SATHYABAMA UNIVERSITY

(Established under Section 3 of the UGC Act, 1956)
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: **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.

- 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	

11. Dr.S.Karthikeyan

12. Ms.K.Srilatha

13. Dr.R.Ramadevi

14. Mrs.K.Sujatha

15. Dr.Susitra

EXTERNAL MEMBERS

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

Dr.Rani Bilas Pachori
Professor, IIT Indore

Dr.Sivakumaran,
Professor, NIT, Thiruchirapaali

SATHYABAMA UNIVERSITY

(Established under Section 3 of the UGC Act, 1956)
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.

- 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	

8. Dr.P.Chitra
9. Dr.S.Karthikeyan
10. Mrs.K.Srilatha
11. Mrs.L.Magthelin Therase
12. Mrs.I.Rexiline Sheeba
13. Dr.Susitra
14. Dr.Ramadevi
15. Mrs. Sujatha

EXTERNAL MEMBERS

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

30/10/17

Dr.Ram Bilas Pachori
Professor, IIT Indore

31/10/17

Dr.Sivakumaran,
Professor, NIIT, Thiruchirappalli

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

SATHYABAMA UNIVERSITY **FACULTY OF ELECTRONICS**
ENGINEERING

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

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

Course Outcome

CO1	Explain the evolution and basics of Nanostructures like 1d and 2d concepts
CO2	Classify the properties and analysis of Nanostructures based on size to surface
CO3	Appraise the analysis of quantum techniques on quantum dots
CO4	Assemble the theory and modelling of nanocomposites and Zeolites
CO5	Analyse the characterization of nanopolymers with different techniques

TEXT BOOK:

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

REFERENCE BOOKS:

1. L.Banyai and S.W.Koch ,Semiconductor Quantum Dots, (World Scientific) 1993, http://www.nanotec.org.uklworkshop.october03health.htm(for health and safety aspects of nanostructures)

2. J.H. Davies, An introduction to the physics-af 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., Electromechan ical 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
SECX1069 (Revised)	NANO ELECTRONICS (Common to EEE, BIO-MED, EIE, E&C, CSE, IT, EEE)	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

CO1	Explain the evolution and basics of Nanostructures like 1d and 2d concepts
CO2	Classify the properties and analysis of Nanostructures based on size to surface
CO3	Appraise the analysis of quantum techniques on quantum dots
CO4	Assemble the theory and modelling of nanocomposites and Zeolites
CO5	Analyse nanoscale memory devices

TEXT BOOK:

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

REFERENCE BOOKS:

1. L.Banyai and S.W.Koch ,Semiconductor Quantum Dots, (World Scientific) 1993, http://www.nanotec.org.uklworkshop.october03health.htm(for health and safety aspects of nanostructures)
2. J.H. Davies, An introduction to the physics-af 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–

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, Pillip 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.

		L	T	P	Credits	Total Marks
SECX1070 (revised)	**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. Plated though 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 amd 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 High way – 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, Pillip 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 communicationsystems.
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 ERRORCONTROLCODING 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 –hopspread spectrum.

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

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

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

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

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

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:** *E*lectromechanical 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.**

Micromachning : 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.

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

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–

CO1	Ability to understand the operation of micro devices, micro systems and their applications
CO2	Ability to design the micro devices, micro systems using the MEMS fabrication process.
CO3	Gain a knowledge of basic approaches for various sensor design
CO4	Gain a knowledge of basic approaches for various actuator design
CO5	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.

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

SEC1612 Revised	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 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

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

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.

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

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

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

Course Outcomes

On completion of the course, student will be 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 and Applying the appropriate techniques on the real time application development

TEXT BOOKS

1. Dude, Hart, and Stock, "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–

CO1	Understand the fundamentals of Pattern Recognition.
CO2	Learn the various approaches to identify the patterns
CO3	Analyze the fuzzy classifiers
CO4	Implement Feature Extraction
CO5	Illustrate the concept of image extraction on computer vision and Applying the appropriate techniques on the real time application development

TEXT BOOKS

3. Dude, Hart, and Stock, "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 toproductroundofferror–additionofoverflowerrors–Scaling–dynamicrange.

UNITIVMULTIRATEDIGITALSIGNALPROCESSING 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 DIGITALSIGNALPROCESSORS 10hrs

TMS320C5'412 family–Architecture–Addressing mode–Instructionset-Simple programs Introduction to code composer studio software–Simulation.

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

Course Outcomes:

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

CO1	Classify various types of System representation and the application of transforms.
CO2	Illustrate Digital filter design techniques
CO3	Demonstrate various digital filter realization structures and finite word length effects
CO4	Describe the concept of multi-rate signal processing and its applications
CO5	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 Schafer, "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

		L	T	P	Credits	Total Marks
SEC1314 (Revised)	DIGITAL SIGNAL PROCESSING	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 ofMultirate 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 dition,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. Schafer, 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

UNITI INTRODUCTIONTOOPERATIONALAMPLIFIERS 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.

UNITII BASICOP-AMPAPPLICATIONS 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-Frequencyresponseandcompensation.

UNITIII FILTERSANDOSCILLATORS 10hrs

First order and Second order Butterworth filters-lowpass, highpass, bandpass and band reject filters-RC phase shift,Wein'sbridgeoscillator-AstableandMonostablemultivibrator-Precisionhalfwaveandfullwaverectifiers.

UNITIV A/DANDD/ACONVERTERS 10hrs

Sample and Hold circuit– Digital to analog converters: R-2Rladder network and Binary weighted– Characteristics of D/A converters – Analog to digital converters: Flash converter – Successive approximation converter – Dual slope and Oversampling ADCs–DeltaSigma ADC.

UNITV SPECIALFUNCTIONICs 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.

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

COURSE OUTCOMES:
On completion of this course, students are able to

CO1	Enhance the knowledge of fabrication steps for integrated circuits
CO2	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.
CO3	Relate the OPAMP for linear and non linear applications including comparators and wave form generators
CO4	Design the Active filters using Op- Amp for the given specifications
CO5	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

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

		L	T	P	Credits	Total Marks
SEC1302 (Revised)	ANALOG INTEGRATED CIRCUITS	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

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

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,

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

2013