable light weight operating system for a specific IoT based applications.
- CO2 - Apply right IoT communication stack for given application requirements.
- CO3 - Develop IoT applications using Contiki Operating System.
- CO4 - Design a Low power PAN and analyze its performance using Cooja emulator.
- CO5 - Analyze the performance of various routing protocols for low power and lossy wireless sensor networks.
- CO6 - Evaluate the performance metrics of LoWPAN and MicroIP stack using an IoT operating system.

TEXT / REFERENCE BOOKS

1. AgusKurniawan, " PracticalContiki-NG: Programming for Wireless Sensor Networks",Apress; 1st ed. Edition, 2018.
2. KazemSohraby, Daniel Minoli, Taieb Znati, "Wireless Sensor Network", Wiley, 1st Edition, 2007. ISBN:978-0-471-74300-2.
3. C.Siva Ram Murthy and B.S.Manoj "AdHocWirelessNetworks:ArchitecturesandProtocols", Prentice Hall, 1st Edition, 2004.
4. James F. Kurose and Keith W. Ross, "Computer Networking: A Top-Down Approach Featuring the Internet", Pearson Education, 6th Edition, 2016.
5. Holger Karl and Andreas Willig, "Protocols and Architectures for Wireless Sensor Networks", Wiley, 1st Edition, 2007.
6. Feng Zhao and Leonidas J. Guibas, "Wireless Sensor Networks: An Information Processing Approach", Morgan Kaufmann, 1st Edition, 2004.

Sathyabama Institute of Science and Technology

Department of Electronics and Communication Engineering
END SEMESTER EXAMINATION QUESTION PAPER PATTERN

Max. Marks: 100
Hrs.

Exam Duration: 3

PART A: 5 Questions of 6 Marks each – No choice

30 Marks

PART B: 2 Questions from each unit of internal choice, each carrying 14 Marks

70 Marks



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School of Electrical and Electronics Engineering

Minutes of Board of Studies Meeting held on 21st May, 2018

**(Venue: Conference Hall, IEC, Sathyabama Institute of Science and Technology,
Chennai 119)**

Time: 9.00 AM – 11.30 AM

In the beginning of the meeting Dr. N. M. Nandhitha, Dean, School of EEE welcomed all the members and briefed them about the progress of the Department. The BOS members expressed their highly appreciation and satisfaction about the courses and activities of the Department. After that the BOS discussed and resolved the following items:

The Agenda for the meeting was as follows:

- Discussions were held on course structure and course outcomes.
- New & Revised Syllabus
- Inclusion of branch specific and new elective subjects
- Bringing down the overall credits to 180.
- Dr M D Selvaraj. Professor, IIITDM accepted the changes suggested by Dr T.Ravi in the subject 'Programming in HDL'. Dr.Sivakumaran, Prof., NIT, Trichy suggested to include Modeling a test bench, timing and delays , Switch level modeling.
- Dr.S.Lakshmi suggested the change in 'Optical Communication'. Dr.sivakumaran accepted the change.
- The new courses introduced are RF and Microwave Engineering, Data communication and networking, Satellite Communications and Project Work (Phase - II).
- Dr.T.Ravi also presented the new course introduced for PG courses are RTOS Programming, Cloud Computing, High Performance Computing, Advanced Digital Image Processing , Big Data Technologies, RTOS Programming lab.
- The Syllabus Revision carried out in PG courses is VLSI circuit Design for Imaging Applications.
- Dr.Selvaraj suggested specific mentioning should be made in the curriculum with regard to:



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- a) Program outcomes
- b) Program specific outcomes
- c) Course objectives
- d) Course outcomes
- Dr.Ramadevi suggested the inclusion of Field and HART protocol in 'Logic and Distributed Control system'. Dr.sivakumaran accepted the change.
- Dr.V.Sivachidambaranathan, Prof.& Head, Dept. of Electrical and Electronics Engineering requested Dr.Sundarsingh, Faculty/EEE to present the curriculum revisions before the board for the subject Power System Protection and Switch gear and High Voltage Engineering.
- Dr.V.Sivachidambaranathan, Prof.& Head, Dept. of Electrical and Electronics Engineering requested Dr.Rameshbabu, Faculty/EEE to present the curriculum revisions for the subject Analysis of Inverters before the board.
- They presented the old and new syllabus before the board and discussed the valid additions made in the syllabus.
- Dr.V.Sivachidambaranathan put forth the syllabus of the new courses, 'Industrial Instrumentation and Automation' for the approval of the board. Dr. A.Amalin Prince approved the Syllabus for this new course.

The next BOS meeting may be scheduled on Oct 2018 to review and finalize the syllabus revision process.



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The following internal and external members were present in the meeting.

INTERNAL MEMBERS

SIGNATURE

1. Dr.N.M.Nandhitha

2. Dr.S.Lakshmi

3. Dr.V.Vijaya Baskar

4. Dr.V.Sivachidambaranathan

5. Dr.T.Ravi

6. Dr. P. Kavipriya

7. Dr.P.Chitra

8. Dr.S.Karthikeyan

9. Mrs.K.Srilatha

10. Dr.V.Balamurugan

11. Mrs.L.Magthelin Therase

12. Mrs.I.Rexiline Sheeba

13. Dr.Ramadevi

14. Mrs.K.Sujatha

15. Dr.Susitra



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External members

Dr.N.Shivakumaran

Professor,
Dept. of I & C
NIT, Trichy

PS
21/5/18

Dr.M.D.Selvaraj,
Associate Professor,
IIITDM, kancheepuram

Selvaraj
21/5/18



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School of Electrical and Electronics Engineering
Minutes of Board of Studies Meeting held on 16th NOV, 2018
Venue: Conference Hall, IEC

Date: 16-11-18

Time: 9.00 AM – 11.30 AM

- Dr. N. M. Nandhitha, Dean, School of EEE welcomed all members of Board of Studies. On the suggestions of various Experts, the contents are designed by the Board of Studies Members considering the various aspects and need of the society. The members appreciated the contents of the syllabus and it was resolved as under:
- Course outcomes for each course has been discussed and modified.
- Dr.T.Ravi put forth the introduction of new courses 'Advanced Microprocessors', 'Automatic Speech recognition', Pattern Recognition and Image Vision' and 'Advanced Electronic Test Engineering'.
- Dr M D Selvaraj. Professor, IIITDM suggested that RF and Microwave Engineering can be renamed as RF Engineering in VIII semester.
- Dr.Sivakumaran, Prof., NIT, Trichy suggested to have Optical Fibre Communication in VII semester can be replaced with visible light communication. Microprocessor Interfacing and its Applications can be modified as Microprocessor and Microcontrollers.
- Dr.Sivakumaran suggested that subject name can be changed from "Control Engineering" to "Modern Control Systems". The members Dr M D Selvaraj advised to revise the fifth unit of Electronic Devices syllabus.
- Dr.T.Ravi also presented the new course introduced for PG courses are AI and Soft Computing, Network Oriented OS, Scada Systems Applications. The Syllabus Revision carried out in PG courses is Computational Nanoelectronics.
- Dr.V.Sivachidambaranathan requested Dr.Susitra to put forth the syllabus of the new courses, 'Testing and Commissioning of Electrical Equipment' for the approval of the board. Dr. A.Amalin Prince approved the Syllabus for this new course.
- Dr.N.M Nandhitha putforth to revise the syllabus of B.E by incorporating the following



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Develop curricula with relevance to:

- Local needs
- National needs
- Regional needs
- Global needs

Develop existing courses with focus on:

- Employability
- Entrepreneurship
- Skill development.
- Note: If any collaboration is made with any organizations to facilitate the courses, MoU's should be signed with them.

Develop existing courses with focus on:

- Gender
- Environment and Sustainability
- Human Values and Professional Ethics.
- Introduce either Field Projects/research projects or Internships at the end of second and fourth semesters.
- New elective courses namely Advanced microprocessor, Automatic Speech recognition, Pattern recognition and image vision, Advanced Electronic Test Engineering has been introduced.
- The Dean reported the members about the efforts of all the members of Board of Studies to prepare the syllabus of the subject B.E for the academic year 2018-19. The next BOS meeting may be scheduled on April 2019 to review and finalize the syllabus revision process. It was resolved as under, "Resolved that the Appreciation of Board of Studies members who contributed to prepare syllabus be noted." There being no other matter, the meeting was concluded with a vote of thanks .



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The following internal and external members were present in the meeting.

INTERNAL MEMBERS

SIGNATURE

1. Dr.N.M.Nandhitha

2. Dr.S.Lakshmi

3. Dr.T.Ravi

4. Dr.V.Sivachidambaranathan

5. Dr.V.Vijaya Baskar

6. Dr. P. Kavipriya

7. Dr.P.Chitra

8. Dr.S.Karthikeyan

9. Mrs.K.Srilatha

10. Dr. V.Balamurugan

11. Mrs.L.Magthelin Therase

12. Mrs.I. Rexiline Sheeba

13. Dr.Susitra

14. Dr.R.Ramadevi

15. Mrs. K.Sujatha



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EXTERNAL MEMBERS

Dr.N.Shivakumaran
Professor
Dept. of I & C
NIT, Trichy

Dr. N. Shivakumaran
16/11/18

Dr.M.D.Selvaraj,
Associate Professor,
IIITDM, kancheepuram

Dr. M. D. Selvaraj
16/11/18

DEPARTMENT OF ELECTRONICS AND COMMUNICATION ENGINEERING
SYLLABUS REVISION(2018-2019)

SL.NO	COURSE CODE	COURSE NAME
1.	SEC1402	Programing in HDL
2.	SEC1403	Optical Communications

SECX1023	PROGRAMMING IN HDL	L	T	P	Credits	Total Marks
		3	0	0	3	100

course objectives

1. To focus on the basic concept of VHDL and Verilog HDL
2. To Introduce the style of modeling in VHDL and Verilog HDL
3. To focus advanced features of Verilog HDL
4. To outline the formal procedures for testing and verification of HDL
5. To introduce the design of switch level modeling and high level architecture

UNIT I INTRODUCTION TO VHDL

10 hrs

Digital system design process – Levels of Abstraction – Language elements of VHDL- Operators-Data Types – Signal assignments – Inertial delay mechanism – Transport delay mechanism – Concurrent and Sequential assignments – Delta delay.

UNIT II STYLES OF MODELING

10 hrs

Process statement – Wait statement – If statement - Loop statement - Assertion statement – Data flow modeling– Concurrent Signal Assignment statement - Structural modeling – Examples – Component declaration – Component Instantiation – Generate statement – Guarded signals.

UNIT III ADVANCED FEATURES

10 hrs

Generics – Configurations – Configuration Specification – Configuration Declaration - Subprograms – Subprogram Overloading – Operator Overloading - Package declaration and package body – Design Libraries –State Machine Modeling – Moore FSM, Mealy FSM.

UNIT IV VERILOG HDL

10 hrs

Verilog as HDL – Levels for design description – Language elements – Data Types – Operators – Module structure – Gate primitives – Timing controls – Procedural and Conditional assignments – Data flow Modeling – Structural Modeling – examples.

UNIT V PROGRAMMING USING VERILOG

10 hrs

Realization of SM charts – Xilinx 3000 series FPGAs – Altera Complex Programmable Logic devices – Static RAM Memory – Interfacing Memory to a Microprocessor Bus – UART design – Design of Microcontroller CPU.

Course Outcomes

On completion of the course, student will be able to–

CO1	Interpret the basic logic designs.
CO2	Understanding the various modelling to interpret digital system design.
CO3	Analyze the synthesis report.
CO4	Built a RTL schematic and analyze the parameters.
CO5	Determine the performance of combinational and sequential circuits and evaluate the efficiency of Digital design in various applications.

TEXT/REFERENCE BOOKS:

1. J.Bhaskar ,“A VHDL primer”,3rd edition 2004, Prentice Hall of India Limited.
2. J.Bhaskar, “A Verilog HDL Primer”, 3rd edition 2004, Prentice Hall of India Limited.
3. Charles H,Roth ,“Digital system design using VHDL” , 2nd Edition, PWS publishing co., 2005.
4. ZainalabedinNavabi, “VHDL analysis and modeling of digital systems”, 2nd Edition, MGH, 2004.
5. Michael D.Ciletti, “Advanced Digital design with Verilog HDL”, 2nd Edition, PHI Ltd, 2005.
6. T.R.Padmanabhan&Bala Tripura sundari, “Design through Verilog HDL”, WSE2004 IEEE press.
7. Michael D.Ciletti “Advanced Digital design with Verilog HDL”, PHI, 2005.

END SEMESTER EXAM QUESTION PAPER PATTERN

Max. Marks : 80 Exam Duration : 3 hrs

PART A :2 Questions from each unit, each carrying 2 marks. No choice 20Marks

PART B :2 Questions from each unit with internal choice, each carrying 12 marks 60Marks

SEC1402	PROGRAMMING IN HDL (For ECE and EEE)	L	T	P	Credits	Total Marks
		3	0	0	3	100

UNIT1 BASIC CONCEPTS IN VHDL 9 hrs

Digital system design process - Hardware simulation - Introduction to VHDL - Language elements of VHDL - Data objects - Data types - Operators - Signal assignments - Inertial delay mechanism - Transport delay mechanism - Variable assignments - Concurrent and Sequential assignments - Delta delay.

UNIT2 MODELING IN VHDL 9 hrs

Data flow modeling - Concurrent Signal Assignment statements - Structural modeling - Component declaration - Component Instantiation - Behavioral modeling - Process statement - wait statement - Conditional and loop statements - Generics and configurations - **Examples for modeling.**

UNIT3 INTRODUCTION TO VERILOG HDL 9 hrs

Basic concepts - Levels for design description - Module - Delays - Language elements - **Compiler directives - value set - data types - Parameters - Expressions - Operands - operators in Verilog HDL.**

UNIT4 STYLES OF MODELING 9 hrs

Gate level modeling - Primitive Gates- Multiple input and multiple output gates - User Defined Primitives - Combination UDP - Sequential UDP- Data flow modeling - Behavioral modeling - procedural constructs - procedural assignments - conditional and loop statements - Structural Modeling - Examples for modeling.

UNIT5 FEATURES IN VERILOG HDL 9 hrs

Tasks- Functions -systems tasks and functions - Verification - **Modeling a test bench - timing and delays - Switch level modeling** - state machine modeling - Moore FSM – Melay FSM - **Design of memories** - Design of microcontroller CPUs.

Max. 45 hrs

COURSE OUTCOMES:

On completion of this course, students are able to

CO1	Identify the use of HDL language in constructing digital logic circuits
CO2	Analyze the combinational sequential logic circuit in gate and switch level modeling
CO3	Conceptualize the system through design and modeling various architectures
CO4	Develop any design based upon the system requirements for solving real time problems
CO5	Validate and Verify the system design
CO6	Design a test bench for any logic circuit

TEXT / REFERENCE BOOKS:

1. J.Bhaskar, "A VHDL Primer", Pearson. 3rd edition, 2013
2. Douglas L. Perry, "VHDL Programming by Example", McGraw Hill, 4th edition, 2012
3. J.Bhaskar, "A Verilog HDL Primer", Star Galaxy Publishing. 3rd edition, 2011
4. Stephen Brown, "Fundamental of Digital logic with VHDL Design", Tata McGraw Hill, 3rd edition, 2012

END SEMESTER EXAMINATION QUESTION PAPER PATTERN

Max. Marks: 100

Exam

Duration: 3 hrs

Part A: 10 questions of 2 marks each -No choice

20 Marks

Part B: 5 questions from each unit with internal choice, each carrying 16 marks

80 Marks

SECX1038 (old)	OPTICAL COMMUNICATION (Common to ECE,ETCE)	L	T	P	Credits	Total Marks
		3	0	0	3	100

UNIT I INTRODUCTION

10 hrs.

Introduction to vector nature of light, propagation of light, propagation of light in a cylindrical dielectric rod. Rays and Modes. Different types of optical fibers, Modal analysis of a step index fiber, Linearly Polarized Modes, Singlemode fibers and Graded- Index Fiber.

UNIT II SIGNAL DEGRADATION AND OPTICAL SOURCES

10 hrs.

Attenuation- Absorption, Scattering Losses, Bending Losses, Core and Cladding Losses. Signal distortion in Optical waveguides- Material Dispersion, Waveguide Dispersion. Optical sources - Semiconductor Device Fabrication, LED and LASER diode - Principles of operation, concepts of line width, phase noise, switching and modulation characteristics.

UNIT III OPTICAL DETECTORS

10 hrs.

Optical detectors – pn detector, pin detector, avalanche photodiode - Principles of operation, concepts of responsivity, sensitivity and quantum efficiency, noise in detection. Multichannel Transmission Technique- Multichannel Frequency Modulation, Subcarrier multiplexing. WDM Concepts and Components.

UNIT IV OPTICAL AMPLIFIERS

10 hrs.

Basic concepts, semiconductor amplifier, Erbium-Doped Fiber Amplifier, Raman amplifier, Brillouin amplifier - principles of operation, amplifier noise, signal to noise ratio, gain, gain bandwidth, gain and noise dependencies, intermodulation effects, saturation induced crosstalk, wavelength range of operation.

UNIT V OPTICAL NETWORKS AND DISPERSION COMPENSATION

10 hrs.

Optical networks: SONET/SDH, ATM, IP, Wavelength routed networks, soliton communication system, fiber soliton, Soliton based communication system design, High capacity and WDM soliton system. Limitations, Post and Precompensation techniques, Equalizing filters, fiber based gratings, Broad band compensation - applications.

Course Outcomes

On completion of the course, student will be able to–

C01	Recall the basic optical laws and recognizing the types of optical fiber cables. Identifying the signal impairments in optical systems
C02	Exemplify the characteristics of optical sources and detectors. Summarize the conversion of light energy into electrical energy and vice versa.
C03	Implementing the transmission techniques and concepts in designing electrical engineering problems

Color red indicates the deleted portion. Color yellow indicates the added portion

C04	Select an appropriate amplifier by critically evaluating its noise parameters
C05	Create the opportunity to design optical communication system for industrial applications

TEXT BOOKS:

1. Keiser. G, "Optical fiber communications", 4th Edition Tata McGraw-Hill, New Delhi, 2008.
2. Agrawal. G.P, "Fiber-Optic Communication Systems" 3rd Edition John Wiley & Sons, 2002.

REFERENCE BOOKS:

1. John Gowar, "Optical Communication Systems", 2nd Edition Prentice Hall, 1993.
2. Franz & Jain, "Optical communication, Systems and Components", Narosa Publications, New Delhi, 2000.
3. Karminvov & T. Li "Optical Fibre Telecommunications", Vol A & B, Academic Press, 2002.

SEC1403 (Revised)	OPTICAL COMMUNICATION (Common to ECE,ETCE)	L	T	P	Credits	Total Marks
		3	0	0		

UNIT1 INTRODUCTION TO OPTICAL FIBERS

9 hrs

Basics of optical communication system, light propagation in optical fibers, Optical spectral bands, Advantages of optical fiber communication over other communication systems, Ray theory and mode theory. Total internal reflection, Acceptance angle, Numerical aperture, phase and group velocity, cutoff wavelength and group delay. Different types of optical fibers, refractive index profiles & mode transmission

UNIT2 TRANSMISSION CHARACTERISTICS AND OPTICAL AMPLIFIER

9 hrs

Characteristics of optical fibers: Attenuation due to absorption, scattering & bending, core and cladding losses, Signal Distortion in optical fibers: Intra modal Dispersion: Material & Waveguide dispersion; Intermodal dispersion: MMSE, MMGI & modal noise Optical Amplifiers: Basic concepts, Erbium-Doped Fiber Amplifier, Raman amplifier -principles of operation, amplifier noise, signal to noise ratio, gain, gain bandwidth, intermodulation effects and wavelength range of operation

UNIT3 OPTICAL TRANSMITTERS AND RECEIVERS

9 hrs

Fiber optic Transmitter module, Optical sources- LEDs, LASER diodes- Principles of operation: concepts of line width, phase noise. Optical detectors- PN, P-I-N, Avalanche photodiodes: Principles of operation: concepts of responsivity, sensitivity and quantum efficiency, noise in detection. Fiber optic receiver module

UNIT4 COUPLERS, CONNECTORS AND OPTICAL LINK

9 hrs

Couplers: 2x2 coupler, Tap coupler, star coupler, Connectors: Cylindrical ferrule, Biconical Ferrule, Double eccentric, Splices: Fusion splices, Mechanical splices, Multiple splices. Design considerations in optical links, Point to point Links: Link Power budget, Rise Time budget, Analog Links: CNR, Multichannel transmission techniques-Multichannel Frequency Modulation, Subcarrier multiplexing. WDM Concepts and Components

UNIT5 OPTICAL NETWORKING PRINCIPLES AND APPLICATIONS

9 hrs

FDDI, WDM, SONET/SDH, ATM, IP over WDM, Optical LAN Standards-IEEE802.3, Broad band and select WDM networks, Applications- Military

Max. 45

COURSE OUTCOMES:

On completion of this course, students are able to

CO1	Illustrate the basics of optical fiber cables
CO2	Describe the attenuation and dispersion characteristics in optical systems and comprehend the types of optical amplifiers
CO3	Distinguish the sources and detectors for real-time applications
CO4	Design optical communication system based on link budget
CO5	Evaluate the capacity of the systems using different networking techniques
CO6	Develop fiber distributed services for military application

TEXT / REFERENCE BOOKS:

1. Gerd Kaiser, "Optical Fiber Communications", 4th edition, Sixth reprint, Tata McGraw Hill, New Delhi, 2009
2. John M. Senior, "Optical Fiber Communications- Principles And Practice", Third Edition, Pearson Education, 2010
3. Gerd Keiser, "Optical communications Essentials", Tata Mc Graw Hill, Special Indian Edition, 2009
4. Govind P Agrawal, "Fiber-Optic Communication Systems", John Wiley & Sons, Third Edition, 2011
5. Ivan P. Kaminow, Casimer DeCusatis, "The Optical Communications Reference", Academic Press, 1st edition, 2009



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DEPARTMENT OF ELECTRONICS AND COMMUNICATION ENGINEERING

Minutes of BOS meeting

DATE: 05.04.2017

TIME: 10AM TO 12.30PM

VENUE: VLSI LAB

- Dr.E.Logashanmugam, Faculty Head of school of electrical and electronics greeted all the members of the board. Dr.G.Sundari, Professor and Head of the ECE department welcomed the external and internal members of the board of studies. The guidelines of the syllabus given by the management were explained by HOD to all the members of the BOS. The external members also ratified the decision to revise the syllabus under the mentioned guidelines. The HODs of ECE, EEE, E&I, E&C and ETCE under the Faculty of Electrical and Electronics, Staff members from the faculty attended the meeting to have an effective interaction with the members as and when required.
- Dr.G.Sundari, Prof. & Head Department of Electronics and Communication started the meeting by welcoming both the external and the internal numbers to the Board of Studies meeting. The guidelines of the syllabus given by the management were explained by HOD to all the members of the BOS. The external members also ratified the decision to revise the syllabus under the mentioned guidelines.
- Dr.T.Ravi, proposed syllabus revision in 'Nano Electronics' Dr.M. Madhavi Latha, Professor, JNTU College of Engineering, Hyderabad accepted the changes.
- Dr.P.Chitra suggested the inclusion of topic synchronization in 'Digital Communication' subject. Dr.Ram Bilas Pachori, Professor, IIT Indore suggested to add the topics such as Tracking and acquisition, application of spread spectrum techniques and types of sampling.
- Dr. M. Madhavi Latha accepted the changes incorporated in the subject 'Advanced Electronic Test Engineering' suggested by Dr.P.kavipriya. The new courses introduced are Computer Architecture and operating systems, Professional Training-2 and Project Work (Phase 1).
- Dr.T.Ravi also presented the new course introduced for PG courses are Pervasive Computing, Fundamentals of IoT, Microcontrollers, Network Programming, Design of Embedded Systems, Advanced Digital Signal Processing and Microcontrollers and IoT Lab. The Syllabus Revision carried out in PG courses is RF Circuit Design and MEMS technology
- Dr.Sivakumaran accepted the changes made in the subject 'Discrete Electronic circuits' by adding the oscillators as suggested by Mrs. Sujatha.



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- Dr.V.Sivachidambaranathan, Prof.& Head, Dept. of Electrical and Electronics Engineering requested Dr.Sundarsingh, Faculty/EEE to present the curriculum revisions before the board.
- He presented the old and new syllabus for Power System Analysis before the board and discussed the valid additions made in the syllabus.
- Dr.V.Sivachidambaranathan put forth the syllabus of the new courses, 'Electrical Power Quality' for the approval of the board. Dr. A.Amalin Prince approved the Syllabus for this new course.

The next BOS meeting may be scheduled on Oct 2017 to review and finalize the syllabus revision process.

The following internal and external members were present in the meeting.

INTERNAL MEMBERS	SIGNATURE
1. Dr.E.Logashanmugam	
2. Dr.G.Sundari	
3. Dr.N.M.Nandhitha	
4. Dr.V.Sivachidambaranathan	
5. Dr.V.Vijaya Baskar	
6. Dr.S.Lakshmi	
7. Dr.T.Ravi	
8. Dr.V.G.Sivakumar	
9. Dr. P. Kavipriya	
10. Dr.P.Chitra	



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11. Dr.S.Karthikeyan

[Signature]

12. Ms.K.Srilatha

13. Dr.R.Ramadevi

R. Ramadevi

14. Mrs.K.Sujatha

15. Dr.Susitra

[Signature]

EXTERNAL MEMBERS

Dr. M. Madhavi Latha
Professor, JNTU College of Engineering
Hyderabad

MML
5/4/17

Dr.Ram Bilas Pachori
Professor, IIT Indore

[Signature]
5/4/17

Dr.Sivakumaran,
Professor, NIT, Thiruchirapaali

[Signature]
5/4/17



SATHYABAMA UNIVERSITY

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Declared as Category 'A' University by MHRD, Govt. of India

Jeppiaar Nagar, Rajiv Gandhi Salai, Chennai – 600 119, Tamil Nadu. India..



DEPARTMENT OF ELECTRONICS AND COMMUNICATION ENGINEERING

Minutes of BOS meeting

DATE: 03.10. 2017

TIME: 10AM TO 12.30PM

VENUE: VLSI LAB

- Dr.N.M.Nandhitha ,Dean and Head, School of Electrical and Electronics Engineering greeted all the internal members of the board of studies. The HODs of ECE, EEE, E&I, E&C and ETCE under the Faculty of Electrical and Electronics, Staff members from the faculty attended the meeting to have an effective interaction with the members as and when required.
- Dr.T.Ravi, proposed syllabus revision in 'MEMS and its applications. Dr.M. Madhavi Latha, Professor, JNTU College of Engineering, Hyderabad accepted the changes. Dr.S.Karthikeyan presented the changes made in 'Pattern Recognition and Image vision'. Dr.Ram Bilas Pachori, Professor, IIT Indore accepted the changes.
- Dr.P.Chitra suggested the inclusion of topic synchronization in 'Digital Signal processing' subject. Dr.Ram Bilas Pachori, Professor, IIT Indore suggested to add the topics such as Applications of Multirate signal processing, Speech compression, Adaptive filter, Musical sound processing.
- Dr S Lakshmi, proposed syllabus revision in 'Analog integrated circuit'. Dr.M. Madhavi Latha, Professor, JNTU College of Engineering, Hyderabad accepted the changes. The new courses introduced are Telecommunication Systems and Services, Microprocessors and Microcontrollers and Embedded Systems.
- Dr.T.Ravi also presented the new course introduced for PG courses are Software Modeling For Embedded System, Wireless Sensor Networks for IoT, Embedded OS and Device Drivers, Embedded OS and device drivers lab, Industry 4.0, and Mobile Application Development. The Syllabus Revision carried out in PG courses is Robotics and Computer Vision.
- Dr.R.Ramadevi proposed the introduction of new subject 'Soft Computing techniques'. Dr.Sivakumaran suggested to add an unit on Genetic algorithm.



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- Dr.V.Sivachidambaranathan, Prof.& Head, Dept. of Electrical and Electronics Engineering requested Dr.Radhika.S, Faculty/EEE to put forth the feedback collected from Staff and 2014 – 2016 Batch Students and requested the board members to approve for the shift in the course titled “Digital Signal Processing & its Applications” (SEC1315) to Semester 6 in 2015 Regulations. With respect to this change the course titled “Principles of Embedded System” (SEC1317) is suggested to shift to Semester 7 in 2015 Regulations.
- Dr.V.Sivachidambaranathan, presented the old and new syllabus for Special Electrical Machines and Power Generation and Utilization before the board and discussed the valid additions made in the syllabus.
- Dr. V. Sivachidambaranathan requested Dr.Vanitha, Faculty /EEE to present the syllabus of the new course, ‘Energy Storage Systems’ for the approval of the board. Dr. A.Amalin Prince approved the Syllabus for this new course.

The next BOS meeting may be scheduled on April 2018 to review and finalize the syllabus revision process.

The following internal members were present in the meeting.

INTERNAL MEMBERS

SIGNATURE

1. Dr.N.M.Nandhitha
2. Dr.V.Sivachidambaranathan
3. Dr.V.Vijaya Baskar
4. Dr.S.Lakshmi
5. Dr.T.Ravi
6. Dr.V.G.Sivakumar
7. Dr. P. Kavipriya



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8. Dr.P.Chitra

P. Chitra

9. Dr.S.Karthikeyan

S. Karthikeyan

10. Mrs.K.Srilatha

K. Srilatha

11. Mrs.L.Magthelin Therase

L. Magthelin Therase

12. Mrs.I.Rexiline Sheeba

I. Rexiline Sheeba

13. Dr.Susitra

Susitra

14. Dr.Ramadevi

R. Ramadevi

15. Mrs. Sujatha

S. Sujatha

EXTERNAL MEMBERS

Dr. M. Madhavi Latha

Professor

JNTU College of Engineering

Hyderabad

MML
30/10/17

Dr.Ram Bilas Pachori

Professor, IIT Indore

R. Pachori
31/10/17

Dr.Sivakumaran,

Professor, NIIT, Thiruchirappalli

S. Sivakumaran
30/10/17

DEPARTMENT OF ELECTRONICS AND COMMUNICATION ENGINEERING

SYLLABUS REVISION (2017-2018)

SL.NO	COURSE CODE	COURSE NAME
1.	SECX1069	NANO ELECTRONICS
2.	SECX1070	ADVANCED ELECTRONIC TEST ENGINEERING
3.	SEC1313	DIGITAL COMMUNICATIONS
4.	SEC1612	MEMS AND ITS APPLICATIONS
5.	SECX1071	PATTERN RECOGNITION AND IMAGE VISION
6.	SEC1314	DIGITAL SIGNAL PROCESSING
7.	SEC1302	ANALOG INTEGRATED CIRCUITS

SECX1020 (old)	NANO ELECTRONICS (Common to EEE, BIO-MED, EIE, E&C, CSE, IT, EEE)	L	T	P	Credits	Total Marks
		3	0	0	3	100

UNIT I CONCEPTS OF NANOSTRUCTURES

10 hrs.

Moore's Law, Wave functions, wave packets, Schrodinger's wave equation, potential barriers and tunneling, FermiDirac statistics, Density of states, Limitations of conventional FET in nanoscales, Electronic states in crystal energy bands, Concepts of 2D nanostructures (quantum wells), 1 D nanostructures (quantum wires) OD nanostructures (quantum dots), artificial atomic clusters.

UNIT II PROPERTIES AND ANALYSIS OF NANOSTRUCTURES

10 hrs.

Size dependent properties, Size dependent absorption spectra, Blue shift with smaller sizes, Phonons in nanostructures, Contacts at Nano level, AFM.ISTM tip on a surface

UNIT III ANALYSIS OF QUANTUM TECHNIQUES

10 hrs.

Charging of quantum dots, Coulomb blockade, Quantum mechanical treatment of quantum wells, wires and dots, Widening of bandgap in quantum dots, Strong and weak confinement, Properties of coupled quantum dots, Optical scattering from Nan defects.

UNIT IV CHARACTERISTICS OF NANOCOMPOSITES AND ZEOLITES

10 hrs.

Nanocomposites Electronic and atomic structure of aggregates and nanoparticles Theory and modeling of nanoparticles fictionalization processes.

UNIT V CHARACTERIZATION OF NANOPOLYMERS

10

hrs.

Nano systems: Synthesis and characterization Methods of Synthesis: Molecular beam epitaxy, MOCVD, chemical routes, nanoparticles on polymers, pulsed laser deposition, ion beam assisted techniques including embedded nanoparticles, RF sputtering.

Course Outcome

C01	Explain the evolution and basics of Nanostructures like 1d and 2d concepts
C02	Classify the properties and analysis of Nanostructures based on size to surface
C03	Appraise the analysis of quantum techniques on quantum dots
C04	Assemble the theory and modelling of nanocomposites and Zeolites
C05	Analyse the characterization of nanopolymers with different techniques

TEXT BOOK:

1. K.Bamam and D.Vvedensky, Low Dimensional Semiconductor Structures, (Cambridge University Book) 2001.

REFERENCE BOOKS:

1. L.Banyai and S.W.Koch ,Semiconductor Quantum Dots, (World Scientific) 1993, <http://www.nanotec.org.uk/workshop/october03/health.htm>(for health and safety aspects of nanostructures)
2. J.H. Davies, An introduction to the physics-of low dimensional semiconductors, Cambridge Press, 1998.
3. Karl Goser, Peter Glosekotter, Jan Dienstuhl Nanoelectronics and Nanosystems , Springer, 2004
4. Krause P. C. and Wasynczuk O., Electromechanical Motion Devices, McGraw-Hill, New York, 1989.Lyshevski S. E., Electromechanical Systems, Electric Machines, andApplied Mechatronics, CRC Press, FL, 1999.
5. Lyshevski S. E., "Integrated control of microactuators and integrated circuits: a new turning approach in MEMS technology," Proceedings Conference Decision and Control, Phoenix, AZ, pp. 2611-2616, 1999.

SECX106 9	NANO ELECTRONICS (Common to EEE, BIO-MED, EIE, E&C, CSE, IT, EEE)	L	T	P	Credits	Total Marks
		3	0	0	3	100

UNIT I CONCEPTS OF NANOSTRUCTURES

10 hrs.

Moore's Law, Wave functions, wave packets, Schrodinger's wave equation, potential barriers and tunneling, FermiDirac statistics, Density of states, Limitations of conventional FET in nanoscales, Electronic states in crystal energy bands, Concepts of 2D nanostructures (quantum wells), 1 D nanostructures (quantum wires) OD nanostructures (quantum dots), artificial atomic clusters.

UNIT II PROPERTIES AND ANALYSIS OF NANOSTRUCTURES

10 hrs.

Size dependent properties, Size dependent absorption spectra, Blue shift with smaller sizes, Phonons in nanostructures, Contacts at Nano level, AFM. ISTM tip on a surface, Digital and Switching abstraction, Quantum Cellular Automata (QCA), Realization of logic gates using QCA

UNIT III ANALYSIS OF QUANTUM TECHNIQUES

10 hrs.

Quantum wires and dots, Widening of bandgap in quantum dots, Strong and weak confinement, Properties of coupled quantum dots, Optical scattering from Nan defects.

UNIT IV CHARACTERISTICS OF NANOCOMPOSITES AND ZEOLITES

10 hrs.

Nanocomposites Electronic and atomic structure of aggregates and nanoparticles Theory and modeling of nanoparticles fictionalization processes.

UNIT V NANOSCALE MEMORY DEVICES

10 hrs.

Semiconductor memory devices-SRAM-Single electron memory and its circuits-Ferroelectric Random access memory and its circuits –Non-volatile memory-Memristor based memory and its properties.

Course Outcome

C01	Explain the evolution and basics of Nanostructures like 1d and 2d concepts
C02	Classify the properties and analysis of Nanostructures based on size to surface
C03	Appraise the analysis of quantum techniques on quantum dots
C04	Assemble the theory and modelling of nanocomposites and Zeolites
C05	Analyse nanoscale memory devices

TEXT BOOK:

1. K.Bamam and D.Vvedensky, Low Dimensional Semiconductor Structures, (Cambridge University Book) 2001.

REFERENCE BOOKS:

1. L.Banyai and S.W.Koch ,Semiconductor Quantum Dots, (World Scientific) 1993,
<http://www.nanotec.org.uk/workshop/october03/health.htm>(for health and safety aspects of nanostructures)
2. J.H. Davies, An introduction to the physics-of low dimensional semiconductors, Cambridge Press, 1998.
3. Karl Goser, Peter Glosekotter, Jan Dienstuhl Nanoelectronics and Nanosystems , Springer, 2004
4. Krause P. C. and Wasynczuk O., Electromechanical Motion Devices, McGraw-Hill, New York, 1989.Lyshevski S. E., Electromechanical Systems, Electric Machines, andApplied Mechatronics, CRC Press, FL, 1999.
5. Lyshevski S. E., "Integrated control of microactuators and integrated circuits: a new turning approach in MEMS technology," Proceedings Conference Decision and Control, Phoenix, AZ, pp. 2611-2616, 1999.

		L	T	P	Credits	Total Marks
SECX1042 (old)	ADVANCED ELECTRONIC TEST ENGINEERING	3	0	0	3	100

UNIT I INTRODUCTION TO PCB TECHNOLOGY

10 hrs.

Printed Circuit Boards(PCB)- Construction – Types of PCB- Multilayer – Surface Mount technology – PCB Manufacturing process – PCB Inspection methods – Bare Board Testing – Optical and X – ray Inspection – Electrical tests – Text fixtures – Bed of nails fixtures – Cross talk test – Mock up test – In circuit test – burn in test – Fault diagnostic methods. Electromagnetic compatibility testing of electronic components, subassemblies, Measuring Instruments and systems

UNIT II PCB TROUBLE SHOOTING PROCESS

10 hrs.

Symptom Recognition – Bracketing Technique – Component failure Analysis – Fault types and causes in circuits – during manufacturing – Manual trouble shooting technique – Tools and Instruments DMM – CRO – PCO – Logic probes – Logic pulsar – Logic Analyzer.

UNIT III AUTOMATED TROUBLE SHOOTING TECHNIQUES

10 hrs. ATE Techniques – CPU Emulator technique – ROM and ROM Emulators – In circuit Comparator – In Circuit Functional test – Trouble shooting digital gates – Testing Linear Integrated Circuits – Guarding Technique – VI trace Technique – Bus Cycle Signature System – Board functional test methods – Boundary scan test basics

UNIT IV ATE SYSTEM ARCHITECTURE

10 hrs.

ATE System Components – Digital Pin Electronics – Drive data formats – Digital High way – Analog Highway – Test Vector Generation – Creating test patterns – Fault Simulations.

UNIT V DESIGN FOR TESTABILITY (DFT)

10 hrs.

MDA test systems – Boundary scan test with I/O pin compatibility – Automatic optical inspection systems – Combinational ATE Systems – Design for testability – Observability and Controllability – Testing Flow diagram – Stuck at fault model – Fault simulation – Ad Hoc technique – Scan design technique – Basics of ATPG – BIST-Test pattern generation for built in self test - Exhaustive pattern generation and deterministic testing – Output response Analysis – Transition count syndrome checking – Signature Analysis – Circular BIST.

COURSE OUTCOMES

On completion of the course, student will be able to–

C01	Identify various types of printed circuit boards and effectively use testing tools.
C02	Describe the working of automated test equipments.
C03	Identify faults in assembled PCBs using automated test equipments both at component level and board level.
C04	Design board fixtures to carry out customized board level testing.
C05	Develop test vectors and test patterns for fault identification in custom PCBs.

TEXT BOOKS:

1. Michael L.Bushnell et al., Essentials of Electronic testing for digital, memory and mixed signal VLSI circuit, 1st edition, Academic Press, 2002.
2. Randall L Geiger, Phillip E Allen, VLSI design techniques for analog and digital circuits, MGH, 1990.

REFERENCE BOOKS:

1. Parag.K.lala, Digital circuit Testing and Testability, 1st edition, Academic press, 2001.
2. Alfred L.Crouch, Design for test for Digital ICs and Embedded core systems, 2nd edition, PHI, 1999.
3. Sabapathy S.R., Test Engineering for electronic hardware, Qmax publishers, 1st Edition, 2007.

SECX1070 (revised)	ADVANCED ELECTRONIC TEST ENGINEERING	L	T	P	Credits	Total Marks
		3	0	0	3	100

UNIT I INTRODUCTION TO PCB TECHNOLOGY

10 hrs.

Printed Circuit Boards(PCB)- Construction – Types of PCB- Multilayer – Surface Mount technology – PCB Manufacturing process – PCB Inspection methods – Bare Board Testing – Optical and X – ray Inspection – Electrical tests – Test fixtures – Bed of nails fixtures – Cross talk test – Mock up test – In circuit test – burn in test – Fault diagnostic methods. Electromagnetic compatibility testing of electronic components, subassemblies, Measuring Instruments and systems. Plated through Hole Technology - Surface Mount Technology (SMT) – Ball Grid Array (BGA) Technology – PCB Bare board manufacturing process – Bare board testing– PCB Inspection methods – Visual, Optical and X-ray Inspection systems– Electrical tests in PCBs

UNIT II PCB TROUBLE SHOOTING PROCESS

10 hrs.

Symptom Recognition – Bracketing Technique – Component failure Analysis – Fault types and causes in circuits – during manufacturing – Manual trouble shooting technique – Tools and Instruments DMM – CRO – PCO – Logic probes – Logic pulsar – Logic Analyzer. PCB assembly troubleshoot – locating faults & Manual troubleshoot – Online & Offline troubleshoot – Fault types and causes in circuits

UNIT III AUTOMATED TROUBLE SHOOTING TECHNIQUES

10 hrs.

ATE Techniques – CPU Emulator technique – ROM and ROM Emulators – In circuit Comparator – In Circuit Functional test – Trouble shooting digital gates – Testing Linear Integrated Circuits – Guarding Technique – VI trace Technique – Bus Cycle Signature System – Board functional test methods – Boundary scan test basics- signature analysis – Board Functional Testing Techniques External Instrumentation in Automated Testing – PCB diagnostic testers – Diagnostic Testing technique.

UNIT IV ATE SYSTEM ARCHITECTURE

10 hrs. ATE System Components – Digital Pin Electronics – Drive data formats – Digital Highway – Analog Highway – Test Vector Generation – Creating test patterns – Fault Simulations. Automated Test Techniques – Various parameters – AC – DC Parametric testing– QA testing– Identify and troubleshoot the failures of parameters– Environmental, Electrical Standards & Requirements for IC testing – In-circuit Testing methodologies – Back Driving – functional test– Digital, Analog and Mixed Signal ICs – Bed of Nails Fixtures – Card Edge Test Fixtures – Reverse Engg to rebuild the Schematic Diagram using ATE and Software.

UNIT V DESIGN FOR TESTABILITY (DFT)

10 hrs.

MDA test systems – Boundary scan test with I/O pin compatibility – Automatic optical inspection systems – Combinational ATE Systems – Design for testability – Observability and Controllability – Testing Flow diagram – Stuck at fault model – Fault simulation – Ad Hoc technique – Scan design technique – Basics of ATPG – BIST-Test pattern generation for built in self test - Exhaustive pattern generation and deterministic testing – Output response Analysis – Transition count syndrome checking – Signature Analysis – Circular BIST. Design for manufacturability (DFM) - Manufacturing phases in industry oriented Production process – strategies – new strategy for DFM – benefits of new strategies – ATE for manufacturing – Various applications.

COURSE OUTCOMES

On completion of the course, student will be able to–

CO1	Identify various types of printed circuit boards and effectively use testing tools.
CO2	Describe the working of automated test equipments.
CO3	Identify faults in assembled PCBs using automated test equipments both at component level and board level.
CO4	Design board fixtures to carry out customized board level testing.
CO5	Develop test vectors and test patterns for fault identification in custom PCBs.

TEXT BOOKS:

1. Michael L.Bushnell et al., Essentials of Electronic testing for digital, memory and mixed signal VLSI circuit, 1st edition, Academic Press, 2002.
2. Randall L Geiger, Phillip E Allen, VLSI design techniques for analog and digital circuits, MGH, 1990.

REFERENCE BOOKS:

1. Parag.K.lala, Digital circuit Testing and Testability, 1st edition, Academic press, 2001.
2. Alfred L.Crouch, Design for test for Digital ICs and Embedded core systems, 2nd edition, PHI, 1999.
3. Sabapathy S.R., Test Engineering for electronic hardware, Qmax publishers, 1st Edition, 2007.

SECX1033 (OLD)	DIGITAL COMMUNICATIONS	L	T	P	Credits	Marks
		3	0	0	3	100

Course Objectives

1. To understand the basic building blocks of digital communication systems.
2. To get introduced to various encoding and digital modulation techniques
3. To understand the principles of error correction codes and its impact on system performance
4. To understand the importance and principles of synchronization schemes used in digital communications systems.
5. To get introduced to concepts of spread spectrum communication.

UNIT I SAMPLING AND QUANTIZATION

9 hrs

Sampling process – Aliasing - PAM- Natural Sampling-Flat Sampling-PPM- PWM–Bandwidth –Noise trade off–PCM- Noise considerations in PCM- Quantization-Delta modulation –Linear prediction – differential pulse code modulation – Adaptive Delta Modulation

UNIT II BASEBAND PULSE TRANSMISSION

9 hrs

Matched Filter- Error Rate due to noise –Intersymbol Interference- Nyquist's criterion for Distortionless Base band Binary Transmission- Correlative level coding – Baseband M-ary PAM transmission – Adaptive Equalization –Eye patterns

UNIT III DIGITAL MODULATION TECHNIQUES

9 hrs

Introduction – ASK- FSK – PSK- coherent modulation techniques-BFSK-BPSK-signal space diagram-probability of error-Coherent Quadrature modulation techniques- QPSK-MSK-signal space diagram-probability of error- Non coherent modulation techniques-M-ary modulation techniques-Carrier Synchronization- Timing Synchronization

UNIT IV ERROR CONTROL CODING

9 hrs

Discrete memoryless channels – Linear block codes - Cyclic codes - Convolutional codes – Maximum likelihood decoding of convolutional codes-Viterbi Algorithm, Trellis coded Modulation, Turbo codes.

UNIT V SPREAD SPECTRUM MODULATION

9 hrs

Pseudo- noise sequences – a notion of spread spectrum – Direct sequence spread spectrum with coherent binary phase shift keying – Signal space Dimensionality and processing gain – Probability of error – Frequency –hops spread spectrum.

Course Outcomes

On completion of the course, student will be able to–

CO1	To understand the working of digital communication systems and describe different source encoding schemes.
CO2	To remember and apply matched filter receiver or correlation receiver for distortion free reception of baseband binary signals.
CO3	To evaluate the performance of digital communication systems with different modulation schemes in the presence of noise.
CO4	To design and analyze the performance of digital communications system in a noisy environment with different error correction codes.
CO5	To design, model and evaluate the performance of spread spectrum based digital communication systems.

TEXT / REFERENCE BOOKS:

1. Simon Haykins, "Communication Systems" John Wiley, 5th Edition, March 2009.
2. Taub. HDL Schilling, G Saha, " Principles of Communication"3rd edition,2007.
3. John G. Proakis, Masoud Salehi, "Digital Communication", McGraw Hill, 5th edition,2007.
4. Bernard Sklar, "Digital Communication, Fundamentals and Application", Pearson Education Asia, 2nd Edition,2001.
5. Taub, Schilling, G Saha, " Principles of Communication"3/e,2007.

SEC1313 (Revised)	DIGITAL COMMUNICATIONS (For ECE and ETCE)	L	T	P	Credits	Total Marks
		3	0	0	3	100

UNIT 1 SAMPLING AND QUANTIZATION

9 hrs

Review of Sampling process - Natural Sampling-Flat Sampling - Aliasing - Signal Reconstruction- Quantization - Uniform & non-uniform quantization - quantization noise Bandwidth -Noise trade off-PCM- Noise considerations in PCM- differential pulse code modulation - Delta modulation - Linear prediction - Adaptive Delta Modulation

UNIT 2 BASEBAND PULSE TRANSMISSION

9 hrs

Base band transmission - Wave form representation of binary digits -Matched filter- error rate due to noise -- Nyquist's criterion for distortion less base band binary transmission- Inter symbol interference - ideal Nyquist channel - Raised cosine channels- correlative level coding - Baseband M-ary pam transmission- equalization - Eye patterns- companding - A law and μ law- Correlation receiver

UNIT 3 DIGITAL MODULATION TECHNIQUES

9 hrs

Introduction - ASK- FSK - PSK- coherent modulation techniques-BFSK-BPSK-signal space diagram-robability of error-coherent quadrature modulation techniques- QPSK-signal space diagram-probability of error- non coherent modulation techniques-M-ary modulation techniques - Vectorial view of MPSK and MFSK - error performance

UNIT 4 SYNCHRONIZATION

9 hrs

Synchronization: Receiver synchronization - Coherent systems - Symbol and frame synchronization - Network synchronization - Open and closed loop transmitter synchronization - Tracking and acquisition in spread spectrum system

UNIT 5 SPREAD SPECTRUM MODULATION

9 hrs

Pseudo- noise sequences - a notion of spread spectrum - Direct sequence spread spectrum with coherent binary phase shift keying - Signal space Dimensionality and processing gain -Probability of error - Frequency -hop spread spectrum- Use of spread spectrum with code division multiple access

Max. 45 hrs

COURSE OUTCOMES:

On completion of this course, students are able to

CO1	Describe the working of digital communication systems and different source encoding schemes
CO2	Analyze the degradation in Baseband Pulse Transmission and techniques to overcome it
CO3	Compare the performance of different digital modulation techniques with different modulation schemes in the presence of noise
CO4	Analyze the performance of various synchronization schemes in digital communication receivers
CO5	Evaluate the performance of spread spectrum based digital communications systems
CO6	Design modulator and demodulator for digital communication systems

TEXT / REFERENCE BOOKS:

1. Simon Haykin, Michael Moher, "Communication Systems" John Wiley, 5th Edition, March 2009
2. Herbut Taub, Donald L. Schilling , Goutam Saha , "Principles of Communication",4thMcGraw Hill edition,2013
3. John G. Proakis, Masoud Salehi, "Digital Communication", McGraw Hill 5th edition, 2014
4. Bernard Sklar, "Digital Communication, Fundamentals and Application", Pearson Education Asia, 3rd Edition, 2013

SECX1022 (old)	MEMS AND ITS APPLICATIONS (Common to ETCE, EIE, E&C, ECE and EEE)	L	T	P	Credits	Total Marks
		3	0	0	3	100

UNIT I INTRODUCTION

10 hrs.

MEMS-Micro fabrications for MEMS -Surface micromachining of silicon -Wafer bonding for MEMS-LIGA process-Micromachining of polymeric MEMS devices -Three-dimensional microfabrications. Materials: Materials for MEMS - Metal and metal alloys for MEMS - Polymers for MEMS - Other materials for MEMS. Metals : Evaporation –Sputtering. Semiconductors :Electrical and chemical properties-Growth and deposition. Thin films for MEMS and their deposition techniques -Oxide film formation by thermal --oxidation -Deposition of silicon dioxide and silicon nitride -Polysilicon film deposition -Ferroelectric thin films. Materials for polymer MEMS :Classification of polymers -UV radiation curing -SU-8 for polymer MEMS.

UNIT II MICROSENSING FOR MEMS

10 hrs.

Piezoresistive sensing - Capacitive sensing - Piezoelectric sensing - Resonant sensing - Surface acoustic wave sensors. **Transducers:** Electromechanical transducers-Piezoelectric transducers - Electrostrictive transducers -Magnetostrictive transducers -Electrostatic actuators-Electromagnetic transducers -Electrodynamic transducers- Actuators: Electrothermal actuators-Comparison of electromechanical actuation schemes.

UNIT III MICRO MACHINING

10 hrs.

Micromachining : Bulk micromachining for silicon-based MEMS -Isotropic and orientation-dependent wet etching - Dry etching -Buried oxide process -Silicon fusion bonding -Anodic bonding -Silicon surface micromachining Sacrificial layer technology - Material systems in sacrificial layer technology - Surface micromachining using plasma etching -Combined integrated-circuit technology and anisotropic wet etching.

UNIT IV LITHOGRAPHY

10 hrs.

Micro stereo lithography for polymer MEMS -Scanning method -Two-photon micro stereo lithography Surface micromachining of polymer MEMS -Projection method -Polymeric MEMS architecture with silicon, metal and ceramics -Micro stereo lithography integrated with thick film lithography.

UNIT V APPLICATIONS

10 hrs.

Switching: Introduction- Switch parameters- Basics of switching - Mechanical switches-Electronic switches- Switches for RF and microwave applications - Mechanical RF switches - PIN diode RF switches - Metal oxide semiconductor field effect transistors and monolithic microwave integrated circuits.

RF MEMS switches: Integration and biasing issues for RF switches -Actuation mechanisms for MEMS devices-Electrostatic switching - Approaches for low-actuation-voltage switches - Mercury contact switches –Magnetic switching - Electromagnetic switching - Thermal switching.Dynamics of the switch operation: Switching time and dynamic response - Threshold voltage. MEMS switch design, modeling and evaluation: Electromechanical finite element analysis - RF design - MEMS switch design considerations.

Course Outcomes

On completion of the course, student will be able to–

C01	Ability to understand the operation of micro devices, micro systems and their applications
C02	Ability to design the micro devices, micro systems using the MEMS fabrication process.
C03	Gain a knowledge of basic approaches for various sensor design
C04	Gain a knowledge of basic approaches for various actuator design
C05	Develop experience on micro/nano systems for computer-aided design

TEXT BOOK:

1. Vijay K.Varadan, K.J.Vinoy and K.A.Jose, “RF MEMS and Their Applications(ISBN 0-470-84308-X)”, 1st edition, John Wiley & Sons Ltd., West Sussex, England, 2003.

REFERENCE BOOKS :

1. P. Rai-choudhury, “MEMS and MOEMS Technology and Applications”, 1st Edition PHI, 2009.
2. S. Senturia, Microsystem Design, Kluwer, 2001.
3. J.W. Gardner, V.K. Varadan, O.O. Awadelkarim, Microsensors, MEMS & Smart Devices John Wiley, 2001.
4. S. Campbell, The Science and Engineering of Microelectronic Fabrication, Oxford Univ. Press, 2001
5. N Maluf, An Introduction to Microelectromechanical Systems Engineering, Artech House.

SEC1612	MEMS AND ITS APPLICATIONS	L	T	P	Credits	Total Marks
Revised	(Common to ETCE, EIE, E&C, ECE and EEE)	3	0	0	3	100

UNIT I OVERVIEW OF MEMS AND MICROSYSTEMS

9 hrs.

Definition - Fundamentals - Properties, Introduction to MEMS and NEMS, Microsystems and miniaturization, Working principle of micro system - Micro sensors, Micro actuators, Micro accelerometers and Micro fluidics, MEMS materials: Silicon, silicon compounds, silicon Piezo-resistors, Gallium Arsenide, Quartz, Piezoelectric crystals, Polymers, Metals.

UNIT II MEMS FABRICATION & PACKAGING

9 hrs

Micro-system fabrication processes: Photolithography, Ion Implantation, Diffusion, and Oxidation. Thin film depositions: LPCVD, Sputtering, Evaporation, Electroplating; Etching techniques: Dry and wet etching, electrochemical etching; Micromachining: Bulk Micromachining, Surface Micromachining, LIGA Technology.

UNIT III MICRO SENSORS AND ACTUATORS

9 hrs

Micro-sensing for MEMS: Piezo-resistive Pressure Sensor, Capacitive sensor, Piezoelectric sensing, Resonant sensing, Surface Acoustic Wave sensors, Electromechanical transducers: Piezoelectric transducers, Electrostrictive transducers, Magnetostrictive transducers, Electrostatic actuators, Electromagnetic transducers, Electro-dynamic transducers, Electro-thermal actuators, comparison of electro-thermal actuation process.

UNIT IV MEMS DESIGN AND INTRODUCTION TO OPTICAL RF MEMS

9 hrs

Micro system Design - Design consideration, process design, Mechanical design, Mechanical design using MEMS. Optical MEMS, System design basics - Gaussian optics, Matrix operations, Resolution. MEMS scanners and retinal scanning display, Digital Micro mirror devices. RF Memes - Design basics, case study - Capacitive RF MEMS switch, Performance issues.

UNIT V MEMS PACKAGING AND APPLICATIONS

9 hrs

MEMS packaging: Role of MEMS packaging, Types of MEMS packaging, selection of packaging materials, flip-chip and multichip Unit packaging, RF MEMS packaging issues. Micro-machined transmission line and components, micro-machined RF Filters, Micro-machined Phase shifters, and Micro-machined antenna, Gyros and Bio-MEMS

COURSE OUTCOMES:

On completion of this course, students are able to

CO1	Explain the operation of micro devices, micro systems and their applications
CO2	Design the micro devices, micro systems using the MEMS fabrication process
CO3	Analyze the approaches for various sensor design
CO4	Explain the approaches for various actuator design
CO5	Develop experience on micro/nano systems for computer-aided design
CO6	Discuss fabrication, analysis and characterization of nano-scale devices

TEXT BOOK:

1. Vijay K.Varadan, K.J.Vinoy and K.A.Jose, "RF MEMS and Their Applications(ISBN 0-470-84308-X)", 1st edition, John Wiley & Sons Ltd., West Sussex, England, 2003.

REFERENCE BOOKS :

1. P. Rai-choudhury, "MEMS and MOEMS Technology and Applications", 1st Edition PHI, 2009.
2. S. Senturia, Microsystem Design, Kluwer, 2001.
3. J.W. Gardner, V.K. Varadan, O.O. Awadelkarim, Microsensors, MEMS & Smart Devices John Wiley, 2001.
4. S. Campbell, The Science and Engineering of Microelectronic Fabrication, Oxford Univ. Press, 2001
5. N Maluf, An Introduction to Microelectromechanical Systems Engineering, Artech House.

SECX1059 old	PATTERN RECOGNITION & IMAGE VISION (Common to ECE, ETCE, E&I & E&C)	L	T	P	Credits	Total Marks
		3	0	0	3	100

UNIT I OBJECT RECOGNITION

10 hrs.

Introduction to pattern recognition, types of images, regular pattern, irregular pattern, fuzzy methods. Statistical pattern recognition, feature selection, syntactic pattern recognition, clustering and non supervised learning methods.

UNIT II OBJECT DETECTION METHODOLOGIES

10 hrs.

Combined detection method, edge detection, edge linking, gradient. Laplacian, line detection, method based, point detection, snake methods. Boundary description detection, matching, merges segmentation, smoothing, splitting of boundaries syntactic, analysis of region boundaries, study of shape by region analysis.

UNIT III FUZZY LOGIC IN PATTERN ANALYSIS

10 hrs.

Explanation of how fuzzy approach can be applied to pattern recognition, classificatory analysis preprocessing, feature detection and primitive extraction, adaptive classification of fuzzy grammar. Algorithms for pattern recognition, neural network fundamentals, approaches for pattern recognition.

UNIT IV IMAGE EXTRACTION CONCEPTS

10 hrs.

Introduction of Computer Vision, Computer Imaging System, Image Formation and sensing CVIP tools Software, Image representation. Area Extraction: Concepts, Data-structures, Edge, Line- Linking, Hough transform, Line fitting, Curve fitting.

UNIT V BOUNDARY ANALYSIS AND MATCHING

10 hrs.

Region Analysis: Region properties, External points, spatial moments, mixed spatial gray-level moments, Boundary analysis: Signature properties, Shape numbers. General Frame Works for Matching: Distance relational approach, Ordered- structural matching, View class matching, Models database organization. Knowledge Based Vision: Knowledge representation, Control strategies, Information integration, Application

Course Outcomes

On completion of the course, student will be able to–

C01	Understand the fundamentals of Pattern Recognition.
C02	Learn the various approaches to identify the patterns
C03	Implement pattern classification
C04	Analyze the fuzzy classifiers
C05	Illustrate the concept of image extraction on computer vision and Applying the appropriate techniques on the real time application development

TEXT BOOKS

1. Duda, Hart, and Stork, "Pattern Classification", John Wiley and Sons, 2nd edition, 2001.
2. Gose, Johnsonbaugh and Jost, "Pattern Recognition and Image Analysis", Prentice Hall; Har/Dsk edition (May 1996).

REFERENCE BOOK

1. Milan Sonka, Vaclav Hlavac, Roger Boyle, "Image Processing, Analysis, and Machine Vision" (Mar. 19, 2007).
2. Robert Haralick and Linda Shapiro, "Computer and Robot Vision", Vol I, II, Addison-Wesley, 1993.

SECX1071 (Revised)	PATTERN RECOGNITION AND IMAGE VISION (Common to ECE, ETCE, E&C & EIE)	L	T	P	Credits	Total Marks
		3	0	0	3	100

UNIT I OBJECT RECOGNITION

10 hrs.

Introduction to pattern recognition, Patterns and features, training and learning in pattern recognition approach, types of images, regular pattern, irregular pattern, fuzzy methods. Statistical pattern recognition, feature selection, syntactic pattern recognition, clustering and non supervised learning methods.

UNIT II OBJECT DETECTION METHODOLOGIES

10 hrs.

Combined detection method, edge detection, edge linking, gradient. Laplacian, line detection, method based, point detection, snake methods. Boundary description detection, matching, merges segmentation, smoothing, splitting of boundaries syntactic, analysis of region boundaries, study of shape by region analysis.

UNIT III FUZZY LOGIC IN PATTERN ANALYSIS

10 hrs.

Fuzzy classifiers - Fuzzy and crisp classification - Fuzzy clustering - Fuzzy pattern recognition, classificatory analysis preprocessing, feature detection and primitive extraction, adaptive classification of fuzzy grammar. Algorithms for pattern recognition, neural network fundamentals, approaches for pattern recognition. Pattern classification by distance functions - Minimum distance classification - Cluster and cluster seeking algorithms - Pattern classification by likelihood functions. Statistical Functions.

UNIT IV IMAGE EXTRACTION CONCEPTS

10 hrs.

Introduction of Computer Vision, Computer Imaging System, Image Formation and sensing CVIP tools Software, Image representation. Area Extraction: Concepts, Data-structures, Edge, Line- Linking, Hough transform, Line fitting, Curve fitting.

UNIT V BOUNDARY ANALYSIS AND MATCHING

10 hrs.

Region Analysis: Region properties, External points, spatial moments, mixed spatial gray-level moments, Boundary analysis: Signature properties, Shape numbers. General Frame Works for Matching: Distance relational approach, Ordered- structural matching, View class matching, Models database organization. Knowledge Based Vision: Knowledge representation, Control strategies, Information integration, Application

Course Outcomes

On completion of the course, student will be able to–

C01	Understand the fundamentals of Pattern Recognition.
C02	Learn the various approaches to identify the patterns
C03	Analyze the fuzzy classifiers
C04	Implement Feature Extraction
C05	Illustrate the concept of image extraction on computer vision and Applying the appropriate techniques on the real time application development

TEXT BOOKS

3. Duda, Hart, and Stork, "Pattern Classification", John Wiley and Sons, 2nd edition, 2001.
4. Gose, Johnsonbaugh and Jost, "Pattern Recognition and Image Analysis", Prentice Hall; Har/Dsk edition (May 1996).

REFERENCE BOOK

3. Milan Sonka, Vaclav Hlavac, Roger Boyle, "Image Processing, Analysis, and Machine Vision" (Mar. 19, 2007).
4. Robert Haralick and Linda Shapiro, "Computer and Robot Vision", Vol I, II, Addison-Wesley, 1993.

SECX1028	DIGITALSIGNALPROCESSING	L	T	P	Credits	Total Marks
		3	0	0	3	100

UNITI DFT AND FFT

10hrs

Review of Time domain and Frequency domain representation of DTLTI system–Discrete random signals Averages– Autocorrelation and power spectral density–DFT–Properties–Linear and Circular convolution–FFT–Decimation in time FFT and Decimation in frequency FFT algorithms–Inverse DFT–Applications of FFT to convolution.

UNITII ANALYSISANDDESIGNOFDIGITALFILTERS

10hrs

Review Butterworth and Chebyshev approximations – Properties of IIR and FIR filters – Design of IIR filter using Impulse invariant and Bilinear transformation method – Design of FIR filter using window method – rectangular, Hanning, hamming,Kaiser windows.

UNITIII EFFECTOFFINITEREGISTERLENGTH

10hrs

Realization structure for FIR & IIR filters – Direct Form I and Direct Form II, cascade, parallel realization – Effect of number representation in registers – fixed point arithmetic – floating point arithmetic –Errors due to rounding – ADC quantization noise – coefficient quantization error – product quantization error – truncation – limit cycles due to product round off error – addition of overflow errors – Scaling – dynamic range.

UNITIV MULTIRATE DIGITAL SIGNAL PROCESSING

10hrs

Introduction- Concepts of Multirate Signal Processing- Decimation by integer factor- interpolation by integer factor - Sampling rate conversion by non integer factor – multistage approach to sampling rate conversion – Application: echo cancellor, efficient digital to analog Conversion in compact hi-fi systems.

UNITV DIGITAL SIGNAL PROCESSORS

10hrs

TMS320C5412 family–Architecture–Addressing mode–Instruction set–Simple programs Introduction to code composer studio software–Simulation.

Course Outcomes:

On completion of the course, student will be able to–

C01	Classify various types of System representation and the application of transforms.
C02	Illustrate Digital filter design techniques
C03	Demonstrate various digital filter realization structures and finite word length effects
C04	Describe the concept of multi-rate signal processing and its applications
C05	Implement DSP Processor based applications in the field of signal processing.

TEXT/REFERENCEBOOKS:

1. SanjitK.Mitra, "Digital signal Processing A Computer Based Approach", 3rd Edition, Mc Graw Hill, 2006.
2. J.G.Prokias, "Digital Signal Processing", 2nd Edition, Prentice Hall, 1996.
3. Rabiner and Gold, "Theory and application of Digital Signal Processing", Prentice Hall, 2007.
4. Oppenheim and Schaffer, "Digital Time Signal Processing", 2nd Edition, Prentice Hall, 1999.
5. Ashok Ambarder, "Digital Signal Processing", 1st Edition, Cengage learning, 2006.
6. Venkataramani, "Digital Signal Processors", Tata Mc Graw Hill, 14th reprint of 2008.
7. John G Proakis and Dimtris G Manolakis, Digital Signal Processing, 3rd Edition, PHI Pearson Education, 2000.
8. P.RameshBabu et al., Digital Signal Processing, 4th Edition, Scitech Publishers, Reprint 2010

SEC1314 (Revised)	DIGITAL SIGNAL PROCESSING	L	T	P	Credits	Total Marks
		3	1	0	4	100

UNIT 1 INTRODUCTION TO SIGNALS AND SYSTEMS **12hrs**

Representation, Characterization and Classifications of Continuous Time (CT) & Discrete Time (DT) signals, Sampling theorem - Aliasing effect, Operations on DT signals, Convolution, Advantages of DSP over ASP, Classification of CT & DT systems, properties of Discrete time systems-Linearity-Time invariance- causality –stability-Linear time Invariant systems, Difference equation representation of LTI systems-The Z transform- properties of Z transform- Inverse Z transform-System transfer Function

UNIT 2 DISCRETE FOURIER TRANSFORM (DFT) AND FAST FOURIER TRANSFORM (FFT) **12hrs**

DFT and its properties, Relation between DTFT and DFT, FFT computations using Decimation in time (DIT) algorithms and Decimation in frequency (DIF) algorithms, Auto correlation, Cross correlation, and their properties. Realization of Discrete Time System: introduction, Basic Realization block diagram and the signal flow graph, Realization of recursive and non recursive systems - Direct Form I and Form II - Cascade and parallel realization

UNIT 3 DIGITAL FILTER DESIGN **12 hrs**

Design of Digital Filters: General considerations: causality and its implications, characteristics of practical frequency selective filter. Design of FIR filter using window method - Rectangular, Hanning and Hamming Windows. Design of IIR filters using Impulse invariant and Bilinear transformation method. Review of Butterworth and Chebyshev approximations, Frequency selective filters: Ideal filter characteristics, low pass, high pass and band pass filters, Properties of IIR and FIR filters

UNIT 4 FINITE WORD LENGTH EFFECTS **12hrs**

Fixed point and floating point number representations - Comparison - Truncation and Rounding errors - Quantization noise - derivation for quantization noise power -coefficient quantization error - Product quantization error - Overflow error - Round off noise power - limit cycle oscillations due to product round off and overflow errors -signal scaling

UNIT 5 MULTIRATE SIGNAL PROCESSING

12 hrs

Introduction to Multirate signal processing-Decimation-Interpolation- Poly phase implementation of FIR filters for interpolator and decimator -Multistage implementation of sampling rate conversion- Design of narrow band filters-Applications of Multirate signal processing, Speech compression, Adaptive filter, Musical sound processing, Image enhancement.

COURSE OUTCOMES:

On completion of this course, students are able to

CO1	Describe the various types of signals and systems and its operations
CO2	Apply various transforms for different types of signals
CO3	Design IIR & FIR filter using various filter approximations
CO4	Make use of the concept of finite word length effects and its applications in signal processing
CO5	Elaborate the concept of Multirate signal processing
CO6	Explain the perception of Multirate signal processing in real time applications

TEXT / REFERENCE BOOKS:

1. John G. Proakis & Dimitris G. Manolakis, "Digital Signal Processing - Principles, Algorithms & Applications", Fourth Edition, Pearson education / Prentice Hall, 2009
2. Sanjit K. Mitra, Digital Signal Processing: A Computer - Based Approach, McGraw-Hill Education, 4th edition, 2013
3. B.P. Lathi, "Signal Processing & Linear systems", Oxford University Press, 2nd edition, 2009
4. Lyons, "Understanding Digital Signal Processing", Prentice Hall, 3rd edition, 2010
5. Johnny R. Johnson, "Introduction to Digital Signal Processing", PHI, 2006
6. Alan V. Oppenheim, Ronald W. Schaffer, Discrete-Time Signal Processing, Pearson, 3rd Edition, 2010
7. Salivahanan, "Digital Signal Processing, 2nd Edition, TMH, 2010

SECX1007 (old)	ANALOG INTEGRATED CIRCUITS	L	T	P	Credits	Total Marks
		3	0	0	3	100

UNIT I INTRODUCTION TO OPERATIONAL AMPLIFIERS

10hrs

Introduction to IC fabrication steps- Differential amplifier -Current sources-Building blocks for operational amplifier Monolithic OP-AMP – Ideal operational amplifier- DC and AC Characteristics Input offset voltage- Input bias current Input offset current- Total output offset voltage- Thermal drift- Slew rate- CMRR -Specifications of typical op-amp(741)—Open loop and closed loop configurations.

UNIT II BASIC OP-AMP APPLICATIONS

10hrs

Inverting amplifier- Non-inverting amplifier- Voltage follower- Summing and differential amplifier -Voltage to current – Current to voltage converters- Integrator- Differentiator- Logarithmic and Anti logarithmic amplifiers-Comparator and Schmitt trigger-Frequency response and compensation.

UNIT III FILTERS AND OSCILLATORS

10hrs

First order and Second order Butterworth filters-lowpass, highpass, bandpass and band reject filters-RC phase shift, Wein's bridge oscillator-Astable and Monostable multivibrator-Precision half wave and full wave rectifiers.

UNIT IV A/D AND D/A CONVERTERS

10hrs

Sample and Hold circuit- Digital to analog converters: R-2R ladder network and Binary weighted- Characteristics of D/A converters – Analog to digital converters: Flash converter – Successive approximation converter – Dual slope and Oversampling ADCs—Delta Sigma ADC.

UNIT V SPECIAL FUNCTION ICs

10hrs

Analog Multiplier IC AD 533- Phase Locked Loop IC 565- Block schematic – Lock range and capture range – Applications of PLL: FM demodulator and Frequency synthesizer- VCO IC LM 566 – Timer IC LM 555 and its applications: Astable and Monostable multivibrator- PWM modulator-Positive and Negative Voltage regulators.

COURSE OUTCOMES:

On completion of this course, students are able to

C01	Enhance the knowledge of fabrication steps for integrated circuits
C02	Design the Active filters using Op- Amp for the given specifications and to describe the concept of CMRR and AC - DC characteristics of operational amplifier.
C03	Relate the OPAMP for linear and non linear applications including comparators and wave form generators
C04	Design the Active filters using Op- Amp for the given specifications
C05	Analyze ADC and DAC for Real time Implementation

TEXT/REFERENCEBOOKS:

1. Grey and Meyer, Analysis and Design of Analog Integrated Circuits, 4th Edition, Wiley International, 2001.
2. Michael Jacob, Applications and Design with Analog Integrated Circuits, 2nd Edition, Prentice Hall of India, 1993.
3. Ramakant A. Gayakwad, OP-AMP and Linear ICs, 4th Edition, Prentice Hall / Pearson Education, 1994.
4. William D. Stanely, Operational Amplifiers with Linear Integrated Circuits, 4th Edition, Pearson Education, 2004.
5. Sergio Franco, Design with operational amplifiers and analog integrated circuits, 3rd Edition, McGraw-Hill, 1997.
6. D. Roy Choudary, Shail Jain, Linear Integrated Circuits, New Age International Pvt. Ltd., 2000

SEC1302 (Revised)	ANALOG INTEGRATED CIRCUITS	L	T	P	Credits	Total Marks
		3	0	0	3	100

UNIT 1 INTRODUCTION TO OP- AMP AND ITS APPLICATIONS

9 hrs

OP-AMP– DC and AC Characteristics- Input offset voltage- Input bias current-Input offset current- Total output offset voltage- Thermal drift- Slew rate- CMRR -Inverting amplifier- Non-inverting amplifier- Voltage follower- Summing and differential amplifier- Integrator- Differentiator- Logarithmic and Anti logarithmic amplifiers-Comparator and Schmitt trigger

UNIT 2 FILTERS AND SIGNAL GENERATORS

9 hrs

First order and Second order Butterworth filters- low pass, high pass, band pass and band reject filters –RC phase shift, Wein's bridge oscillator- Astable and Monostablemultivibrator- Precision half wave and full wave rectifiers

UNIT 3 A/D AND D/A CONVERTERS

9 hrs

Sample and Hold circuit – Digital to analog converters: R-2R ladder network and Binary weighted – Characteristics of D/A converters – Analog to digital converters: Flash converter – Successive approximation converter – Dual slope ADC.

UNIT 4 PLL AND TIMER CIRCUITS

9 hrs

Phase Locked Loop IC 565– Block schematic – Applications of PLL: FM demodulator and Frequency synthesizer-FSK Demodulator- VCO IC LM 566 – Timer IC LM 555 and its applications: Astable and Monostablemultivibrator

UNIT 5 SPECIAL FUNCTION ICs

9 hrs

Integrated circuit Tuned amplifier, Instrumentation Amplifier, Series and shunt voltage regulator, Opto coupler, CMOS Operational Amplifier- Dc analysis- small signal analysis- specifications of IC MC 14573

COURSE OUTCOMES:

On completion of the course, students are able to

CO1	Interpret the DC-AC Characteristics and applications of Operational Amplifier
CO2	Design the Active filters using OP-AMP
CO3	Develop a voltage controlled oscillator for PLL application
CO4	Examine the applications of special function IC's namely voltage Regulator and 555 timer
CO5	Analyze ADC and DAC for Real time Implementation
CO6	Implement a research oriented application using OPAMP

TEXT / REFERENCE BOOKS:

1. D.RoyChoudary, Shail Jain, Linear Integrated Circuits, New Age International Pvt. Ltd., 2000
2. Grey and Meyer, Analysis and Design of Analog Integrated Circuits, 4th Edition, Wiley International, 2001
3. Sergio Franco, "Design with Operational Amplifiers and Analog Integrated Circuits", 3rd Edition, Tata McGraw-Hill, 2007
4. S. Salivahanan, V.S. KanchanaBhaaskaran, " Linear integrated circuits", 3rd Edition, McGraw-Hill, 2011
5. William D.Stanely, Operational Amplifiers with Linear Integrated Circuits, 4th Edition, Pearson Education, 2004
6. D. Choudhari, S. Jain "Linear Integrated Circuits", New Age International (P) limited, 4th edition, 2010
7. Sedra A. S. and K. C. Smith, Microelectronic Circuits, 6/e, Oxford University Press,

2013