DHANALAKSHMI SRINIVASAN UNIVERSITY

SAMAYAPURAM (NEAR SAMAYAPURAM TOLL PLAZA),

TIRUCHIRAPALLI – 621 112 TAMIL NADU, INDIA

SCHOOL OF ENGINEERING AND TECHNOLOGY

B.TECH-ELECTRONICS AND COMMUNICATION ENGINEERING

CURRICULUM & SYLLABUS

REGULATION-2021

21ECE01	ELECTRONIC DEVICES	L	T	P	C
		3	1	0	4

Course Objectives

- To acquaint the students with the construction, theory and operation of the basic electronic devices such as PN junction diode, Bipolar and Field effect Transistors, Power control devices, LED, LCD and other Opto-electronic devices.
- To explain the characteristics of BJT,FET and Power devices

Course Outcomes

On completion of the course, students should be able to

1. Operate the basic electronic devices such as PN junction diode, Bipolar and Field effect Transistors, Power control devices, and display devices
2. Explain the V-I characteristic of diode,BJT, UJT and SCR
3. Describe the equivalence circuits of transistors

Unit 1 - Semiconductor Diode **9**

PN Junction Diode-Current Equation & Energy band diagram-Diffusion Current-Densities Drift Current Densities- Forward and Reverse Bias Characteristic- Transition capacitances-Diffusion capacitances- Switching Characteristics- Break down in PN Junction Diodes.

Unit 2 - Bipolar Junction Transistors **9**

NPN-PNP Operations & Early Effect-Current Equation-Input and Output Characteristics of CE, CB & CC-Hybrid π Model - h-parameter Model-Ebers Moll Model-Gummel Poon Model-Multi Emitter Transistor.

Unit 3 - Field Effect Transistors **9**

JFETs-Drain Characteristics- Transfer Characteristics, Current Equation, Pinch off Voltage and its significance, MOSFET- Characteristics & Threshold voltage, Channel length modulation, E-MOSFET & D-MOSFET Characteristics, Comparison of MOSFET with JFET

Unit 4 - Special Semiconductor Devices **9**

Metal Semiconductor Junction –MESFET, PINFET, CNTFET, Dual Gate MOSFET, Schottky Barrier Diode, Zener Diode, Varactor Diode, Tunnel Diode, LASER Diode, LDR

Unit 5 - Power Devices and Display Devices **9**

Operation and Characteristics - UJT, SCR, DIAC, TRIAC &Solar Cell - LED, LCD, Photo Transistor and Opto Coupler

Total Hours: 45

TEXT BOOKS:

1. Donald A Neaman, Semiconductor Physics and Devices, Fourth Edition, Tata McGrawHill Inc. 2012
2. Salivahanan. S, Suresh Kumar. N, Vallavaraj.A, Electronic Devices and circuits, Third Edition, Tata McGraw- Hill, 2008

REFERENCES:

1. Robert Boylestad and Louis Nashelsky, Electron Devices and Circuit Theory Pearson Prentice Hall, 10th edition, July 2008
2. R.S.Sedha, A Text Book of Applied Electronics S.Chand Publications, 2006
3. Yang, Fundamentals of Semiconductor devices, McGraw Hill International Edition, 1978

21CSE02	DATA STRUCTURES	L	T	P	C
		3	0	0	3

Course Objectives

The course aims:

- To understand the various techniques of sorting and searching
- To design and implement arrays, stacks, queues, and linked lists
- To understand the complex data structures such as trees and graphs
- To increase the knowledge of usage of data structures in algorithmic perspective.

Course Outcomes

On completion of the course, students should be able to

1. Develop understand linear data structures such as stacks, queues, linked lists, etc.
2. Apply the concept of trees and graph data structures in real world scenarios
3. Comprehend the implementation of sorting and searching algorithms

Unit 1 - Linear Data Structures **9**

Notations and Analysis– Arrays and its representations – Stacks and Queues – Linked lists – Linked list-based implementation of Stacks and Queues – Evaluation of Expressions – Linked list based polynomial addition.

Unit 2 - Non-Linear Data Structures **9**

Trees – Binary Trees – Binary tree representation and traversals – Threaded binary trees – Binary tree representation of trees – Application of trees: Set representation and Union -Find operations – Graph and its representations – Graph Traversals – Connected components.

Unit 3 - Search Structures and Priority Queues **8**

AVL Trees – Red-Black Trees – B-Tree, B+ - Tree – Splay Trees – Binary Heap –Leftist Heap

Unit 4 - Sorting **8**

Insertion sort – Merge sort – Quick sort – Heap sort – Sorting with disks – k-waymerging – Sorting with tapes – Polyphase merge.

Unit 5 - Searching and Indexing **8** Linear Search – Binary Search - Hash tables – Overflow handling – Cylinder Surface Indexing – Hash Index – B-Tree Indexing.

Unit 6 - Recent Trends **3**

Recent trends in algorithms and data structures

Total Hours: 45

Text Books

1. Mark A. Weiss, Data Structures & Algorithm Analysis in C++, 3rd edition, 2008, PEARSON
2. Ellis Horowitz and Sartaj Sahni. Fundamentals of Data Structures. 2nd Edition, 2008
3. Thomas H. Cormen, C.E. Leiserson, R L.Rivest and C. Stein, Introduction to Algorithms, Third edition, MIT Press, 2009.

Reference Books

1. Jean-Paul Tremblay and Paul G. Sorenson, An Introduction to Data Structures with Applications, Second Edition, Tata McGraw -Hill, New Delhi, 1991.
2. Alfred V. Aho, John E. Hopcroft and Jeffry D. Ullman, Data Structures &Algorithms, Pearson Education, New Delhi, 2006

21ECE02	ELECTRONIC CIRCUITS	L	T	P	C
		3	0	0	3

Course Objectives

The course aims:

- To study and analysis the design of multistage amplifiers with different coupling
- schemes
- To study and analysis of frequency response of BJT amplifiers
- To familiarize the concepts of feedback amplifiers, oscillators and wave shaping
- circuits
- To study and analysis of various power amplifiers.

Course Outcomes

On completion of the course, students should be able to

1. Analyse the characteristics of different forms of amplifiers
2. Understand the importance of amplifiers used in high frequency
3. Use concepts of amplifiers for design practical applications
4. Evaluate the performance of time base generators and multivibrators
5. Analyse the characteristics of various power amplifiers.

Unit 1- Multistage Amplifiers **8**

Classification of amplifiers- Distortion in amplifiers-Analysis of CE,CB,CC-Frequency response of BJT-RC coupled amplifier –Differential amplifier-cascode and cascade amplifier-Darlington pair-Different coupling schemes used in Amplifiers-illustrative problems.

Unit 2 – High Frequency Response **8**

Effect of Coupling and Bypass capacitance-Analysis of BJT amplifiers in High frequency-Hybrid PI CE model-CE short circuit gain-Single stage CE transistor Amplifier response-Gain bandwidth product-Emitter follower at high frequency.

Unit 3 = Feedback amplifiers and Sinusoidal Oscillators **8**

Basic Concept of Feedback amplifiers- Classification-characteristics of negative feedback-topologies of voltage amplifier-current amplifier-transconductance –trans-resistance - Basic Concept of oscillators – condition for oscillations - RC oscillator - LC oscillator - crystal oscillator.

Unit 4 – Time Base Generators and Multivibrators **8**

Introduction of Time base circuits – Voltage-Time base circuit, Current-Time base circuit clipper and clamper circuits-monostable multivibrator-astable multivibrator- Bistable multivibrators.

Unit 5 - Power Amplifiers **8**

Classification of Power Amplifiers – Class A, Class B and Class AB power Amplifiers-Transformer Coupled and Push Pull Class A and Class B Power Amplifiers. Cross-over Distortion in Pure Class B Power Amplifier, Class AB Power Amplifier – Complementary symmetry Push Pull Amplifier

Unit 6- Contemporary Issues **5**

Total: 45 hours

Text Books

1. Jacob Millman and D. Halkias, Integrated Electronics, 2nd edition McGraw Hill, 2017
2. Robert L.Boylested, Louis Nashelsky, Electronic Devices and circuit Theory, 11th edition, Pearson education, 2016

	Reference Books
1.	Adel S. Sedra and Kenneth C. Smith, Microelectronic Circuits: Theory and Applications Sixth edition, Oxford University Press,2016
2.	Jacob Millman and Arvin Grabel, Microelectronics, McGraw Hill, 2nd edition,2017

21ECE03	SIGNALS AND SYSTEMS	L	T	P	C
		3	0	0	3

Course Objectives

- To understand the basic properties of signal & systems.
- To know the methods of characterization of LTI systems in time domain.
- To analyze continuous time signals and system in the Fourier and Laplace domain.
- To analyze the signals and systems using Z transform.

Course Outcomes

At the end of the course student will be able

1. Classify the signals as continuous time and discrete time signals and classify systems based on their properties.
2. Determine the response of LTI system using convolution sum for DT system and Convolution Integral for CT system
3. Apply Fourier series and Fourier Transform for periodic Signals
4. Analyze system using Laplace transform and realize the structure for CT system
5. Analyze system using Z transform and realize the structure for DT system

Unit 1 - Classification of Signals and Systems **9**

Continuous-Time and Discrete-Time signals–The Unit Impulse Unit Step, Unit RampSignals and other Basic Signals – Operation of Signals -Time Shifting – Time Reversal – Amplitude Scaling – Time Scaling – Signal Addition – Multiplications – Continuous- Timeand Discrete-Time Systems– Basic System Properties - Systems with and Without Memory – Causality – Stability – Time Invariance – Linearity.

Unit 2 – Linear Time- Invariant Systems **8**

Discrete-Time LTI system: The Convolution sum-tabulation method-matrix multiplication method-graphical and analytical approach – Solution of Difference Equations. Continuous-Time LTI Systems: The Convolution Integral - graphical and analytical approach – Properties of Linear Time-Invariant Systems – Solution of Differential Equations.

Unit 3 - Analysis of CT Signals using Fourier Series & Fourier Transform **8**

Fourier Series Representation (Trigonometric and Exponential) of Continuous-Time Periodic Signals – Properties of Continuous-Time Fourier Series – Representation of Aperiodic Signals: The Continuous-Time Fourier Transform – The Fourier Transform for Periodic Signals – Properties of the Continuous-Time Fourier Transform – Convolution Property – The Multiplication Property.

Unit 4 - Analysis of Signals and Systems using Laplace Transform **9**

The Laplace Transform – The Region of Convergence for Laplace Transform– The Inverse Laplace Transform using Partial fraction– Properties of the Laplace Transform– System Function and Block Diagram Representations-Direct Form I and Direct Form II.

Unit 5 - Analysis of Signals and Systems using Z-Transform **9**

The Z-Transform – The Region of Convergence for the Z-Transform –The Inverse Z-Transform using Partial fraction and long division method– Properties of the Z-Transform – System Function and Block Diagram Representations-Direct Form I and Direct Form II.

Unit 6 – Recent Trends **2**

Total Hours: 45

Text Books

1. Alan V. Oppenheim, Alan S. Willsky, S. Hamid Nawab, “Signals and Systems”, 2nd E, Prentice Hall India, 2019.
2. A.Anand Kumar, “Signals and Systems”, 3rd Edition, Prentice Hall India, 2018.

References
1. John G. Proakis, Dimitris G. Manolakis, “Digital Signal Processing, Principles, Algorithms, and Applications”, 4th E, PHI, 2012 2. Robert A. Gable, Richard A. Roberts, “Signals & Linear Systems”, 3rd E, John Wiley, 2014. 3. W Kamen& Bonnie’s Heck, “Fundamentals of Signals and Systems”, Pearson Education, 2016.

21ECE04	DIGITAL ELECTRONICS WITH HDL	L	T	P	C
		3	0	0	3

Course Objectives

- To understand and design digital logic circuits
- To study and analyze the concepts of Combinational and sequential circuits
- To Understand Memory design concepts and its types
- Design the Combinational and Sequential circuits using HDL Programming

Course Outcomes

At the end of the course student will be able

1. Apply concepts of Digital Binary System and implementation of Gates.
2. Analyze and design of Combinational logic circuits with HDL Programming.
3. Analyze and design of sequential logic circuits with HDL Programming.
4. Apply the concept of Digital Logic Families with circuit implementation.
5. Understand the Memory design and its types

Unit 1 - Digital Logic and Arithmetic Circuits **9**

Binary to decimal conversion – Decimal to binary conversion – Octal numbers – Hexadecimal numbers – Excess-3 code – Gray code. Binary to decimal conversion – Decimal to binary conversion – Octal numbers – Hexadecimal numbers – Excess-3 code – Gray code. NOT, OR, AND – Universal NAND and NOR gates – EX-OR and EX-NOR gates – DeMorgan's Theorems – Universal building blocks (NOT, OR, AND) Binary addition and subtraction – 1's complement – 2's complement – Adders (half & full) – Subtractor (half & full)

Unit 2 – Combinational and Data Processing Circuits **8**

Sum of products method – Product of methods – Truth table of Karnaugh map – Pairs, Quads and Octet – Karnaugh map simplification – Digital Logic families and their parameters- 4X1 Multiplexer – 8X1 Multiplexer – 1X4 Demultiplexer – 1X8 De-multiplexer – Decoder – BCD-to-decimal decoder – Encoder – Parity Checkers, HDL Programming of Combinational circuits

Unit 3 - Sequential Circuits: Flip-Flops **8**

Introduction, Terminologies used, S-R flip-flop, D flip-flop, JK flip-flop, Race-around condition, Master – slave JK flip-flop, T flip-flop, Conversion from one type of flip-flop to another, Application of flip-flops.

Unit 4 - Digital Counters & Shift Register **9**

Introduction- Modes of operation of register (SISO, SIPO, PISO and PIPO). Counters – Asynchronous counter- Synchronous counter – Ripple counters – MOD-7 ripple counter – Decade counter – 4 bit down counter – Up/down counter, HDL Programming of Sequential circuits.

Unit 5 – Memories **9**

Classification of memories –RAM organization – Write operation –Read operation –Memory cycle-Memory decoding – memory expansion – Static RAM Cell-Dynamic RAM cell-Programmable Logic Array (PLA)- Programmable Array Logic (PAL)

Unit 6 – Recent Trends **2**

Total Hours: 45

Text Books

1. Donald P Leach, Malvino Digital Principles and Applications, McGraw Hill Electronic Devices and circuit.
2. Prof. C. Kumar and Selvakumar, Digital Electronics, , N.V Publications

3. Stephen Brown, Zvonko Vranesic, Fundamentals of Digital Logic with VHDL Design, TMH, 3rd Edition, 2012

References

1. Frank Vahid, Digital Design with RTL Design, Verilog and VHDL, Wiley India, 2nd Edition , 2010
2. Samir Palnitkar, Verilog HDL: A Guide to Digital Design and Synthesis, PHI, 2010W Kamen& Bonnie's Heck, "Fundamentals of Signals and Systems", Pearson Education, 2016.
3. M. Morris Mano and M. D. Ciletti, Digital Design, Pearson Education.
4. RP Jain, Modern Digital Electronics, Tata McGraw Hill Publication.
5. David J. Comer, Digital Logic & State Machine Design, Oxford University Press.

21ECEP1	ELECTRONIC DEVICES AND CIRCUITS LABORATORY	L	T	P	C
		0	0	4	2

Course Objectives

To familiarise the students with

- To learn the usage of electronic components.
- To learn the characteristics of basic electronic devices such as Diode, BJT, FET.
- To learn the Pulse generation using IC 555 Timer.

Course Outcomes

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

1. Use the Multimeter, Power supplies, Oscilloscopes and Function Generators.
2. Analyse the Characteristics of Semiconductors such as diode, BJT and FET and its configuration.
3. Analyse the pulse generation using 555 timers.

List of Experiments

1. Identification, Study and Testing of various electronic components, devices and software tools:

a. Passive components like Resistors, Capacitors, Variable Resistor/Pot; Activecomponents like BJTs, FETs, UJTs.

b. Instruments/Devices like Multimeter, Ammeter, Voltmeter, FG, RPS, CRO (Analogand Digital Storage), Breadboard, Transformer, PCB, Soldering Kit, probes, Cables, Connectors, Battery types, Relays (Mechanical and Electronic)

2. Study of a Digital Storage CRO and store a signal on it software tool
3. Plot V-I characteristic of P-N junction diode using breadboard
4. Transistor Characteristics

a. Plot I/O characteristics of BJT in CE/CB/CC configuration.

b. Plot the characteristics of FET

5. Design a biasing circuit for BJT. Use breadboard
6. Amplifiers - Plot frequency response of BJT CE amplifier with and w/o negative f/busing breadboard
7. Plot the characteristics of UJT and UJT as relaxation. Use breadboard
8. Oscillators, Pulse Generators

a. Design of Monostable Multivibrator using 555 Timers

b. Design of Astable Multivibrator using 555 Timers

9. Power Supplies

a. Study Zener diode as voltage regulator. Observe the effect of load changes anddetermine load limits of the voltage regulator. Use breadboard.

b. Design a Bridge rectifier and measure the effect of filter network

10. Clipper and Clamper circuit design its analysis

Refernce Books

1. http://www.sentex.ca/~mec1995/tutorial/xtor/xtor6/xtor6.html
2. Practical Electronics Handbook, Ian Sinclair, John Dunton, 6th Edition, Newnes/Elsevier
3. Starting Electronics, Keith Brindley, 4th Edition, Newnes/Elsevier

21ECEP2	DIGITAL ELECTRONICS LABORATORY WITH HDL	L	T	P	C
		0	0	2	1

Course Objectives

To familiarize the students with

- Students can design digital circuits using a hardware description language and synthesis.
- Students understand modern programmable logic devices and can use them in practicalapplications.

Course Outcomes

On completion of the course, students should be able to

1. Apply and implement the learned algorithm for problem solving
2. Identify the data structure to develop program for real time applications
3. Design and develop optimal algorithms using appropriate data structures

1. Study of simulation tools
2. Study of synthesis tools, Study of FPGA board
3. Simulation of simple digital circuit using Verilog HDL/VHDL
4. Simulation of 4-bit multiplier, 8 bit adder, Accumulator/Calculator (Addition, Subtraction and Multiplication of 2's complement numbers)
5. Simulation of Multiplexer, Address decoder
6. Simulation of Clock generator
7. Simulation of Edge Triggered Data Flip Flop
8. Simulation of 2 bit counter as a FSM
9. Simulation of 4/8 bit Barrel shifter, 8 bit Parallel to serial converter (with a 'go' bit forstart of transmission)
10. Simulation of PRBS generator, Memory unit
11. Verification of the Functionality designed in experiment 10 with test bench
12. Synthesis of the (experiment 9) design and power, timing analysis of the synthesized design on an FPGA

Total Hours: 30

Reference Books

1. Practical Electronics Handbook, Ian Sinclair, John Dunton, 6th Edition, Newnes/Elsevier, 2013.
2. Verilog HDL: A Guide to Digital Design and Synthesis, Samir Palnitkar, PHI , 2009
3. VHDL: Programming by Example, Douglas L. Perry, TMH
4. Digital Design with RTL Design, Verilog and VHDL, Frank Vahid, 2nd Edition, Wiley

21CSEP3	DATA STRUCTURES LABORATORY	L	T	P	C
		0	0	2	1

Course Objectives

The course aims:

- To implement linear and non-linear data structures
- To implement non-linear data structures
- To understand the different operations of search trees
- To implement graph traversal algorithms
- To get familiarized to sorting and searching algorithms

Course Outcomes

On completion of the course, students should be able to

1. Apply and implement the learned algorithm for problem solving
2. Identify the data structure to develop program for real time applications
3. Design and develop optimal algorithms using appropriate data structures

INDICATIVE LIST OF EXPERIMENTS (Using C):

1. Array and Linked list implementation of List ADT.
2. Array and Linked list implementation of Stack ADT.
3. Array and Linked list implementation of Queue ADT.
4. Applications of List, Stack and Queue ADTs.
5. Implementation of Binary trees and operations of Binary trees.
6. Implementation of Binary Search Trees.
7. Implementation of AVL Trees.
8. Implementation of Heaps using Priority Queues.
9. Graph representation and Traversal algorithms.
10. Applications of Graphs.
11. Implementation of searching and sorting algorithms.
12. Hashing – any two collision techniques.

Total Hours: 30

Reference Books

1. Ellis Horowitz and Sartaj Sahni, Fundamentals of Data Structures, Galgotia Book Source, Gurgon, 1976.
2. Gregory L. Heilman, Data Structures, Algorithms and Object Oriented Programming, Tata Mcgraw-Hill, New Delhi, 2002.

21ECE05	ANALOG AND DIGITAL COMMUNICATION	L	T	P	C
		3	0	0	3

Course Objectives

- To analyze techniques for the generation, transmission and reception of amplitude modulation, frequency modulation and phase modulation signals
- To gain knowledge of various pulse modulation techniques and the corresponding demodulation techniques
- To understand various digitization techniques, generation, and reconstruction of PCM, DPCM and DM
- To gain knowledge in various band pass digital transmission

Course Outcomes

At the end of the course student will be able

1. Understand about fundamentals of Analog communication
2. Understand the concepts of FM, PM with its transmitter.
3. Explain Pulse modulation techniques
4. Demonstrate all digitalization techniques
5. Demonstrate digital modulation techniques

Unit 1 - Fundamentals of Analog Communication Systems **9**

Introduction to Communication Systems: Modulation – Types - Need for Modulation. Theory of Amplitude Modulation -DSB Signals and Spectra, Suppressed Side Band Amplitude Modulation - Single Side Band Signals and Spectra, Single Side Band Generation, Vestigial Side Band Signals and Spectra, Illustrative Problems.

Unit 2 –Angle Modulation **8**

Principle of frequency and phase modulation-Relation between FMand PM waves-Bandwidth of FM-Narrow band and wideband FM-Generation of FM wave Direct and Indirect methods-FM transmitters-Block diagram-Function of each block-FM Receiver

Unit 3 - Pulse Modulation Techniques **8**

Pulse amplitude modulation – Flat top sampling and Pulse amplitude modulation (PAM), PAM Transmitter and Receiver-Pulse-Time Modulation – Pulse Duration and Pulse Position modulations, PPM spectral analysis, Illustrative Problems.

Unit 4 - Digitization Techniques **9**

Pulse Code Modulation (PCM) - Generation and Reconstruction, Quantization Noise, Non-Uniform Quantization and Companding, PCM with Noise, Delta modulation, Adaptive Delta Modulation, Differential PCM systems (DPCM), Digital Multiplexing-Multiplexers and Hierarchies

Unit 5 - Band Pass Digital Transmission **9**

Coherent ASK (OOK (on-off keying)), FSK, PSK, QAM, Quadrature Carrier and M–ary Systems- M–ary FSK Systems, M–ary PSK Systems, M–ary QAM Systems, Timing and Synchronization, Interference, Non-Coherent Binary Systems, Non-Coherent FSK, Differentially Coherent PSK, Optimum Binary Detection.

Unit 6 –Recent Trends **2**

Total Hours: 45

Text Books

1. Bruce Carlson, & Paul B. Crilly, "Communication Systems – An Introduction to Signals & Noise in Electrical Communication", McGraw-Hill International Edition, 5th

Edition, 2010
2. Simon Haykin, “Communication Systems”, Wiley-India edition, 3rd edition, 2010
3. B. P. Lathi and Z. Ding, Modern Digital and Analog Communication Systems, 4th Edition, Oxford University Press, 2011.

References

1. Sam Shanmugam, “Digital and Analog Communication Systems”, John Wiley, 2005
2. J. M. Wozencraft and I. M. Jacobs, Principles of Communication Engineering, Wiley, 1965.
3. J. R. Barry, E. A. Lee, and D. G. Messerschmitt, Digital Communication, 3rd Edition, Springer, 2004.
4. Taub and Schilling , “Principles of Communication Systems”, 2nd ed., Mc-Graw Hill
5. V Chandra Sekar, “ Analog Communication”, Oxford University Press
6. G.B.Gustafson& C.H. Wilcox, “Advanced Engineering Mathematics”, Springer Verlag, 1998.

21ECE06	NETWORK THEORY	L	T	P	C
		3	0	0	3

Course Objectives

To familiarise the students with

- Electric circuits and networks, Resonance of circuits
- Coupled circuits and their characteristics
- First order transients and sinusoidal steady state analysis
- Electric network models and parameters
- Synthesis a network from its equation

Course Outcomes

At the end of the course student will be able

1. Explain concepts in graphical model used for description of electric networks.
2. Apply the basic network theorems to simplify, analyse and design large-scale Networks
3. Compute the impedance, resonance and responses for RLC circuits
4. Derive network parameters for two-port networks
5. Synthesize one-port and two-port networks

Unit 1 - Network Basics and Theorems **9**

Elements and sources – Graph of a network - Tree and Co–tree – Twigs and links – Matrices associated with graphs; incidence, fundamental cut set and fundamental circuit matrices – Duality - Linearity and non-linearity – Distributed and Lumped parameters - Review of Network Theorems (DC, AC) – Review of steady state AC analysis.

Unit 2 - Resonance, Coupled Circuits **8**

Series, Parallel Resonance – Resonant frequency for a tank circuit – Variation of impedance with frequency – Bandwidth, Q factor of series and parallel resonance – Conductively coupled circuits – Mutual Inductance – Dot convention – Coefficient of coupling – Ideal Transformer – Tuned circuits.

Unit 3 – Transients **8**

Transients (DC, AC) of RL, RC and RLC networks – Time domain analysis of RLC networks - Transmission criteria: Delay and rise time, Elmore's and other definitions.

Unit 4 - Network Parameters **9**

Two port network parameters – Conversion between parameters – Lattice Networks – Interconnection of two–port networks – T and PI representation – Terminated two port networks.

Unit 5 - Compensator Design **9**

Hurwitz polynomials – Positive real function – Synthesis of one port, two port networks – Synthesis of RL and RC networks by Foster and Cauer Methods –State equations for networks.

Unit 6 –Contemporary issues **2**

Total Hours: 45

Text Books

1. William H. Hayt, Jack Kemmerly and Steven M. Durbin, "Engineering Circuit Analysis", McGraw Hill India, 2013(8th Edition – Indian Edition).
2. Sudhakar, S. P. Shyammohan, Circuits and Networks, TMH, 4th Edition 2010.
3. M.S. Sukhija and T.N. Nagsarkar, "Circuits and Networks: Analysis, Design and Synthesis", Oxford University Press India, 2016,

References

1. Valkenburg M.E.Van, Network Analysis, PHI, 3rd Edition, 2009
2. Franklin F.Kuo, Network Analysis and Synthesis, Wiley India, 2nd Edition, 2009
3. B. R. Gupta, Vandana Singhal, Fundamentals of Electrical Networks, S. Chand Publishers, 2005
4. Aatre, Vasudev K., Network Theory and Filter Design, 3rd Edition, 2014
5. Syed Nasar, 3,000 Solved Problems in Electric Circuits, TMH, 2010

21ECE07	ENGINEERING ELECTROMAGNETICS	L	T	P	C
		3	0	0	3

Course Objectives

- To gain knowledge on vector calculus
- To acquire knowledge of various static electric and magnetic fields
- To gain knowledge on different applications of electromagnetic fields
- To acquire knowledge on Electromagnetic Fields in various Materials
- To understand about Maxwell's equations in various forms

Course Outcomes

At the end of the course student will be able

1. Relate vector calculus to electrostatic fields and infer the behavior of static electric field of various Geometries.
2. Summarize the applications of Electrostatics
3. Explore the knowledge in magneto statics fields and its applications.
4. Infer knowledge about electromagnetic fields in various materials and Boundary conditions.
5. Extract the Maxwell's equation in different forms to determine field waves, potential waves, Energy and Charge conservation conditions.

Unit 1 - Electrostatic Fields **9**

Vector Calculus - Scalar and Vector fields - Coordinate Systems and Transformation, Del - Gradient of a Scalar-Divergence of a Vector and Divergence Theorem-Curl of a Vector and Stokes Theorem, Coulombs Law - Coulombs Law in Vector Form - Electric Field Intensity - Electric Field due to discrete charges. electric fields due to point, line, surface and volume charge distributions – Electric flux density – Gauss law – Electric potential – potential gradient –Poisson's and Laplace equations.

Unit 2 - Electrostatic Applications **8**

Field due to dipoles – dipole moment – Current and current density – Conductors and Dielectrics - Boundary conditions – capacitance – Dielectric interface – Capacitance of system of conductors – Dielectric constant and Dielectric strength - Energy stored in capacitor – Energy density.

Unit 3 - Magnetostatics Fields **8**

Biot - Savart Law and Field Intensity - Magnetic Field intensity due to a finite and infinite wire carrying a current - Magnetic field intensity on the axis of a circular loop carrying a current - Amperes Circuital Law - Applications - infinite line current-infinite sheet of current-infinitely long coaxial transmission line. Magnetic Potential-Magnetic Scalar and Vector Potentials - Magnetic Flux Density.

Unit 4 - Magnetic Forces, Materials and Devices **9**

Forces due to magnetic field- Lorentz force equation for a moving charge- Force on a Current Element-Force between Two Current Elements. Magnetic Torque and moment-Magnetic dipole - Magnetization in materials – Classification of Magnetic materials –- magnetic boundary conditions – Inductors - inductances – magnetic energy stored in inductors.

Unit 5 - Time Varying Electromagnetic Fields **9**

Maxwell's Equations - Faradays Law - Displacement Current – Maxwell's Equations in integral form and differential form - Time-Varying Potentials. Wave Propagation-Helmholtz wave Equation-wave motion in free space- perfect dielectric - lossy dielectric and good conductor- Skin effect. Poynting vector and power considerations.

Unit 6 –Contemporary issues **2**

Total Hours: 45

Text Books

1. Matthew Sadiku, 'Elements of Electromagnetics', Oxford University Publication, 2018

2. Edward C. Jordon, Keith G. Balmain, "Electromagnetic Waves and Radiating Systems", Pearson Education, Prentice hall, 2015.
3. William H. Hayt and John A. Buck, 'Engineering Electromagnetics', McGraw Hill Special Indian edition, 2014.

References

1. Joseph A.Edminister, 'Theory and Problems of Electromagnetics-Schaum series'-TMH-2007.
2. J.D.Kraus and D.A Fleisch, Electromagnetics with applications,5/e-Tata McGraw-Hill-2011.
3. Bhag Guru and HuseyinHiziroglu," Electromagnetic Field Theory Fundamentals", Cambridge University Press, 2nd edition, 2004
4. S.P.Ghosh, Lipika Datta, "Electromagnetic Field Theory "1st edition ,Mc Graw Hill Education(India) Private Limited, 2012.
5. David K. Cheng, "Field and Wave Electromagnetics", 2nd edition, Pearson Education, 1989.

21ECE08	LINEAR INTEGRATED CIRCUITS	L	T	P	C
		3	0	0	3

Course Objectives

- To study and analyze the characteristics of op–amp
- To design application which employs op–amp
- To analyze types of ADC, DAC and IC555 Configurations.

Course Outcomes

At the end of the course student will be able

1. Analyze the loop (open and closed) configuration of op–amp.
2. Apply the concept to analog applications
3. Use analog multiplier and PLL for detection of modulated signals.
4. Evaluate the performance of different data converters.
5. Design the Engineering applications using Op-Amp

Unit 1 - IC Fabrication and Circuit Configuration for IC **9**

Manufacturing process of monolithic ICs – Construction of monolithic bipolar transistor – Monolithic diodes – Integrated Resistors – Monolithic Capacitors – Inductors. Differential gain – CMRR, General operational amplifier stages – internal circuit diagrams of IC 741 – DC and AC performance characteristics – slew rate operational amplifier.

Unit 2 - Applications of Operational Amplifiers **9**

Advantages of ICs over discrete components – Open and closed loop configurations- Sign Changer – Scale Changer – Voltage Follower – Adder – Subtractor – Instrumentation amplifier – Integrator – Differentiator – Low–pass, High– pass and Band–pass Butterworth filters, Conditions for oscillations –Sinewave generators - RC Oscillators – LC Oscillators - Comparators – Schmitt trigger – Multivibrators – Precision rectifier – V to I and I to V converters.

Unit 3 - Voltage Regulators and PLL **9**

Timer IC 555 –Timer applications - IC Voltage regulators – LM317 Three terminal fixed and adjustable voltage regulators – IC 723 general purpose regulator– Switching Regulators, Monolithic switching regulator

Operation of the basic PLL – Closed loop analysis – Voltage controlled oscillator – Monolithic PLL IC 565 – application of PLL for AM detection – FM detection.

Unit 4 - Analog to Digital and Digital to Analog Converters **8**

Analog and Digital Data Conversions – specifications – D/A converter– weighted resistor type, R–2R Ladder type – Voltage Mode and Current Mode– high speed sample–and–hold circuits – A/D Converters– Flash type – Counter type-Successive Approximation type – Single Slope, Dual Slope.

Unit 5 - Analog Multiplier and Special Function ICs **8**

Analog Multiplier using Emitter Coupled Transistor Pair – Gilbert Multiplier cell – Variable transconductance technique – analog multiplier and phase detection,

DC-DC converters– Switched capacitor filter IC MF10 – Frequency to Voltage and Voltage to Frequency converters –Audio Power amplifier – Video Amplifier.

Unit 6 –Contemporary issues **2**

Total Hours: 45

Text Books

1. S.Salivahanan& V.S. KanchanaBhaskaran, “Linear Integrated Circuits”, 2nd Edition, TMH, 2015.

2. D.RoyChoudhry, Shail Jain, “Linear Integrated Circuits”, New Age International Pvt. Ltd., 2015.

References

1. B.S.Sonde, “System design using Integrated Circuits” , 2nd Edition, New Age Pub, 2001
2. RamakantA.Gayakwad, “OP–AMP and Linear ICs”, 4th Edition, Prentice Hall / Pearson Education, 2001.
3. Sergio Franco, “Design with operational amplifiers and analog integrated circuits”, 3rd Edition, Tata McGraw–Hill, 2007.
4. Gray and Meyer, “Analysis and Design of Analog Integrated Circuits”, Wiley International, 2005.
5. J.Michael Jacob, “Applications and Design with Analog Integrated Circuits”, Prentice Hall of India, 1996.
6. William D.Stanley, “Operational Amplifiers with Linear Integrated Circuits”, Pearson Education, 2004.
7. K Lal Kishore, “Operational Amplifier and Linear Integrated Circuits”, Pearson Education, 2006.

21ECEP3	COMMUNICATION SYSTEMS LABORATORY	L	T	P	C
		0	0	4	2

Course Objectives

- To provide experience on design, testing and analysis of circuits used in communication engineering.
- Develop the ability to design and experimentally test RF circuits and hardware systems for analog communication systems.
- To understand the concepts of pre-emphasis and de-emphasis in communication transmitters and receivers.
- To understand the concepts of time division multiplexing and de-multiplexing techniques.
- Acquire the ability to design, implement and test modems for digital communication systems

LIST OF EXPERIMENTS

CYCLE I (Six experiments are mandatory)

1. AM generation using discrete components
2. AM using multiplier IC AD534 or AD633.
3. AM detection using envelope detector.
4. IF tuned amplifier.
5. FM using 555 IC.
6. FM generation and demodulation using PLL.
7. Frequency multiplier using PLL
8. Pre-emphasis and de-emphasis circuits
9. Analog signal sampling & Reconstruction

CYCLE II (Six mandatory)

10. Generation of Pseudo Noise Binary sequence using Shift registers
11. Time Division Multiplexing and De-multiplexing
12. Generation & Detection of DM/SIGMA DELTA/ ADM
13. Generation & Detection of PAM/PWM/PPM
14. Generation & Detection of BPSK/DPSK/DEPSK
15. Generation & Detection of PCM
16. QPSK Modulation and Demodulation

Total Hours: 45

References

1. Sam Shanmugam, “Digital and Analog Communication Systems”, John Wiley, 2005
2. J. M. Wozencraft and I. M. Jacobs, Principles of Communication Engineering, Wiley, 1965.
3. J. R. Barry, E. A. Lee, and D. G. Messerschmitt, Digital Communication, 3rd Edition, Springer, 2004.
4. Taub and Schilling , “Principles of Communication Systems”, 2nd ed., Mc-Graw Hill
5. V Chandra Sekar, “Analog Communication”, Oxford University Press, 2008

21ECEP4	LINEAR INTEGRATED CIRCUITS LABORATORY	L	T	P	C
		0	0	4	2

Course Objectives

- To examine the ac and dc characteristics of Opamp 741.
- To practice and familiarize the different applications of IC 741/TL082
- To verify the Filtering characteristics of opamp.
- To simulate the opamp applications using PSpice

LIST OF EXPERIMENTS

1. Implementation of Inverting, Noninverting, differential amplifiers and voltage follower.
2. Implementation of Integrator and Differentiator.
3. Implementation of Schmitt trigger and Instrumentation amplifier.
4. Design of Active low pass, high pass, band pass and notch filters.
5. Implementation of Phase shift and Wien bridge oscillators.
6. Astable and mono stable multivibrators using NE555 Timer.
7. Study of PLL 565 characteristics and its use as Frequency Multiplier.
8. Study of DC power supply using LM317, LM723 and Low Drop out (LDO) Regulator using TPS72.
9. Design of DC to DC converter that can give regulated output voltage for a given input voltage range using TPS40020 IC.
10. Designing with 12 bit parallel input multiplying DAC 7821
11. Simulation of Experiments 4, 5, 6, 7 and 8 using Spice tools.
12. Mini Project

Total Hours: 45

21ECE09	DISCRETE-TIME SIGNAL PROCESSING	L	T	P	C
		3	1	0	4

Course Objectives

- To learn discrete fourier transform, properties of DFT and its application to linear filtering
- To understand the characteristics of digital filters, design digital IIR and FIR filters and apply these filters to filter undesirable signals in various frequency bands
- To understand the effects of finite precision representation on digital filters
- To understand the fundamental concepts of multi rate signal processing and its applications
- To introduce the concepts of adaptive filters and its application to communication engineering

Course Outcomes

At the end of the course, the student should be able to

1. Apply DFT for the analysis of digital signals and systems
2. Design IIR and FIR filters
3. Characterize the effects of finite precision representation on digital filters
4. Design multirate filters
5. Apply adaptive filters appropriately in communication systems

Unit 1-Discrete Fourier Transform **12**

Review of signals and systems, concept of frequency in discrete-time signals, summary of analysis & synthesis equations for FT & DTFT, frequency domain sampling, Discrete Fourier transform (DFT) - deriving DFT from DTFT, properties of DFT - periodicity, symmetry, circular convolution. Linear filtering using DFT. Filtering long data sequences - overlap save and overlap add method. Fast computation of DFT - Radix-2 Decimation-in-time (DIT) Fast Fourier transform (FFT), Decimation-in-frequency (DIF) Fast Fourier transform (FFT). Linear filtering using FFT.

Unit 2-Infinite Impulse Response Filters **12**

Characteristics of practical frequency selective filters. characteristics of commonly used analog filters - Butterworth filters, Chebyshev filters. Design of IIR filters from analog filters (LPF, HPF, BPF, BRF) - Approximation of derivatives, Impulse invariance method, Bilinear transformation. Frequency transformation in the analog domain. Structure of IIR filter - direct form I, direct form II,Cascade, parallel realizations.

Unit 3-Finite Impulse Response Filters **12**

Design of FIR filters - symmetric and Anti-symmetric FIR filters - design of linear phase FIR filters using Fourier series method - FIR filter design using windows (Rectangular, Hamming and Hanning window), Frequency sampling method. FIR filter structures - linear phase structure, direct form realizations.

nit 4-Finite Word Length Effects **11**

Fixed point and floating point number representation - ADC - quantization - truncation and rounding - quantization noise - input / output quantization - coefficient quantization error - product quantization error - overflow error - limit cycle oscillations due to product quantization and summation - scaling to prevent overflow.

Unit 5-Introduction To Digital Signal Processors **11**

DSP functionalities - circular buffering – DSP architecture – Fixed and Floating point architectureprinciples – Programming – Application examples.

Unit 6 –Contemporary issues **2**

Total Hours: 60

Text Books
1. John G. Proakis & Dimitris G.Manolakis, "Digital Signal Processing – Principles, Algorithms & Applications", Fourth Edition, Pearson Education / Prentice Hall, 2007. (UNIT I – V)
References
1. Emmanuel C. Ifeachor & Barrie. W. Jervis, "Digital Signal Processing", Second Edition, Pearson Education / Prentice Hall, 2002. 2. A. V. Oppenheim, R.W. Schafer and J.R. Buck, "Discrete-Time Signal Processing", 8th Indian Reprint, Pearson, 2004. 3. Sanjit K. Mitra, "Digital Signal Processing – A Computer Based Approach", Tata Mc Graw Hill, 2007. 4. Andreas Antoniou, "Digital Signal Processing", Tata Mc Graw Hill, 2006.

21ECE11	COMMUNICATION NETWORKS	L	T	P	C
		3	0	0	3

Course Objectives

- To understand the concepts of network architecture and transmission medium
- To Perform and understand methods for error detection and correction of data.
- To be exposed to various addressing schemes and routing protocols.
- To learn the flow control and congestion control algorithms
- To be familiar with real time applications of networks

Course Outcomes

At the end of the course, the student should be able to

1. Adopt the required functionality at each layer for given application
2. Recognize and Correct the error in the frame
3. Exercise the knowledge of addressing scheme and various routing protocols in data communication to select optimal path.
4. Determine the flow of information from one node to another node in the network
5. Develop real time applications of networks

Unit 1- Fundamentals Of Networking **9**

Overview of Data Communication Networks – Network Topology – Types of Networks – LAN – WAN - Building a Network - Layering and protocols - OSI Model – Overview of Data and Signals.

Unit 2-Data Link Layer **9**

Introduction to Data Link Layer – Link Layer Addressing - Error Detection and Correction -Media access control - Ethernet - Wireless LANs – Bluetooth - Zigbee – Switching.

Unit 3-Routing **9**

Basic Internetworking - Routing – Unicast Routing – Algorithms - Protocols – Multicast Routing - Protocols – IPv4 & IPv6 Addressing - Transition from IPv4 to IPv6.

Unit 4-Transport Layer **8**

Introduction to Transport layer – Protocols - UDP - TCP - Connection management - Flow control - Retransmission – Timer Management - TCP Congestion control - Congestion avoidance – QoS.

Unit 5-Application Layer **8**

Traditional Applications - Electronic Mail – WWW & HTTP – DNS – Need for Cryptography & Network Security.

Unit 6 –Contemporary issues **2**

Total Hours: 45

Text Books

1. Behrouz A. Forouzan, "Data Communications and Networking", Fifth Edition, McGrawHill, 2013.
2. Andrew S. Tanenbaum, David J. Wetherall , "Computer Networks" 5th Edition, Kindle Edition.

References

1. James F. Kurose, Keith W. Ross, "Computer Networking - A Top-Down Approach Featuring the Internet", Fifth Edition, Pearson Education, 2009.
2. Nader. F. Mir, "Computer and Communication Networks", Pearson Prentice Hall Publishers, 2010.
3. Ying-Dar Lin, Ren-Hung Hwang, Fred Baker, "Computer Networks: An Open-Source Approach", Mc Graw Hill Publisher, 2011.
4. Larry L. Peterson, Bruce S. Davie, "Computer Networks: A Systems Approach",

Fifth Edition, Morgan Kaufmann Publishers, 2011.

21ECE12	MICROPROCESSORS ,MICROCONTROLLERS AND INTERFACING TECHNIQUES	L	T	P	C
		3	0	0	3

Course Objectives

- To develop an in-depth understanding of the operation of microprocessors and microcontrollers, machine language programming & interfacing techniques

Course Outcomes

At the end of the course, the student should be able to

1. Describe the architecture, role of CPU, registers of intelmicroprocessors.
2. Write an assembly language programs by using the knowledge on instruction set and programming of 8085 and 8086 processors.
3. Interface a peripheral with 8085/8086 processor.
4. Select a microcontroller required an application by using knowledge gained on architecture of microcontrollers.
5. Develope a microcontroller based system by acquiring knowledge on programming a microcontroller.

Unit 1- The 8085 Microprocessor **9**

Microprocessors Introduction:Computer and its organisation,Programming system,Address Bus, Data Bus and Control Bus,Tristate Bus,Clock generation, Connecting Microprocessorto I/O Devices, Data transfer schemes, Architectural Advancements,Evolution–8085:Hardware Architecture,Instructionset and Programming.

Unit 2-8086 Microprocessor **8**

8086: Hardware Architecture, Instruction set and Programming – Introduction to Architecture of:Intel's P5, Netburst, Core, Nehalem, Skylake, Bonnell, Goldmont and AMD's Bulldozer, Jaguar.

Unit 3- Processor - Peripheral Interfacing **8**

Memory Interfacing and I/O interfacing - Parallel communication interface – Serial communication interface – D/A and A/D Interface - Timer – Keyboard /display controller – Interrupt controller – DMA controller – Programming and applications Case studies: Traffic Light control, LED display , LCD display, Keyboard display interface and Alarm Controller.

Unit 4-Microcontrollers **9**

Introduction toarchitecture of: Intel 8051, PIC 32, ARM Cortex A processor-Introduction to Arduino - AVR Microcontroller History and Features – AVR Architecture and Assembly Language Programming, Programming in C – I/O Port Programming – Instructions – AddressingModes – Bit addressability – AVR Fuse bits – Timer, Counter programming – AVR Interrupts –SPI Bus protocol – SPI Programming in AVR.

Unit 5-Microcontroller Interfacing **9**

ATMEGA32 connection to RS232 – LCD Interfacing – Keyboard Interfacing – ATMEGA32ADC features – Interfacing temperature sensor to AVR – DAC Interfacing – AVR connection torelay – AVR connection to solid state relay – DC motor interfacing – DC motor control usingPWM – Seven Segment Decoder interfacing

Unit-6- Recent Trends **2**

Total Hours: 45

Text Books

1. Muhammad Ali Mazidi, Sarmad Naimi, Sepehr Naimi, AVR Microcontroller andEmbedded Systems: Using Assembly and C, Pearson India, 2014.
2. Krishna Kant, Microprocessors and Microcontrollers, PHI, 1st Edition, 2011.
3. ATmega48A/PA/88A/PA/168A/PA/328/P Complete Datasheet, ATMEL,2012.

References

1. Douglas Hall, S S S P Rao, Microprocessors and its Interfacing, TMH, 3rd Edition, 2012.
2. Rafiquzzaman M, Microprocessors: Theory and Applications, PHI, 2008.
3. N. Senthil Kumar, M. Saravanan, S. Jeevananthan and S. K. Shah, Microprocessors And Interfacing, Oxford Press India, 1st Edition, 2012.
4. Dhananjay Gadre, Programming and Customizing the AVR Microcontroller, TMH, 1st Edition, 2009.
5. Richard H. Barnett, Larry D. O'Cull, Sarah Alison Cox, Embedded C Programming And the ATMEL AVR, Cengage International, 2010

21ECEP5	DIGITAL SIGNAL PROCESSING LABORATORY	L	T	P	C
		0	0	2	1

Objectives:

- To perform basic signal processing operations such as Linear Convolution, CircularConvolution, Auto Correlation, Cross Correlation and Frequency analysis in MATLAB
- To implement FIR and IIR filters in MATLAB and DSP Processor
- To study the architecture of DSP processor
- To design a DSP system to demonstrate the Multi-rate and Adaptive signal processingconcepts.

Course Outcomes

At the end of the course, the student should be able to

1. Carryout basic signal processing operations
2. Demonstrate their abilities towards MATLAB based implementation of various DSP systems
3. Analyze the architecture of a DSP Processor
4. Design and Implement the FIR and IIR Filters in DSP Processor for performing filtering operation over real-time signals
5. Design a DSP system for various applications of DSP

LIST OF EXPERIMENTS: MATLAB / EQUIVALENT SOFTWARE PACKAGE
CYCLE-I

1. Generation of elementary Discrete-Time sequences
2. Linear and Circular convolutions
3. Auto correlation and Cross Correlation
4. Frequency Analysis using DFT
5. Design of FIR filters (LPF/HPF/BPF/BSF) and demonstrates the filtering operation
6. Design of Butterworth and Chebyshev IIR filters (LPF/HPF/BPF/BSF) and demonstrate the filtering operations

DSP PROCESSOR BASED IMPLEMENTATION
CYCLE-II

7. Study of architecture of Digital Signal Processor
8. Perform MAC operation using various addressing modes
9. Generation of various signals and random noise
10. Design and demonstration of FIR Filter for Low pass, High pass, Band pass and Band stop filtering
11. Design and demonstration of Butter worth and Chebyshev IIR Filters for Low pass, High pass, Band pass and Band stop filtering
12. Implement an Up-sampling and Down-sampling operation in DSP Processor

Total Hours:30

21ECEP6	MICROPROCESSORS ,MICROCONTROLLERS AND INTERFACING LABORATORY	L	T	P	C
		0	0	2	1

Course Objectives

To familiarise the students with

- Architecture of 8085, 8086 processor, assembling languageprogramming and interfacing with various modules.
- AVR Microcontroller concepts, architecture,programming and application of Microcontrollers

Course Outcomes

At the end of the course student will be able to

1. Write Assembly Language Programs for Microprocessors and Microcontroller.
2. Interface various devices to a microprocessor/microcontroller, including memoryInterfaceaperipheral with 8085/8086 processor.
3. Design and develop a microcontroller based systems as per the requirements.

LIST OF EXPERIMENTS:

1. Microprocessor Trainer kits: Familiarisation – Hardware, Software

8085 Programs (Any three)

2. Addition of Two 8-Bit Numbers and Sum is 16 Bit.
3. Addition of Two 16-BitNumbers and Sum is 32-bit
4. Subtraction of Two 8-Bit Numbers.
5. Square root of a number

8086 Programs (Any Four)

6. Multiply two 8/16 bit numbers.
7. Divide two 8/16 bit numbers.
8. Finding Largest in the given n number.
9. Arrange 'n' numbers in ascending/descending order.
10. Find Factorial of a number.

Microcontroller Programs(Using ATMEL Studio IDE/ Using Arduino IDE)

11. Microcontroller Programming – Familiarisation

(Any three)

12. Switching ON/OFF LED with Software Button Debounce.
13. Generate Square Wave, Sawtooth Wave, Triangular Wave using PWM.
14. Use Timer to flash LED.
15. Display temperature using temperature sensor (ADC, Interrupts, LCD interface).

Scroll a text on a 16x2 LCD screen.

Total Hours: 30

Textbooks

1. Krishna Kant, "Microprocessors and Microcontrollers: Architecture, Programming and System Design8085,8086,8051,8096",PHIIndia,2014(2nd Edition), ISBN: 9788120348530.
2. Douglas V. Hall and S S S P Rao, "Microprocessors Interfacing", McGraw Hill India, 2012(3rd Edition), ISBN: 9781259006159
3. Arduino Cookbook, Michael Margolis, 2nd Edition, O'Reilly

References

1. N. Senthil Kumar, M. Saravanan, S. Jeevananthan and S. K. Shah, Microprocessors and Interfacing, Oxford Press India, 1st Edition, 2012.
2. Rafiquzzaman M, Microprocessors: Theory and Applications, PHI, 2008.
3. Getting Started with Arduino, Massimo Banzi, 2nd Edition, O'Reilly.

21ECE13	VLSI DESIGN	L	T	P	C
		3	0	0	3

Course Objectives

- Study the fundamentals of CMOS circuits and its characteristics.
- Learn the design and realization of combinational & sequential digital circuits.
- Architectural choices and performance tradeoffs involved in designing and realizing the circuits in CMOS technology are discussed
- Learn the different FPGA architectures and testability of VLSI circuits.

Course Outcomes

At the end of the course student will be able

1. Realize the concepts of digital building blocks using MOS transistor.
2. Design combinational MOS circuits and power strategies.
3. Design and construct Sequential Circuits and Timing systems.
4. Design arithmetic building blocks and memory subsystems.
5. Apply and implement FPGA design flow and testing.

Unit 1 – Introduction to MOS Transistor **9**

MOS Transistor, CMOS logic, Inverter, Pass Transistor, Transmission gate, Layout Design Rules, Gate Layouts, Stick Diagrams, Long-Channel I-V Charters tics, C-V Charters tics, Non ideal I-V Effects, DC Transfer characteristics, RC Delay Model, Elmore Delay, Linear Delay Model, Logical effort, Parasitic Delay, Delay in Logic Gate, Scaling.

Unit 2 – Combinational MOS Logic Circuits **9**

Circuit Families: Static CMOS, Ratioed Circuits, Cascode Voltage Switch Logic, Dynamic Circuits, Pass Transistor Logic, Transmission Gates, Domino, Dual Rail Domino, CPL, DCVSPG, DPL, Circuit Pitfalls.

Power: Dynamic Power, Static Power, Low Power Architecture.

Unit 3 – Sequential Circuit Design **9**

Static latches and Registers, Dynamic latches and Registers, Pulse Registers, Sense Amplifier Based Register, Pipelining, Schmitt Trigger, Monostable Sequential Circuits, Astable Sequential Circuits.

Timing Issues : Timing Classification Of Digital System, Synchronous Design.

Unit 4 - Design Of Arithmetic Building Blocks And Subsystem **8**

Arithmetic Building Blocks: Data Paths, Adders, Multipliers, Shifters, ALUs, power and speed tradeoffs, Case Study: Design as a tradeoff.

Designing Memory and Array structures: Memory Architectures and Building Blocks, Memory Core, Memory Peripheral Circuitry.

Unit 5 – Implementation Strategies And Testing **8**

FPGA Building Block Architectures, FPGA Interconnect Routing Procedures. Design for Testability: *Ad Hoc* Testing, Scan Design, BIST, IDDQ Testing, Design for Manufacturability, Boundary Scan.

Unit 6 –Contemporary issues **2**

Total Hours: 45

Text Books

1. Neil H.E. Weste, David Money Harris "CMOS VLSI Design: A Circuits and SystemsPerspective", 4th Edition, Pearson , 2017 (UNIT I,II,V)

2. Jan M. Rabaey ,Anantha Chandrakasan, Borivoje. Nikolic, ”Digital Integrated Circuits:ADesign perspective”, Second Edition , Pearson , 2016.(UNIT III,IV)

References

1. M.J. Smith, “Application Specific Integrated Circuits”, Addisson Wesley, 1997
2. Sung-Mo kang, Yusuf leblebici, Chulwoo Kim “CMOS Digital Integrated Circuits:Analysis& Design”,4th edition McGraw Hill Education,2013
3. Wayne Wolf, “Modern VLSI Design: System On Chip”, Pearson Education, 2007
4. R.Jacob Baker, Harry W.LI., David E.Boyee, “CMOS Circuit Design, Layout andSimulation”, Prentice Hall of India 2005.

21ECE14	WIRELESS COMMUNICATION	L	T	P	C
		3	0	0	3

Course Objectives

- To study the characteristic of wireless channel
- To understand the design of a cellular system
- To study the various digital signaling techniques and multipath mitigation techniques
- To understand the concepts of multiple antenna techniques

Course Outcomes

The student should be able to:

1. Characterize a wireless channel and evolve the system design specifications
2. Design a cellular system based on resource availability and traffic demands
3. Identify suitable signaling and multipath mitigation techniques for the wireless channel and system under consideration.

Unit 1-Wireless Channels **9**

Large scale path loss – Path loss models: Free Space and Two-Ray models -Link Budget design – Small scale fading- Parameters of mobile multipath channels – Time dispersion parameters-Coherence bandwidth – Doppler spread & Coherence time, fading due to Multipath time delay spread – flat fading – frequency selective fading – Fading due to Doppler spread – fast fading – slow fading.

Unit 2-Cellular Architecture **9**

Multiple Access techniques - FDMA, TDMA, CDMA – Capacity calculations–Cellular concept- Frequency reuse - channel assignment- hand off- interference & system capacity-trunking & grade of service – Coverage and capacity improvement.

Unit 3-Digital Signaling For Fading Channels **9**

Structure of a wireless communication link, Principles of Offset-QPSK, p/4-DQPSK, Minimum Shift Keying, Gaussian Minimum Shift Keying, Error performance in fading channels, OFDM principle – Cyclic prefix, Windowing, PAPR.

Unit 4-Multipath Mitigation Techniques **8**

Equalisation – Adaptive equalization, Linear and Non-Linear equalization, Zero forcing and LMS Algorithms. Diversity – Micro and Macro diversity, Diversity combining techniques, Error probability in fading channels with diversity reception, Rake receiver.

Unit 5-Multiple Antenna Techniques **8**

MIMO systems – spatial multiplexing -System model -Pre-coding - Beam forming - transmitter diversity, receiver diversity- Channel state information-capacity in fading and non-fading channels.

Unit 6 –Contemporary issues **2**

Total Hours: 45

Text Books

1. Rappaport,T.S., ―Wireless communications‖, Pearson Education, Second Edition,2010.(UNIT I, II, IV)
2. Andreas.F. Molisch, ―Wireless Communications‖, John Wiley – India, 2006. (UNIT III,V)

References

1. Wireless Communication –Andrea Goldsmith, Cambridge University Press, 2011
2. Van Nee, R. and Ramji Prasad, ―OFDM for wireless multimedia communications,Artech House, 2000
3. David Tse and Pramod Viswanath, ―Fundamentals of Wireless Communication,Cambridge University Press, 2005.
4. Upena Dalal, ―Wireless Communication‖, Oxford University Press, 2009.

21ECE15	TRANSMISSION LINES AND RF SYSTEMS	L	T	P	C
		3	0	0	3

Course Objectives

- To introduce the various types of transmission lines and its characteristics
- To give thorough understanding about high frequency line, power and impedance measurements
- To impart technical knowledge in impedance matching using smith chart
- To introduce passive filters and basic knowledge of active RF components
- To get acquaintance with RF system transceiver design

Course Outcomes

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

1. Explain the characteristics of transmission lines and its losses
2. Write about the standing wave ratio and input impedance in high frequencytransmission lines
3. Analyze impedance matching by stubs using smith charts
4. Analyze the characteristics of TE and TM waves
5. Design a RF transceiver system for wireless communication

Unit 1-Transmission Line Theory **9**

General theory of Transmission lines - the transmission line - general solution - The infinite line - Wavelength, velocity of propagation - Waveform distortion - the distortion-less line - Loading anddifferent methods of loading - Line not terminated in Z0 - Reflection coefficient - calculation of current, voltage, power delivered and efficiency of transmission - Input and transfer impedance - Open and short circuited lines - reflection factor and reflection loss.

Unit 2-High Frequency Transmission Lines **9**

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

Unit 3-Impedance Matching In High Frequency Lines **9**

Impedance matching: Quarter wave transformer - Impedance matching by stubs - Single stub and double stub matching - Smith chart - Solutions of problems using Smith chart - Single and double stub matching using Smith chart.

Unit 4-Waveguides **8**

General Wave behavior along uniform guiding structures – Transverse Electromagnetic Waves, Transverse Magnetic Waves, Transverse Electric Waves – TM and TE Waves between parallel plates. Field Equations in rectangular waveguides, TM and TE waves in rectangular waveguides, Bessel Functions, TM and TE waves in Circular waveguides.

Unit 5-RF System Design Concepts **8**

Active RF components: Semiconductor basics in RF, bipolar junction transistors, RF field effect transistors, High electron mobility transistors Basic concepts of RF design, Mixers, Low noise amplifiers, voltage control oscillators, Power amplifiers, transducer power gain and stability considerations.

Unit 6 –Contemporary issues **2**

Total Hours: 45

Text Books

1. John D Ryder, “Networks, lines and fields”, 2nd Edition, Prentice Hall India, 2015. (UNIT I-IV)
2. Mathew M. Radmanesh, “Radio Frequency &Microwave Electronics”, Pearson EducationAsia, Second Edition,2002. (UNIT V)

References

1. Reinhold Ludwig and Powel Bretchko,” RF Circuit Design – Theory and Applications”,Pearson Education Asia, First Edition,2001.
2. D. K. Misra, “Radio Frequency and Microwave Communication Circuits- Analysis andDesign”, John Wiley & Sons, 2004.
3. E.C.Jordan and K.G. Balmain, ―Electromagnetic Waves and Radiating Systems Prentice Hall of India, 2006.
4. G.S.N Raju, "Electromagnetic Field Theory and Transmission Lines Pearson Education,First edition 2005.

21ECEP7	VLSI DESIGN LABORATORY	L	T	P	C
		0	0	4	2

Course Objectives

The student should be made:

- To learn Hardware Descriptive Language(Verilog/VHDL)
- To learn the fundamental principles of VLSI circuit design in digital and analogdomain
- To familiarize fusing of logical modules on FPGAs
- To provide hands on design experience with professional design (EDA) platforms

Course Outcomes

At the end of the course, the student should be able to

1. Write ALP Programmes for fixed and Floating Point and Arithmetic operations
2. Interface different I/Os with processor
3. Generate waveforms using Microprocessors
4. Execute Programs in 8051
5. Explain the difference between simulator and Emulator

LIST OF EXPERIMENTS:

1. HDL based design entry and simulation of Combinational circuits
   (a) 4-bit Ripple Carry Adder
   (b) Carry Look ahead adder
   (c) Multiplexer and Demultiplexer
   (d) Decoder and Priority Encoder
   (e) Code Converters
2. HDL based design entry and simulation of Sequential circuits
   (a) Shift register (SISO, SIPO, PIPO)
   (b) Synchronous and asynchronous Counter design
   (c) Mealy and Moore model
3. HDL based design entry, simulation and implementation of Multiplier and ALU.
   Perform Synthesis, P&R, post P&R simulation and static timing analysis.
   Identification of critical path
4. Simulation of Static/Dynamic logic using EDA tool.
5. Design and simulation of a MOS differential amplifier.
6. Layout generation, parasitic extraction and post-simulation of Inverter
7. Area,Delay and Power estimation of Adder using EDA tool.

Total Hours:45

21ECE16	ANTENNAS AND MICROWAVE ENGINEERING	L	T	P	C
		3	0	0	3

Course Objectives

- To enable the student to understand the basic principles in antenna and microwave system design
- To enhance the student knowledge in the area of various antenna designs.
- To enhance the student knowledge in the area of microwave components and antenna for practical applications.

Course Outcomes

The student should be able to:

1. Apply the basic principles and evaluate antenna parameters and link power budgets
2. Design and assess the performance of various antennas
3. Design a microwave system given the application specifications.

Unit1-Introduction To Microwave Systems And Antennas **9**

Microwave frequency bands, Physical concept of radiation, Near- and far-field regions, Fields and Power Radiated by an Antenna, Antenna Pattern Characteristics, Antenna Gain and Efficiency, Aperture Efficiency and Effective Area, Antenna Noise Temperature and G/T,Impedance matching, Friis transmission equation, Link budget and link margin, Noise Characterization of a microwave receiver.

Unit II-Radiation Mechanisms And Design Aspects **9**

Radiation Mechanisms of Linear Wire and Loop antennas, Aperture antennas, Reflector antennas, Microstrip antennas and Frequency independent antennas, Design considerations and applications.

Unit III-Antenna Arrays And Applications **9**

Two-element array, Array factor, Pattern multiplication, Uniformly spaced arrays with uniform and non-uniform excitation amplitudes, Smart antennas.

Unit IV-Passive And Active Microwave Devices **8**

Microwave Passive components: Directional Coupler, Power Divider, Magic Tee, attenuator, resonator, Principles of Microwave Semiconductor Devices: Gunn Diodes, IMPATT diodes, Schottky Barrier diodes, PIN diodes, Microwave tubes: Klystron, TWT, Magnetron.

Unit V-Microwave Design Principles **8**

Impedance transformation, Impedance Matching, Microwave Filter Design, RF and Microwave Amplifier Design, Microwave Power amplifier Design, Low Noise Amplifier Design, Microwave Mixer Design, Microwave Oscillator Design.

Unit 6 –Contemporary issues **2**

Total Hours: 45

Text Books

1. John D Krauss, Ronald J Marhefka and Ahmad S. Khan, "Antennas and Wave Propagation: Fourth Edition, Tata McGraw-Hill, 2006. (UNIT I, II, III).
2. David M. Pozar, "Microwave Engineering", Fourth Edition, Wiley India, 2012.(UNIT I,IV,V).

References

1. Constantine A.Balanis, “Antenna Theory Analysis and Design”, Third edition, John Wiley India Pvt Ltd., 2005.
2. R.E.Collin, "Foundations for Microwave Engineering", Second edition, IEEE Press, 2001.

21ECE17	OPTICAL COMMUNICATION	L	T	P	C
		3	0	0	3

Course Objectives

- To study about the various optical fiber modes, configuration and transmission characteristics of optical fibers
- To learn about the various optical sources, detectors and transmission techniques
- To explore various idea about optical fiber measurements and various coupling techniques
- To enrich the knowledge about optical communication systems and networks

Course Outcomes

At the end of the course student will be able

1. Realize basic elements in optical fibers, different modes and configurations.
2. Analyze the transmission characteristics associated with dispersion and polarizationtechniques.
3. Design optical sources and detectors with their use in optical communicationsystem.
4. Construct fiber optic receiver systems, measurements and coupling techniques.
5. Design optical communication systems and its networks.

Unit 1-Introduction To Optical Fibers **9**

Introduction-general optical fiber communication system- basic optical laws and definitions- optical modes and configurations -mode analysis for optical propagation through fibers- modes in planar wave guide-modes in cylindrical optical fiber-transverse electric and transverse magnetic modes- fiber materials-fiber fabrication techniques-fiber optic cables- classification of optical fiber-single mode fiber-graded index fiber.

Unit 2-Transmission Characteristic Of Optical Fiber **9**

Attenuation-absorption --scattering losses-bending losses-core and cladding losses-signal dispersion –inter symbol interference and bandwidth-intra model dispersion-material dispersion- waveguide dispersion-polarization mode dispersion-intermodal dispersion-dispersion optimization of single mode fiber-characteristics of single mode fiber-R-I Profile- cutoff wave length-dispersion calculation-mode field diameter.

UNIT 3-Optical Sources And Detectors **9**

Sources: Intrinsic and extrinsic material-direct and indirect band gaps-LED-LED structures- surface emitting LED-Edge emitting LED-quantum efficiency and LED power-light source materials-modulation of LED-LASER diodes-modes and threshold conditions-Rate equations-external quantum efficiency-resonant frequencies-structures and radiation patterns-single mode laser-external modulation-temperature effort.

Detectors: PIN photo detector-Avalanche photo diodes-Photo detector noise-noise sources-SNR-detector response time-Avalanche multiplication noise-temperature effects-comparisons of photo detectors.

Unit 4-Optical Receiver, Measurements And Coupling **9**

Fundamental receiver operation-preamplifiers-digital signal transmission-error sources-Front end amplifiers-digital receiver performance-probability of error-receiver sensitivity-quantum limit.

Optical power measurement-attenuation measurement-dispersion measurement- Fiber Numerical Aperture Measurements- Fiber cut- off Wave length Measurements- Fiber diameter measurements-Source to Fiber Power Launching-Lensing Schemes for Coupling Management-Fiber to Fiber Joints-LED Coupling to Single Mode Fibers-Fiber Splicing-Optical Fiber connectors.

Unit 5-Optical Communication Systems And Networks **9**

System design consideration Point – to –Point link design –Link power budget –rise time budget, WDM –Passive DWDM Components-Elements of optical networks-SONET/SDH-Optical Interfaces-SONET/SDH Rings and Networks-High speed light wave Links-OADM configuration-Optical ETHERNET-Soliton.

Unit 6 –Contemporary issues **2**

Total Hours: 45

Text Books

1. P Chakrabarti, "Optical Fiber Communication", McGraw Hill Education (India)Private Limited**,** 2016 (UNIT I, II, III)
2. Gred Keiser,"Optical Fiber Communication", McGraw Hill Education (India) Private Limited. Fifth Edition, Reprint 2013. (UNIT I, IV, V)

References

1. John M.Senior, "Optical fiber communication", Pearson Education, second edition.2007.
2. Rajiv Ramaswami, "Optical Networks " , Second Edition, Elsevier , 2004.
3. J.Gower, "Optical Communication System", Prentice Hall of India, 2001.
4. Govind P. Agrawal, "Fiber-optic communication systems", third edition, John Wiley & sons, 2004.

21ECE18	EMBEDDED AND REAL TIME SYSTEMS	L	T	P	C
		3	0	0	3

Course Objectives

- Understand the concepts of embedded system design and analysis
- Learn the architecture and programming of ARM processor
- Be exposed to the basic concepts of embedded programming
- Learn the real time operating systems

Course Outcomes

At the end of the course student will be able

1. Describe the architecture and programming of ARM processor
2. Outline the concepts of embedded systems
3. Explain the basic concepts of real time operating system design
4. Model real-time applications using embedded-system concepts

Unit I-Introduction To Embedded system Design **9**

Complex systems and micro processors– Embedded system design process –Design example: Model train controller- Design methodologies- Design flows - Requirement Analysis – Specifications-System analysis and architecture design – Quality Assurance techniques - Designing with computing platforms – consumer electronics architecture – platform-level performance analysis.

Unit 2-Arm Processor And Peripherals **9**

ARM Architecture Versions – ARM Architecture – Instruction Set – Stacks and Subroutines – Features of the LPC 214X Family – Peripherals – The Timer Unit – Pulse Width Modulation Unit – UART – Block Diagram of ARM9 and ARM Cortex M3 MCU.

Unit 3-Embedded Programming **9**

Components for embedded programs- Models of programs- Assembly, linking and loading – compilation techniques- Program level performance analysis – Software performance optimization – Program level energy and power analysis and optimization – Analysis and optimization of program size- Program validation and testing.

Unit 4-Real Time Systems **8**

Structure of a Real Time System — Estimating program run times – Task Assignment and Scheduling – Fault Tolerance Techniques – Reliability, Evaluation – Clock Synchronisation.

Unit 5-Processes And Operating Systems **8**

Introduction – Multiple tasks and multiple processes – Multirate systems- Preemptive real-time operating systems- Priority based scheduling- Interprocess communication mechanisms

- Evaluating operating system performance- power optimization strategies for processes – Example Real time operating systems-POSIX-Windows CE. - Distributed embedded systems
- MPSoCs and shared memory multiprocessors. – Design Example - Audio player, Engine control unit – Video accelerator.

Unit 6 –Contemporary issues **2**

Total Hours: 45

Text Books

1. Marilyn Wolf, "Computers as Components - Principles of Embedded Computing System Design", Third Edition "Morgan Kaufmann Publisher (An imprint from Elsevier), 2012. (UNIT I, II, III, V)
2. Jane W.S.Liu," Real Time Systems", Pearson Education, Third Indian Reprint, 2003.(UNIT IV)

References

1. Lyla B.Das, "Embedded Systems : An Integrated Approach" Pearson Education, 2013.
2. Jonathan W.Valvano, "Embedded Microcomputer Systems Real Time Interfacing", Third Edition Cengage Learning, 2012.
3. David. E. Simon, "An Embedded Software Primer", 1st Edition, Fifth Impression, Addison- Wesley Professional, 2007.
4. Raymond J.A. Buhr, Donald L.Bailey, "An Introduction to Real-Time Systems-From Design to Networking with C/C++", Prentice Hall, 1999.
5. C.M. Krishna, Kang G. Shin, "Real-Time Systems", International Editions, Mc Graw Hill 1997
6. K.V.K.K.Prasad, "Embedded Real-Time Systems: Concepts, Design & Programming", Dream Tech Press, 2005.
7. Sriram V Iyer, Pankaj Gupta, "Embedded Real Time Systems Programming", Tata Mc Graw Hill, 2004.

21ECEP8	EMBEDDED LABORATORY	L	T	P	C
		0	0	2	1

Course Objectives

The student should be made to:

- Learn the working of ARM processor
- Understand the Building Blocks of Embedded Systems
- Learn the concept of memory map and memory interface
- Write programs to interface memory, I/Os with processor
- Study the interrupt performance

Course Outcomes

At the end of the course student will be able

1. Write programs in ARM for a specific Application
2. Interface memory, A/D and D/A convertors with ARM system
3. Analyze the performance of interrupt
4. Write program for interfacing keyboard, display, motor and sensor.
5. Formulate a mini project using embedded system

LIST OF EXPERIMENTS:

1. Study of ARM evaluation system
2. Interfacing ADC and DAC.
3. Interfacing LED and PWM.
4. Interfacing real time clock and serial port.
5. Interfacing keyboard and LCD.
6. Interfacing EPROM and interrupt.
7. Mailbox.
8. Interrupt performance characteristics of ARM and FPGA.
9. Flashing of LEDS.
10. Interfacing stepper motor and temperature sensor.
11. Implementing zigbee protocol with ARM.

Total Hours: 30

21ECEP9	ADVANCED COMMUNICATION LABORATORY	L	T	P	C
		0	0	2	1

Course Objectives

The student should be made to:

- Understand the working principle of optical sources, detector, fibers
- Develop understanding of simple optical communication link
- Understand the measurement of BER, Pulse broadening
- Understand and capture an experimental approach to digital wireless communication
- Understand actual communication waveforms that will be sent and received across wireless channel

Course Outcomes

At the end of the course student will be able

1. Measurement of connector, bending and fiber attenuation losses.
2. Numerical Aperture and Mode Characteristics of Fibers.
3. DC Characteristics of LED and PIN Photo diode.
4. Fiber optic Analog and Digital Link Characterization - frequency response(analog), eye diagram and BER (digital)

LIST OF EXPERIMENTS:

LIST OF OPTICAL EXPERIMENTS

1. Measurement of connector, bending and fiber attenuation losses.
2. Numerical Aperture and Mode Characteristics of Fibers.
3. DC Characteristics of LED and PIN Photo diode.
4. Fiber optic Analog and Digital Link Characterization - frequency response(analog), eye diagram and BER (digital)

LIST OF WIRELESS COMMUNICATION EXPERIMENTS

1. Wireless Channel Simulation including fading and Doppler effects
2. Simulation of Channel Estimation, Synchronization & Equalization techniques
3. Analysing Impact of Pulse Shaping and Matched Filtering using Software Defined Radios
4. OFDM Signal Transmission and Reception using Software Defined Radios

Total Hours: 30

PROFESSIONAL ELECTIVE I

21ECE20	MEDICAL ELECTRONICS	L	T	P	C
		3	0	0	3

Course Objectives

- To gain knowledge about the various physiological parameter's measurements
- To understand the various biochemical and nonelectrical sensors
- To study about the assist devices
- To gain knowledge on surgical equipment's and telemetry in healthcare
- To understand the concepts of recent advancements in healthcare.

Course Outcomes

At the end of the course student will be able

1. Explain the electro- physiological parameters and bio-potentials recording
2. Measure the biochemical and non-electrical physiological parameters
3. Interpret the various assist devices used in the hospitals
4. Identify physical medicine methods and biotelemetry
5. Analyse recent trends in medical instrumentation

Unit 1 - Electro-Physiology and Bio-Potential Recording **9**

Sources of bio medical signals, Bio-potentials, Bio potential electrodes, biological amplifiers, ECG, EEG, EMG, PCG, typical waveforms and signal characteristics

Unit 2 - Bio-chemical and Non Electrical Parameter Measurement **9**

pH, PO2, PCO2, Colorimeter, Blood flow meter, Cardiac output, respiratory, blood pressure, temperature and pulse measurement, Blood Cell Counters.

Unit 3 - Assist Devices **8**

Artificial kidney, Dialysis action, hemodialyser unit, membrane dialysis, portable dialyser monitoring and functional parameters, Heart-Lung Machine.

Unit 4 - Physical Medicine and Biotelemetry **9**

Diathermies - Shortwave, ultrasonic and microwave type and their applications, Surgical Diathermy, Biotelemetry - Single Channel and Multiple Channel.

Unit 5 - Recent Trends in Medical Instrumentation **8**

Telemedicine, Insulin Pumps, Radio pill, Endo-microscopy, Brain machine interface, Lab on a chip, Cryogenic Technique.

Unit 6 –Contemporary issues ` **2**

Total Hours: 45

Text Books

1. Leslie Cromwell, "Biomedical Instrumentation and Measurement", Prentice Hall of India, New Delhi, 2011.
2. Khandpur, R.S., "Handbook of Biomedical Instrumentation", TATA McGraw-Hill, New Delhi, 2017.
3. John G.Webster, "Medical Instrumentation Application and Design", Third Edition, Wiley India , 2012.

References

1. Joseph J.Carr and John M.Brown, "Introduction to Biomedical Equipment Technology", John Wiley and Sons, New York, 2011.
2. R.Anandanatarajan, "Biomedical Instrumentation and Measurements", Second Edition, PHI Learning, 2016.

3. Mandeep singh, “Introduction to Biomedical Instrumentation”, Second Edition, Prentice Hall of India, New Delhi,2014
4. Shakti Chatterjee, Aubert Miller, “Biomedical Instrumentation Systems”, Cengage Learning, 2012
5. C.Raja Rao, Sujoy K.Guha, “ Principles of Medical Electronics and Biomedical Instrumentation”, Universities Press, 2010

21ECE21	ROBOTICS AND AUTOMATION	L	T	P	C
		3	0	0	3

Course Objectives

- To introduce basic components required for Robot
- To analyze different control mechanism applied for Robotics
- To understand the concept of path planning in Robotics
- To Manipulate forward and inverse kinematics
- To understand application of robots in various fields

Course Outcomes

At the end of the course student will be able

1. Describe the components required for robotics
2. Demonstrate control mechanism required for Robotics
3. Explain path planning of Robotics
4. Demonstrate forward and inverse kinematics

Demonstrate application of Robots in industrial and other application

Unit 1 - Introduction 9

Robotics – Basic components – Classification – Performance characteristics – Actuators- Electric actuator- DC motor horse power calculation, magnetostrictive hydraulic and pneumatic actuators. Sensors and vision systems: Different types of robot transducers and sensors – Tactile sensors – Proximity and range sensors –ultrasonic sensor-touch sensors-slip sensors-sensor calibration- vision systems – Image processing and analysis – image data reduction – segmentation feature extraction – Object recognition.

Unit 2 - Robot Control 8

Control of robot manipulators- state equations-constant solutions-linear feedback systems-single axis PID control- PD gravity control- computed torque control- variable structure control- Impedance control..

Unit 3 - End Effectors 9

End effectors and tools– types – Mechanical grippers – Vacuum cups – Magnetic grippers – Robot end effectors interface, workspace analysis work envelope-workspace fixtures-pick and place operation- continuous path motion interpolated motion- straight line motion.

Unit 4 - Robot Motion Analysis 8

Robot motion analysis and control: Manipulator kinematics –forward and inverse kinematics- arm equation-link coordinates- Homogeneous transformations and rotations and Robot dynamics.

Unit 5 - Robot Applications 9

Industrial and Non industrial robots, Robots for welding, painting and assembly – Remote Controlled robots – Robots for nuclear, thermal and chemical plants – Industrial automation – Typical examples of automated industries.

Unit 6 –Contemporary issues ` 2

Total Hours: 45

Text Books

1. Mikel P. Grover, 'Industrial Robots – Technology Programming and Applications', second edition, McGraw Hill, 2012
2. Robert J.Schilling 'Fundamentals of Robotics-Analysis and Control', PHI, 2015,

3. R.K.Mittal and I.J.Nagrath, Robotics and Control, Tata McGraw Hill, New Delhi,4th Reprint, 2005.

References

1. K.S.Fu,R.C.Gonzalez, CSG. Lee, "Robotics, Control sensing vision and Intelligence", Tata Mcgraw-Hill, Indian edition, 2008.
2. JohnJ.Craig, "Introduction to Robotics Mechanics and Control", Third edition, Pearson Education 2009.
3. M.P.Groover, M.Weiss, R.N. Nageland N. G.Odrej, "Industrial Robotics", McGraw-Hill, Singapore, 2007
4. Ashitava Ghoshal, "Robotics-Fundamental Concepts and Analysis", Oxford University Press, Sixth impression, 2010
5. B.K.Ghosh, "Control in Robotics and Automation: Sensor Based Integration", Allied Publishers, Chennai,

21ECE22	NANO TECHNOLOGY AND APPLICATIONS	L	T	P	C
		3	0	0	3

Course Objectives

- To understand the basic concepts of Nanotechnology
- To obtain a broad idea on fundamentals of Nano electronics
- To study the channel and gate effect of MOS system
- To analyze the process involved in carbon nanotubes
- To study the recent trends of Nano devices in the industry

Course Outcomes

At the end of the course student will be able

1. Defines the basic concepts of nanotechnology
2. Explains the conceptual ideas behind Nano electronics
3. Describes the concepts of Silicon MOSFET and quantum transport devices
4. Get a clear idea on process involved in carbon nanotubes and their properties
5. Be familiar with molecular electronics and future applications

Unit 1 - Introduction to Nanotechnology **9**

Background to nanotechnology: Types of nanotechnology and nano machines; Molecular, Nanotechnology: Electron microscope-scanning electron microscope-atomic force microscope- scanning tunneling microscope-nano manipulator-nano tweezers-atom manipulation-nano dots; Top down and bottom-up approaches: self-assembly-dip pen nano lithography. Nanomaterials: preparation-plasma arcing-chemical vapor deposition-sol-gels-electrode position ball milling

Unit 2 - Fundamentals of Nanoelectronics **9**

Fundamentals of logic devices: -Requirements-dynamic properties-threshold gates; physical limits to computations; concepts of logic devices:-classifications-two terminal devices-field effect devices-coulomb blockade devices-spintronics-quantum dot cellular automata-quantum computing-DNA computer, Ultimate computation:-power dissipation limit-dissipation in reversible computation.

Unit 3 - Silicon MOSFETS **9**

Silicon MOSFETS-Novel materials and alternate concepts:-fundamentals of MOSFET Devices-scaling rules-silicon-dioxide based gate dielectrics-metal gates-junctions & contacts-advanced MOSFET concepts. Quantum transport devices based on resonant tunneling:-Electron tunneling-resonant tunneling diodes-resonant tunneling devices; Single electron devices for logic applications:-Single electron devices

Unit 4 - Carbon Nanotubes8

Fullerenes-types of nanotubes-formation of nanotubes-assemblies-purification of carbon nanotubes-electronic properties-synthesis of carbon nanotubes-carbon nanotube interconnects carbon nanotube FETs-Nanotube for memory applications.

Unit 5 - Molecular Electronics **8**

Electrodes & contacts-functions-molecular electronic devices-first test systems-simulation and circuit design-fabrication; Future applications.

Unit 6 –Contemporary issues ` **2**

Total Hours: 45

Text Books

1. Michael Wilson, KamaliKannangara, Geoff Smith, Michelle Simmons and Burkhard Raguse, Chapman & Hall 'Nanotechnology: Basic Science and Emerging

Technologies',CRC,2002
2. T.Pradeep, "NANO: The Essentials-Understanding Nanoscience and Nanotechnology' TMH,2007
3. Prof. Marc Baldo, "Introduction to Nanoelectronics", TMH,2010

References

1. Rainer Waser (Ed.), "Nanoelectronics and Information Technology: Advanced Electronic Materials and Novel Devices", Wiley-VCH,2012
2. George W. Hanson, "Fundamentals of Nano Electronics", Prentice Hall,2008
3. Vladimir V. Mitin, ,Viatcheslav A. Kochelap, Michael A. Stroscio, "Introduction to Nano Electronics", Cambridge University Press, 2012
4. Manoj Kumar Majumder , Vijay Rao Kumbhare, Brajesh Kumar Kaushik, "Introduction to Microelectronics to Nano Electronics -Design and Technology", CRC Press,2020
5. Vladimir V Mitin, Viatcheslav A Kochelap, Introduction to Nanoelectronics, applications, Cambridge University Press, 2018

21ECE23	OBJECT ORIENTED PROGRAMMING	L	T	P	C
		3	0	0	3

Course Objectives

- To understand Object Oriented Programming concepts and basic characteristics of Java
- To know the principles of packages, inheritance, and interfaces
- To define exceptions and use I/O streams
- To develop a java application with threads and generics classes
- To design and build simple Graphical User Interfaces

Course Outcomes

At the end of the course student will be able

1. Develop Java programs using OOP principles
2. Develop Java programs with the concepts inheritance and interfaces
3. Build Java applications using exceptions and I/O streams
4. Develop Java applications with threads and generics classes
5. Develop interactive Java programs using swings

Unit 1 - Introduction to OOP and JAVA Fundamentals 9

Object Oriented Programming - Abstraction – objects and classes - Encapsulation- Inheritance - Polymorphism- OOP in Java – Characteristics of Java – The Java Environment - Java Source File -Structure – Compilation. Fundamental Programming Structures in Java – Defining classes in Java – constructors, methods -access specifiers - static members -Comments, Data Types, Variables, Operators, Control Flow, Arrays, Packages - JavaDoc comments.

Unit 2 - Inheritance and Interfaces 9

Inheritance – Super classes- sub classes –Protected members – constructors in sub classes- the Object class – abstract classes and methods- final methods and classes – Interfaces – defining an interface, implementing interface, differences between classes and interfaces and extending interfaces - Object cloning -inner classes, Array Lists – Strings

Unit 3 - Exception Handling and I/O 8

Exceptions - exception hierarchy - throwing and catching exceptions – built-in exceptions, creating own exceptions, Stack Trace Elements. Input / Output Basics – Streams – Byte streams and Character streams – Reading and Writing Console – Reading and Writing Files

Unit 4 - Multithreading and Generic Programming 8

Differences between multi-threading and multitasking, thread life cycle, creating threads, synchronizing threads, Inter-thread communication, daemon threads, thread groups. Generic Programming – Generic classes – generic methods – Bounded Types – Restrictions and Limitations.

Unit 5 - Event Driven Programming 9

Graphics programming - Frame – Components - working with 2D shapes - Using color, fonts, and images - Basics of event handling - event handlers - adapter classes - actions - mouse events - AWT event hierarchy - Introduction to Swing – layout management - Swing Components – Text Fields, Text Areas – Buttons- Check Boxes – Radio Buttons – Lists- choices- Scrollbars – Windows –Menus – Dialog Boxes.

Unit 6 –Contemporary issues ` 2

Total Hours: 45

Text Books

1. Herbert Schildt, “Java The complete reference”, 8th Edition, McGraw Hill Education,

2011.
2. Cay S. Horstmann, Gary cornell, "Core Java Volume –I Fundamentals", 9th Edition, Prentice Hall, 2013.

References

1. Paul Deitel, Harvey Deitel, "Java SE 8 for programmers", 3rd Edition, Pearson, 2015.
2. Steven Holzner, "Java 2 Black book", Dreamtech press, 2011.
3. Timothy Budd, "Understanding Object-oriented programming with Java", Updated Edition, Pearson Education, 2000.

21ECE24	NUMERICAL ANALYSIS USING MATLAB	L	T	P	C
		3	0	0	3

Course Objectives

- To understand basic representation of Matrices and vectors in MATLAB;
- To learn various program- ming structures in MATLAB;
- To study built in and user defined functions in MATLAB;
- To become conversant with 2D as well as 3D graphics in MATLAB;
- To make a Graphical User Interface (GUI) in MATLAB to achieve interactivity

Course Outcomes

At the end of the course student will be able

1. Explain the various programming structures, functions, and data types in MATLAB
2. Apply MATLAB for real time applications with the ability to plot on graphics and design in- teractive GUI
3. Develop an understanding of MATLAB for designing systems as per requirements
4. Work as part of a team and as individual effectively in applying MATLAB as a tool following the safety procedures and ethics
5. Find, interpret and communicate documentation related to MATLAB programming.

Unit 1 – Scalars and Vectors **9**

Basics: MATLAB IDE – MATLAB Script Files – MATLAB Editor

Scalar variables: Approximation of numbers and discrete mathematical operations – mathematical ex- pressions – Relational and Logical Operations – Complex Scalar Variables, Vector Variables: Vector creation – Relational and Logical Operations – accessing elements – arithmetic operations – plotting vectors.

Unit 2 - Arrays, Functions **8**

Creating arrays – relational and logical operations – accessing elements – arithmetic operations – plot- ting arrays Creating functions – scope of variables.

Unit 3 - Loops and Decisions, Structures **9**

Conditional statements: 'if 'statements, 'if else' statements, recursive functions, 'if elseif else' state- ments, 'switch case' statements Loop Statements: 'for' loop statements, combined 'for' and 'if' statements, 'while' statements, 'nested for' statements, 'try and catch' Structures: Structures in MATLAB – A vector of structures.

Unit 4 – Graphic **9**

The plotting process – Graph components – Figure tools – arranging graph within a figure – Selecting the plot types – editing plots – Basic 2D – using subplot for multiple graphs – Interactive plotting – Basic Fitting Interface – Polyfit – 3D plots – Images: reading and writing images – Saving and printing graphs – animation – GUI: Creation Fundamentals – Layout GUIDE – Programming GUIDE –Capturing mouse actions.

Unit 5 - Applications **8**

Numeric Computation Applications: Linear Algebra – Curve Fitting and Interpolation – Data Analysis and Statistics – Numerical Integration (Quadrature) – Ordinary Differential Equations – Non-linear Algebraic Equations (Roots of a polynomial)

Symbolic Computation Applications: The Symbolic Math Toolbox – Algebraic equations – Differentiation and Integration – Differential Equations – Laplace and Fourier Transforms Introduction to Simulink.

Unit 6 –Contemporary issues ` **2**

Total Hours: 45

Text Books
1. MuntherGdeisat Francis Lilley, "MATLAB by example: Programming Basics", Elsevier India,2013 (1st Edition). 2. Ram N Patel, Ankush Mittal, "Programming in MATLAB: A Problem-Solving Approach", Pearson India, 2014(1st Edition).
References
1. Raj Kumar Bansal, Ashok Goel, Manoj Kumar Sharma, "MATLAB and its applications in Engineering", Pearson India, 2016(2nd Edition). 2. William J. Palm III, "MATLAB for Engineering Applications", McGraw Hill U.S., 2019. 3. Huei-Huang Lee, "Programming with MATLAB 2016", SDC Publications Korea, 2016(1st Edition).

PROFESSIONAL ELECTIVE II

21ECE25	SOFT COMPUTING	L	T	P	C
		3	0	0	3

Course Objectives

- To learn the basic concepts of Soft Computing
- To become familiar with various techniques like neural networks, genetic algorithms and fuzzy systems.
- To apply soft computing techniques to solve problems

Course Outcomes

At the end of the course, the student should be able to

1. Apply suitable soft computing techniques for various applications.
2. Integrate various soft computing techniques for complex problems.

Unit 1-Introduction To Soft Computing **9**

Introduction-Artificial Intelligence-Artificial Neural Networks-Fuzzy Systems-Genetic Algorithm and Evolutionary Programming-Swarm Intelligent Systems-Classification of ANNs-McCulloch and Pitts Neuron Model-Learning Rules: Hebbian and Delta- Perceptron Network-Adaline Network-Madaline Network.

Unit 2-Artificial Neural Networks **9**

Back propagation Neural Networks - Kohonen Neural Network -Learning Vector Quantization -Hamming Neural Network - Hopfield Neural Network- Bi-directional Associative Memory -Adaptive Resonance Theory Neural Networks- Support Vector Machines - Spike Neuron Models.

Unit 3-Fuzzy Systems **9**

Introduction to Fuzzy Logic, Classical Sets and Fuzzy Sets - Classical Relations and Fuzzy Relations -Membership Functions -Defuzzification - Fuzzy Arithmetic and Fuzzy Measures - Fuzzy Rule Base and Approximate Reasoning - Introduction to Fuzzy Decision Making.

Unit 4-Genetic Algorithms **9**

Basic Concepts- Working Principles -Encoding- Fitness Function - Reproduction - Inheritance Operators - Cross Over - Inversion and Deletion -Mutation Operator - Bit-wise Operators -Convergence of Genetic Algorithm.

Unit 5-Hybrid Systems **9**

Hybrid Systems -Neural Networks, Fuzzy Logic and Genetic -GA Based Weight Determination - LR-Type Fuzzy Numbers - Fuzzy Neuron - Fuzzy BP Architecture - Learning in Fuzzy BP- Inference by Fuzzy BP - Fuzzy ArtMap: A Brief Introduction - Soft Computing Tools - GA in Fuzzy Logic Controller Design - Fuzzy Logic Controller

Total Hours: 45

Text Books

1. N.P.Padhy, S.P.Simon, "Soft Computing with MATLAB Programming", Oxford University Press, 2015.
2. S.N.Sivanandam ,S.N.Deepa, "Principles of Soft Computing", Wiley India Pvt.Ltd., 2nd Edition, 2011.
3. S.Rajasekaran, G.A.VijayalakshmiPai, "Neural Networks, Fuzzy Logic and Genetic

Algorithm, Synthesis and Applications ", PHI Learning Pvt.Ltd., 2017.

References

1. Jyh-Shing Roger Jang, Chuen-Tsai Sun, Eiji Mizutani, "Neuro-Fuzzy and Soft Computing", Prentice-Hall of India, 2002.
2. KwangH.Lee, "First course on Fuzzy Theory and Applications", Springer, 2005.
3. George J. Klir and Bo Yuan, "Fuzzy Sets and Fuzzy Logic-Theory and Applications", Prentice Hall, 1996.
4. James A. Freeman and David M. Skapura, "Neural Networks Algorithms, Applications, and Programming Techniques", Addison Wesley, 2003.

21ECE26	PRINCIPLES OF MANAGEMENT	L	T	P	C
		3	0	0	3

Course Objectives

The student should be made to:

- To enable the students to study the evolution of Management, to study the functions and principles of management and to learn the application of the principles in an organization.

Course Outcomes

At the end of the course, the student should be able to:

- Managerial functions like planning, organizing, staffing, leading & controlling and have same basic knowledge on international aspect of management

Unit 1 –Introduction To Management And Organizations **9**

Definition of Management – Science or Art – Manager Vs Entrepreneur - types of managers -managerial roles and skills – Evolution of Management – Scientific, human relations, system andcontingency approaches –Types of Business organization- Sole proprietorship, partnership,company-public and private sector enterprises - Organization culture and Environment – Currenttrends andissuesinManagement**.**

Unit 2-Planning **9**

Nature and purpose of planning – planning process – types of planning – objectives – settingobjectives–policies–Planningpremises–StrategicManagement– PlanningToolsandTechniques–Decisionmakingsteps andprocess**.**

Unit 3-Organising **9**

Nature andpurpose–Formal and informal organization–organization chart – organization structure – types – Line and staff authority – departmentalization – delegation of authority –centralization and decentralization – Job Design - Human Resource Management – HR Planning,Recruitment, selection, Training and Development, Performance Management, Career planningandmanagement

Unit 4-Directing **9**

Foundations of individual and group behaviour – motivation – motivation theories – motivationaltechniques – job satisfaction – job enrichment – leadership – types and theories of leadership –communication– process of communication– barrier incommunication–effectivecommunication
–communication and IT.

Unit 5-Controlling **9**

System and process of controlling – budgetary and non-budgetary control techniques – use ofcomputers and IT in Management control – Productivity problems and management – control andperformance–directandpreventivecontrol–reporting**.**

Total Hours: 45

Text Books

1. Stephen P. Robbins & Mary Coulter, “Management”, Prentice Hall (India) Pvt. Ltd., 10th Edition, 2009.
2. JAF Stoner, Freeman R.E and Daniel R Gilbert “Management”, Pearson Education, 6th Edition, 2004.

References

1. Stephen A. Robbins & David A. Decenzo& Mary Coulter, "Fundamentals of Management" Pearson Education, 7th Edition, 2011.
2. Robert Kreitner&MamataMohapatra, " Management", Biztantra, 2008.
3. Harold Koontz & Heinz Weihrich "Essentials of management" Tata McGraw Hill,1998.
4. Tripathy PC & Reddy PN, "Principles of Management", Tata McGraw Hill, 1999

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21ECE27	COMPUTER ARCHITECTURE AND ORGANIZATION	L	T	P	C
		3	0	0	3

Course Objectives

- To make students understand the basic structure and operation of digital computer
- To familiarize with implementation of fixed point and floating-point arithmetic operations
- To study the design of data path unit and control unit for processor
- To understand the concept of various memories and interfacing
- To introduce the parallel processing technique

Course Outcomes

At the end of the course, the student should be able to

- Describe data representation, instruction formats and the operation of a digital computer
- Illustrate the fixed point and floating-point arithmetic for ALU operation
- Discuss about implementation schemes of control unit and pipeline performance
- Explain the concept of various memories, interfacing and organization of multiple processors
- Discuss parallel processing technique and unconventional architectures

Unit 1-Computer Organization & Instructions **9**

Basics of a computer system: Evolution, Ideas, Technology, Performance, Powerwall, Uniprocessors to Multiprocessors. Addressing and addressing modes.Instructions: Operations and Operands, Representing instructions, Logical operations, control operations**.**

Unit 2-Arithmetic **9**

Fixed point Addition, Subtraction, Multiplication and Division.Floating Point arithmetic, High performance arithmetic,Sub word parallelism.

Unit 3-The processor **9**

Introduction, Logic Design Conventions, Building a Datapath - A Simple Implementation scheme -An Overview of Pipelining - Pipelined Datapath and Control. Data Hazards: Forwarding versus Stalling,Control Hazards,Exceptions,Parallelism via Instructions**.**

Unit 4-Memory and I/O Organization **9**

Memory hierarchy,Memory Chip Organization,Cache memory,Virtual memory.
Parallel Bus Architectures, Internal Communication Methodologies, Serial Bus Architectures, Mass storage,Input and Output Devices**.**

Unit 5- Advanced Computer architecture **9**

Parallel processing architectures and challenges, Hardware multithreading, Multicore and sharedmemory multiprocessors, Introduction to Graphics Processing Units, Clusters and Warehousescalecomputers –Introduction to Multiprocessor network topologies.

Total Hours: 45

Text Books

1. David A. Patterson and John L. Hennessey, “Computer Organization and Design”, Fifth edition, Morgan Kauffman / Elsevier, 2014. (UNIT I-V)
2. Miles J. Murdocca and Vincent P. Heuring, “Computer Architecture and Organization: An Integrated approach”, Second edition, Wiley India Pvt Ltd, 2015 (UNIT IV,V)

References

1. V. Carl Hamacher, Zvonko G. Varanesic and Safat G. Zaky, “Computer Organization“,
2. William Stallings “Computer Organization and Architecture”, Seventh Edition, Pearson Education, 2006.
3. Govindarajalu, “Computer Architecture and Organization, Design Principles and Applications", Second edition, McGraw-Hill Education India Pvt Ltd, 2014.

21ECE28	MULTIMEDIA COMPRESSION AND COMMUNICATION	L	T	P	C
		3	0	0	3

Course Objectives

The student should be made:

- To understand the compression schemes for text, voice, image and video
- To understand the QoS issues in multimedia network
- To know the communication protocols for multimedia networking

Course Outcomes

At the end of the course, the student should be able to

1. Design audio compression techniques
2. Configure Text, image and video compression techniques
3. Select suitable service model for specific application
4. Configure multimedia communication network

Unit 1-Audio Compression **9**

Sampling and Quantization of Speech (PCM) - Adaptive differential PCM - Delta Modulation -Vector Quantization- Linear predictive coding(LPC) – Code excited Linear predictive Coding(CELP)

Unit 2-Image And Video Compression **9**

Graphics Interchange format- Tagged image file format-Digitized documents-Digitized pictures- JPEG- Video Encoding-Motion estimation–Overview of H.263 and MPEG-2

Unit 3-Text Compression **7**

Staticand Dynamic Huffman coding –Arithmetic coding–Lempel-Ziv coding–LZWcoding

Unit 4-Guaranteed Service Model **10**

Best Effort service model–Scheduling and Dropping policies–Network Performance Parameters-Quality of Service and metrics – WFQ and its variants – Random Early Detection – QoS aware Routing – Admission Control – Resource Reservation – RSVP - Traffic Shaping Algorithms –Caching–Laissez Faire Approach-Possible Architectures–An Overview of QoS Architectures

Unit 5-Multimedia Communication **10**

Stream characteristics for Continuous media–Temporal Relationship–Object Stream Interactions,Media Levity,Media Synchronization–Models forTemporal Specifications–Streaming of Audio and Video – Jitter – Fixed playout and Adaptive playout – Recovering frompacketloss–RTSP—Multimedia Communication Standards–RTP/RTCP–SIPand H.263

Total Hours: 45

Text Books

1. FredHalsall -Multimediacommunication-Applications,Network Protocols and Standards, Pearson education, 2007**.**

References

1. Tay Vaughan, ―Multimedia Making it work , McGraw-Hill Osborne Media, 2006.
2. Kurose and W. Ross, ―Computer Networking ―A Top Down Approach, Pearson education,3rd ed, 2005.
3. KR. Rao,Z S Bojkovic, D A Milovanovic, ―Multimedia Communication Systems: Techniques,Standards, and Networks‖, Pearson Education 2007
4. R. Steimnetz, K. Nahrstedt, ―Multimedia Computing, Communications and Applications‖,Pearson Education, First ed, 1995.
5. Nalin K Sharda, 'Multimedia Information Networking', Prentice Hall of India, 1999
6. Aura Ganz, Zvi Ganz and KittiWongthawaravat, 'Multimedia WirelessNetworks: Technologies, Standards and QoS', Prentice Hall, 2003.
7. Ellen Kayata Wesel, 'Wireless Multimedia Communications: Networking Video, Voice and Data', Addision Wesley, 1998

21ECE29	CMOS ANALOG IC DESIGN	L	T	P	C
		3	0	0	3

Course Objectives

- To study the fundamentals of analog circuits and MOS device models
- To gain knowledge on various configurations of MOS transistors and feedback concepts
- To study the characteristics of noise and frequency response of the amplifier
- To learn the concepts of Op-Amp frequency compensation, capacitor switches and PLLs.

Course Outcomes

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

1. Realize the concepts of Analog MOS devices and current mirror circuits.
2. Design different configuration of Amplifiers and feedback circuits.
3. Analyze the characteristics of frequency response of the amplifier and its noise.
4. Analyze the performance of the stability and frequency compensation techniques of Op- Amp Circuits.
5. Construct switched capacitor circuits and PLLs.

Unit 1–Introduction to Analog IC Design and current mirrors 9

Concepts of Analog Design - General consideration of MOS devices – MOS I/V Characteristics –Second order effects –MOS device models. Basic current mirrors- Cascode current mirrors-Active current mirrors-Large and Small signal analysis-Common mode properties**.**

Unit 2-Amplifiers And feedback 9

Basic Concepts – Common source stage- Source follower- Common gate stage- Cascode stage.Single ended and differential operation-BasicDifferential pair-Common mode response-Differential pair with MOS loads- Gilbert Cell. Feedback- General Considerationof feedback circuits-Feedback topologies-Effect of loading-Effect of feedback on Noise.

Unit 3-Frequency Response Of Amplifiers And Noise 9

General considerations- Miller Effect and Association of Poles with Nodes, Common source stage- Source followers- Common gate stage- Cascode stage- Differential pair. Noise-Statistical characteristics of noise- Types of noise- Representation of noise in circuits- Noise in single stage amplifiers-Noise in differential pairs-Noise Bandwidth.

Unit 4-Operational Amplifier Stability And Frequency Compensation 9

General Considerations- One and Two Stage Op Amps- Gain Boosting- Comparison-Common mode feedback- Input range limitations- Slew rate- Power Supply Rejection- Noise in Op Amps-General consideration of stability and frequency compensation- Multipole system- Phase margin-Frequency compensation-Compensation of two stage op Amps-Other compensation Techniques**.**

Unit 5- Switched Capacitor Circuits And PLLs 9

General Considerations- Sampling switches- Switched Capacitor Amplifiers- Switched Capacitor Integrator-Switched Capacitor Common mode feedback. Phase Locked Loops-Simple PLL-Charge pump PLLs –Non ideal Effects in PLLs-Delay locked loops-its Applications.

Total Hours: 45

Text Books

1. BehzadRazavi,"DesignofAnalogCMOSIntegratedCircuits",TataMcGrawHill,2001, 33rdre-print,2016.

References

1. Phillip Allen and Douglas Holmberg "CMOS Analog Circuit Design" Second Edition, Oxford University Press, 2004.
2. Paul R. Gray, Paul J. Hurst, Stephen H. Lewis, Robert G. Meyer, Analysis and Design of Analog Integrated Circuits, 5th Edition, Wiley, 2009
3. Grebene, "Bipolar and MOS Analog Integrated circuit design", John Wiley & sons, Inc., 2003

21ECE30	ELECTRONICS PACKAGING AND TESTING	L	T	P	C
		3	0	0	3

Course Objectives

- To introduce and discuss various issues related to the system packaging

Course Outcomes

At the end of the course, the student should be able to:

1. Give a comprehensive introduction to the various packaging types used along with the associated thermal, speed, signal and integrity power issues
2. Enable design of packages which can withstand higher temperature, vibrations and shock
3. Design of PCBs which minimize the EMI and operate at higher frequency
4. Analyze the concepts of Testing and testing methods

Unit 1- Overview Of Electronic Systems Packaging 9

Functions of an Electronic Package, Packaging Hierarchy, IC packaging: MEMS packaging, consumer electronics packaging, medical electronics packaging, Trends, Challenges, Driving Forces on Packaging Technology, Materials for Microelectronic packaging, Packaging Material Properties, Ceramics, Polymers, and Metals in Packaging, Material for high density inter connect substrates

Unit 2- Electrical Issues In Packaging 9

Electrical Issues of Systems Packaging, Signal Distribution, Power Distribution, ElectromagneticInterference, Transmission Lines, Clock Distribution, Noise Sources, Digital and RF Issues. DesignProcess Electrical Design: Interconnect Capacitance, Resistance and Inductance fundamentals; Packaging road maps-Hybrid circuits - Resistive,Capacitive and Inductive parasitics.

Unit 3- Chip Packages 9

IC Assembly - Purpose, Requirements, Technologies, Wire bonding, Tape Automated Bonding,Flip Chip, Wafer Level Packaging, reliability, wafer level burn – in and test. Single chip packaging:functions, types, materials processes, properties, characteristics, trends. Multi chip packaging:types, design, comparison, trends. System –in - package(SIP); Passives: discrete,integrated,and embedded

Unit 4-PCB, Surface Mount Technology And Thermal Considerations 9

Printed Circuit Board: Anatomy, CAD tools for PCB design, Standard fabrication, Micro via Boards.Board Assembly: Surface Mount Technology, Through Hole Technology, Process Control and Design challenges. Thermal Management, Heat transfer fundamentals, Thermal conductivity and resistance,Conduction,convection and radiation– Cooling requirements

Unit 5- Testing 9

Reliability, Basic concepts, Environmental interactions. Thermal mismatch and fatigue – failures –thermo mechanically induced–electrically induced–chemically induced. Electrical Testing:Systemlevelelectrical testing,Interconnection tests, Active Circuit Testing, DesignforTestability

Total Hours: 45

Text Books

1.Tummala, Rao R., Fundamentals of Microsystems Packaging, McGraw Hill, 2001

References

1. Blackwell (Ed), The electronic packaging handbook, CRC Press, 2000.
2. Tummala, Rao R, Microelectronics packaging handbook, McGraw Hill, 2008.
3. Bosshart, Printed Circuit Boards Design and Technology, TataMcGraw Hill, 1988.
4. R.G. Kaduskar and V.B.Baru, Electronic Product design, Wiley India, 2011
5. R.S.Khandpur, Printed Circuit Board, Tata McGraw Hill, 2005
6. Recent literature in Electronic Packaging
7. Michael L. Bushnell &Vishwani D. Agrawal," Essentials of Electronic Testing for Digital, memory & Mixed signal VLSI Circuits", Kluwer Academic Publishers.2000.
8. M. Abramovici, M. A. Breuer, and A.D. Friedman, "Digital System Testing and Testable Design", Computer Science Press,1990

PROFESSIONAL ELECTIVE III

21ECE31	CRYPTOGRAPHY AND NETWORK SECURITY	L	T	P	C
		3	0	0	3

Course Objectives

- To understand Cryptography Theories, Algorithms and Systems.
- To understand necessary Approaches and Techniques to build
- Protection mechanisms inorder to secure computer Networks.

Course Outcomes

At the end of the course,the student should be able to:

1. Understand the fundamentals of networks security, security architecture, threats and vulnerabilities
2. Apply the different cryptographic operations of symmetric cryptographic algorithms
3. Apply the different cryptographic operations of public key cryptography
4. Apply the various Authentication schemes to simulate different applications.
5. Understand various Security practices and System security standards

Unit 1-Introduction **9**

Security trends - Legal, Ethical and Professional Aspects of Security, Need for Security atMultiple levels, Security Policies - Model of network security – Security attacks, services andmechanisms –OSI security architecture–Classical encryption techniques :substitution techniques, transposition techniques, steganography).-Foundations of modern cryptography :perfect security–informationtheory–product cryptosystem–cryptanalysis.

Unit 2-Symmetric Cryptography **9**

MATHEMATICS OF SYMMETRIC KEY CRYPTOGRAPHY: Algebraic structures – Modular arithmetic-Euclid's algorithm- Congruence and matrices -Groups, Rings, Fields-Finite fields- SYMMETRIC KEY CIPHERS: SDES – Block cipher Principles of DES – Strength of DES – Differential and linear cryptanalysis - Block cipher design principles – Block ciphermode of operation – Evaluation criteria for AES – Advanced Encryption Standard - RC4 –Key distribution**.**

Unit 3-Public Key Cryptography **9**

MATHEMATICS OF ASYMMETRIC KEY CRYPTOGRAPHY: Primes – Primality Testing –Factorization – Euler's totient function, Fermat's and Euler's Theorem - Chinese Remainder Theorem–Exponentiation and logarithm-ASYMMETRIC KEY CIPHERS:RSA cryptosystem–Key distribution–Key management–Diffie Hellman key exchange-ElGamal cryptosystem–Elliptic curve arithmetic-Elliptic curve cryptography**.**

Unit 4-Message Authentication And Integrity **9**

Authentication requirement – Authentication function – MAC – Hash function – Security of Hash function and MAC – SHA –Digital signature and authentication protocols – DSS- Entity Authentication: Biometrics,Passwords,Challenge Response protocols-Authentication applications -Kerberos, X.509

Unit 5-Security Practice And System Security **9**

Electronic Mail security–PGP, S/MIME–IP security–Web Security-SYSTEM SECURITY:Intruders–Malicious software–viruses –Firewalls**.**

Total Hours: 45

Text Books

1. William Stallings,Cryptography and Network Security:Principles and Practice,PHI 3rd Edition,2006**.**

References

1. C K Shyamala, N Harini and Dr. T R Padmanabhan: Cryptography and Network Security,Wiley IndiaPvt.Ltd
2. Behrouz A.Foruzan,Cryptography and Network Security,Tata Mc GrawHill2007.
3. Charlie Kaufman, Radia Perlman, and Mike Speciner, Network Security: PRIVATE Communication in a PUBLIC World,Prentice Hall, ISBN 0-13-046019-2

21ECE32	ADVANCED DIGITAL SIGNAL PROCESSING	L	T	P	C
		3	0	0	3

Course Objectives

- To learn and understand the concepts of stationary and non-stationaryr and signals and analysis & characterization of discrete-time random processes
- To enunciate the significanceof estimation of power spectral density of random processes
- Tointroducetheprinciples ofoptimumfilters suchasWienerandKalmanfilters
- To introduce the principles of adaptive filters and their applications to communication engineering
- To introduce the concepts of multi-resolution analysis

Course Outcomes

At the end of the course,the student should be able to:

1. Articulate and apply the concepts of special random processes in practical applications
2. Choose appropriate spectrum estimation techniques for a given random process
3. Apply optimum filters appropriately for a given communication application
4. Apply appropriate adaptive algorithm for processing non-stationary signals
5. Apply and analyse wavelet transforms for signal and image processing based applications

Unit 1-Discrete-Time Random Processes 9

Random variables-ensemble averages are view,random processes-ensemble averages,autocorrelation and autocovariance matrices, ergodic random process,white noise,filtering random processes,spectral factorization, special typesof random processes-AR,MA, ARMA

Unit 2-Spectrum Estimation 9

Bias and consistency,Non-parametric methods-Periodogram,modified-Periodogram-performance analysis. Bartlett's method, Welch's method, Blackman-Tukey method. Performance comparison. Parametric methods - autoregressive(AR) spectrum estimation-auto correlation method, Prony'smethod, solution using Levinson Durbin recursion**.**

Unit 3-Optimum Filters 9

Wiener filters - FIR Wiener filter - discrete Wiener Hopf equation, Applications - filtering, linearprediction. IIR Wiener filter - causal and non-causal filters. Recursive estimators - discrete Kalmanfilter.

Unit 4-Adaptive Filters 9

Principles and properties of adaptive filters - FIR adaptive filters. Adaptive algorithms - steepestdescent algorithm, the LMS algorithm - convergence. Applications of adaptive filtering - noisecancellation,channelequalization**.**

Unit 5-Multi Resolution Analysis 8

Short-time Fourier transform - Heisenberg uncertainty principle.Principles of multi-resolution analysis-sub-band coding,the continuous and discrete wavelet transform-properties. Applications of wavelet transform –noise reduction,image compression**.**

Total Hours: 45

Text Books

1. Monson H. Hayes, "Statistical digital signal processing and modeling", John Wiley and Sons Inc. New York, Indian reprint 2008. (UNIT I-IV)
2. P. P. Vaidyanathan, "Multirate systems and filter banks", Prentice Hall Inc. 1993 (UNIT V)

References

1. John G. Proakis & DimitrisG.Manolakis, “Digital Signal Processing – Principles, Algorithms & Applications”, Fourth Edition, Pearson Education / Prentice Hall, 2007.
2. Sophoncles J. Orfanidis, "Optimum signal processing", McGraw Hill, 2000

21ECE33	FOUNDATION SKILLS IN INTEGRATED PRODUCT DEVELOPMENT	L	T	P	C
		3	0	0	3

Course Objectives

- To understand the global trends and development methodologies of various types of products and services
- To conceptualize, prototype and develop product management plan for a new product based on the type of the new product and development methodology integrating thehardware, software, controls, electronics and mechanical systems
- To understand requirement engineering and know how to collect, analyze and arrive at requirements for new product development and convert the minto design specification
- To understand system modeling for system, sub-system and their interfaces and arrive at the optimum system specification and characteristics
- To develop documentation, test specifications and coordinate with various teams to validate and sustain upto the EoL(EndofLife)support activities for engineering customer

Course Outcomes

At the end of the course,the student should be able to:

1. Define,formulate and analyze a problem
2. Solve specific problems independently or as part of a team
3. Gain knowledge of the Innovation & Product Development process in the Business Context
4. Work independently as well as in teams
5. Manage a project from start to finish

Unit 1-Fundamentals Of Product Development 9

Global Trends Analysis and Product decision - Social Trends - Technical Trends-EconomicalTrends - Environmental Trends - Political/Policy Trends - Introduction to Product DevelopmentMethodologies andManagement - Overview ofProducts andServices - Types of ProductDevelopment - Overview of Product Development methodologies - Product Life Cycle – Product Development Planning and Management.

Unit 2-Requirements And System Design 9

Requirement Engineering - Types of Requirements - Requirement Engineering – traceability Matrix and Analysis - Requirement Management - System Design & Modeling - Introduction toSystem Modeling - System Optimization - System Specification - Sub-System Design – Interface Design.

Unit 3-Design And Testing 9

Conceptualization-Industrial Design and User Interface Design-Introduction to Concept generation Techniques–Challenges in Integration of Engineering Disciplines-Concept Screening & Evaluation - Detailed Design - Component Design and Verification – Mechanical,Electronics and Software Subsystems - High Level Design/Low Level Design of S/W Program –Types of Prototypes,S/WTesting-Hardware Schematic,Component design, Layoutand Hardware Testing – Prototyping - Introduction to Rapid Prototyping and Rapid Manufacturing –System Integration,Testing,Certificationand Documentation

Unit 4- Sustenance Engineering And End-Of-Life(Eol)Support 9

Introduction to Product verification processes and stages - Introduction to Product Validation processes and stages - Product Testing Standards and Certification - Product Documentation -Sustenance-Maintenance and Repair–Enhancements-Product EoL-Obsolescence Management–Configuration Management- EoL Disposal

Unit 5- Business Dynamics–Engineering Services Industry **9**

The Industry-Engineering Services Industry-Product Development inIndustry versus Academia–The IPD Essentials-Introduction to Vertical Specific Product Development processes-Manufacturing/Purchase andAssemblyofSystems-Integration of Mechanical,Embedded and Software Systems – Product Development Trade-offs - Intellectual PropertyRights and Confidentiality–Security and Configuration Management**.**

Total Hours: 45

Text Books

1. Book specially prepared by NASSCOM as per the MoU.
2. Karl T Ulrich and Stephen D Eppinger, "Product Design and Development", Tata Mc Graw Hill, Fifth Edition,2011.
3. John W Newstorm and Keith Davis, "Organizational Behavior", Tata McGraw Hill,Eleventh Edition,2005.

References

1. Hiriyappa B, “Corporate Strategy–Managing the Business”,Author House,2013.
2. Peter F Drucker, “People and Performance”, Butterworth – Heinemann [Elsevier], Oxford, 2004.
3. Vinod Kumar Gargand Venkita Krishnan NK, “Enterprise Resource Planning – Concepts”,Second Edition,PrenticeHall,2003.
4. Mark S Sanders and Ernest J McCormick, "Human Factors in Engineering and Design",McGrawHill Education, Seventh Edition, 2013

21ECE34	MACHINE LEARNING TECHNIQUES	L	T	P	C
		3	0	0	3

Course Objectives

- To understand the need for machine learning for various problem solving
- To study the various supervised, semi-supervised and unsupervised learning algorithms in machine learning
- To learn the new approaches in machine learning
- To design appropriate machine learning algorithms for problem solving

Course Outcomes

At the end of the course,the student should be able to:

1. Differentiate between supervised, unsupervised, semi-supervised machine learning approaches
2. Apply specific supervised or unsupervised machine learning algorithm for a particular problem
3. Analyse and suggest the appropriate machine learning approach for the various types of problem
4. Design and make modifications to existing machine learning algorithms to suit an
5. individual application
6. Provide useful case studies on the advanced machine learning algorithms

Unit 1-Introduction **9**

Learning Problems–Perspectives and Issues –Concept Learning–Version Spaces and Candidate Eliminations – Inductive bias – Decision Tree learning – Representation – Algorithm –Heuristic Space Search.

Unit 2- Neural Networks And Genetic Algorithms **9**

Neural Network Representation – Problems – Perceptrons – Multilayer Networks and Back Propagation Algorithms – Advanced Topics – Genetic Algorithms – Hypothesis Space Search –Genetic Programming–Models of Evaluationand Learning.

Unit 3-Bayesian And Computation All Earning **9**

Bayes Theorem–Concept Learning– Maximum Likelihood–Minimum Description Length Principle – Bayes Optimal Classifier – Gibbs Algorithm – Naïve Bayes Classifier – Bayesian Belief Network – EM Algorithm – Probability Learning – Sample Complexity **–** Finite and Infinite Hypothesis Spaces–Mistake Bound Model.

Unit 4-Instant Based Learning **9**

K-Nearest Neighbour Learning – Locally weighted Regression – Radial bases function – case based learning

Unit 5- Advanced Learning **9**

Learning Sets of Rules– Sequential Covering Algorithm– Learning Rule Set– First Order Rules – Sets of First Order Rules – Induction on Inverted Deduction – Inverting Resolution–Analytical Learning–Perfect Domain Theories–Explanation Base Learning –FOCL Algorithm–Reinforcement Learning–Task–Q-Learning–Temporal Difference Learning

Total Hours: 45

Text Books

1. Tom M.Mitchell, "Machine Learning",McGraw-Hill Education (India) Private Limited, 2013.

References

1. Ethem Alpaydin, "Introduction to Machine Learning (Adaptive computation and Machine Learning)",The MIT Press 2004.
2. Stephen Marsland,"MachineLearning:An Algorithmic Perspective", CRC Press,2009

21ECE35	VIDEO ANALYTICS	L	T	P	C
		3	0	0	3

Course Objectives

- To understand the need for videoAnalytics
- To understand the basic configuration of video analytics
- To understand the functional blocks of a video analytic system
- To get exposed to the various applications of video analytics

Course Outcomes

At the end of the course,the student should be able to:

1. Design video analytic algorithms for security applications
2. Design video analytic algorithms for business intelligence
3. Design custom made video analytics system for the given target application

Unit 1-Video Analytic Components **9**

Need for Video Analytics-Overview of video Analytics- Foreground extraction- Feature extraction-classifier-Preprocessing-edge detection-smoothening-Feature space-PCA-FLD-SIFT features.

Unit 2-Foreground Extraction **9**

Background estimation-Averaging-Gaussian Mixture Model-Optical Flowbased-Image Segmentation-Region growing-Region splitting-Morphological operations-erosion-Dilation-Tracking in a multiple camera environment.

Unit 3-Classifiers **9**

Neural networks(back propagation)-Deep learning networks-Fuzzy Classifier-Bayesian classifier-HMM based classifier.

Unit 4-Video Analytics For Security **9**

Abandoned object detection-human behavior alanalysis-human action recognition-Perimeter security-crowd analysis and prediction of crowd congestion.

Unit 5-Video Analytics For Business Intelligence & Traffic Monitoring And Assistance **9**

Customer behavior analysis-people counting-Traffic rule violation detection-traffic congestion identification for route planning-driver assistance-lane change warning.

Total Hours: 45

Text Books

1. Graeme A. Jones (Editor), Nikos Paragios (Editor), Carlo S. Regazzoni (Editor) Video-Based Surveillance Systems: Computer Vision and Distributed Processing ,Kluwer academic publisher,2001.

References

1. Nilanjan Dey(Editor), Amira Ashour (Editor) and Suvojit Acharjee (Editor),Applied Video Processing in Surveillance and Monitoring Systems (IGIglobal) 2016.
2. Zhihao Chen (Author), YeYang (Author), Jing yu Xue (Author), LipingYe (Author), FengGuo (Author), The Next Generation of Video Surveillance and Video Analytics: The Unified Intelligent Video Analytics Suite, Create Space Independent Publishing Platform,2014.
3. Caifeng Shan (Editor), Fatih Porikli (Editor), TaoXiang (Editor), Shaogang Gong (Editor) Video Analytics for Business Intelligence, Springer,2012.

21ECE36	DIGITAL IMAGE PROCESSING	L	T	P	C
		3	0	0	3

Course Objectives

- To become familiar with digital image fundamentals
- To get exposed to simple image enhancement techniques in Spatial and Frequency domain.
- To learn concepts of degradation function and restoration techniques.
- To study the image segmentation and representation techniques.
- To become familiar with image compression and recognition methods

Course Outcomes

At the end of the course,the student should be able to:

1. Know and understand the basics and fundamentals of digital image processing,such as digitization,sampling,quantization,and 2D-transforms.
2. Operateon images using the techniques of smoothing,sharpening and enhancement.
3. Understand the restoration concepts and filtering techniques.
4. Learn the basics of segmentation, features extraction, compression and recognition methods for color models.

Unit 1-Digital Image Fundamentals **9**

Steps inDigital ImageProcessing –Components –Elements of Visual Perception – ImageSensing and Acquisition – Image Sampling and Quantization – Relationships between pixels -Color image fundamentals - RGB, HSI models, Two-dimensional mathematical preliminaries, 2Dtransforms -DFT,DCT**.**

Unit 2-Image Enhancement **9**

Spatial Domain: Gray level transformations – Histogram processing – Basics of Spatial Filtering–Smoothing and Sharpening Spatial Filtering, Frequency Domain:Introduction to FourierTransform–Smoothing and Sharpening frequency domain filters–Ideal,Butterworth and Gaussian filters,Homomorphic filtering,Color image enhancement**.**

Unit 3-Image Restoration **9**

Image Restoration-degradation model,Properties,Noise models–Mean Filters–Order Statistics – Adaptive filters – Band reject Filters – Band pass Filters – Notch Filters – Optimum Notch Filtering–Inverse Filtering–Wiener filtering.

Unit 4-Image Segmentation **9**

Edge detection, Edge linking via Hough transform – Thresholding - Region based segmentation –Region growing – Region splitting and merging – Morphological processing-erosion and dilation,Segmentation by morphological watersheds – basic concepts – Dam construction – Water shed segmentation algorithm**.**

Unit 5-Image Compression And Recognition **9**

Need for data compression, Huffman, Run Length Encoding, Shift codes, Arithmetic coding, JPEG standard, MPEG. Boundary representation, Boundary description, Fourier Descriptor, RegionalDescriptors – Topological feature, Texture - Patterns and Pattern classes - Recognition based on matching**.**

Total Hours: 45

Text Books

1. Rafael C.Gonzalez,Richard E.Woods,'Digital Image Processing', Pearson, Third Edition,2010.
2. AnilK.Jain,'Fundamentals of Digital Image Processing',Pearson,2002.

References

1. Kenneth R.Castleman,'Digital Image Processing',Pearson,2006.
2. RafaelC.Gonzalez,Richard E. Woods, Steven Eddins,' Digital Image Processing using MATLAB',Pearson Education,Inc.,2011.
3. D,E.Dudgeon and RM.Mersereau ,'Multidimensional Digital Signal Processing ', Prentice Hall Professional Technical Reference,1990.
4. William K.Pratt,'Digital Image Processing',JohnWiley,NewYork,2002
5. Milan Sonka et al 'Image processing, analysis and machine vision', Brookes/Cole, Vikas Publishing House

PROFESSIONAL ELECTIVE IV

21ECE37	ADHOC AND WIRELESS SENSOR NETWORKS	L	T	P	C
		3	0	0	3

Course Objectives

The student should be made to:

- Learn Adhoc network and Sensor Network fundamentals
- Understand the different routing protocols
- Have an in-depth knowledge on sensor network architecture and design issues
- Understand the transport layer and security issues possible in Adhoc and Sensor networks
- Have an exposure to mote programming platforms and tools.

Course Outcomes

At the end of the course,the student would be able to:

1. Know the basics of Adhoc networks and Wireless Sensor Networks
2. Apply this knowledge to identify the suitable routing algorithm based on the network and user requirement
3. Apply the knowledge to identify appropriate physical and MAC layer protocols
4. Understand the transport layer and security issues possible in Adhoc and sensor networks.
5. Be familiar with the OS used inWireless Sensor Networks and build basic modules.

Unit 1 –Adhoc Networks–Introduction And Routing Protocols 9

Elements of Adhoc Wireless Networks,Issues in Adhoc wireless networks,Example commercial applications of Adhoc networking, Adhoc wireless Internet,Issues in Designing a Routing Protocol for Ad Hoc Wireless Networks, Classifications of Routing Protocols, Table Driven Routing Protocols - Destination Sequenced Distance Vector (DSDV), On–DemandRoutingprotocols–AdhocOn–Demand Distance Vector Routing (AODV).

Unit 2- Sensornetworks–Introduction & Architectures 9

Challenges for Wireless Sensor Networks,Enabling Technologies for Wireless Sensor Networks, WSN application examples, Single-Node Architecture - Hardware Components,Energy Consumption of Sensor Nodes, Network Architecture - Sensor Network Scenarios,Transceiver DesignConsiderations,Optimization Goals and Figures of Merit.

Unit 3 – WSN Networking Concepts And protocols 9

MAC Protocols for Wireless Sensor Networks,Low Duty Cycle Protocols And Wakeup Concepts - S-MAC, The Mediation Device Protocol, Contention based protocols - PAMAS,Schedule based protocols–LEACH,IEEE 802.15.4 MACprotocol,Routing Protocols-Energy Efficient Routing,Challenges and IssuesinTransportlayerprotocol

Unit 4 – Sensor Network Security 9

Network Security Requirements, Issues and Challenges in Security Provisioning, NetworkSecurityAttacks,Layer wise attacks in wireless sensor networks,possible solutions for jamming, tampering, black hole attack, flooding attack. Key Distribution and Management,Secure Routing–SPINS,reliability requirements in sensor networks.

Unit 5-Sensor Network Platforms And Tools 9

Sensor Node Hardware – Berkeley Motes, Programming Challenges, Node-level softwareplatforms – TinyOS, nesC, CONTIKIOS, Node-level Simulators – NS2 and its extension tosensor networks, COOJA, TOSSIM, Programming beyond individual nodes – State centricprogramming.

Total Hours: 45

Text Books

1. C.Siva Ram Murthyan dB. S. Manoj, " AdHoc Wireless Networks Architectures and Protocols",PrenticeHall,PTR,2004.(UNIT I)
2. Holger Karl, Andreas willig," Protocol and Architecture for Wireless Sensor Networks ",John wiley publication,Jan 2006.(UNITII-V)

References

1. Feng Zhao , Leonidas Guibas," Wireless Sensor Networks :an information processing approach",Elsevier publication,2004.
2. Charles E.Perkins, "AdHoc Networking", Addison Wesley,2000.
3. I.F.Akyildiz,W.Su,Sankara subramaniam, E. Cayirci," Wireless sensor networks: a survey",computer networks,Elsevier,2002,394-422.

21ECE38	MEMS AND NEMS	L	T	P	C
		3	0	0	3

Course Objectives

- To introduce the concepts of micro and nano electromechanical devices
- To know the fabrication process of Microsystems
- To know the design concepts of micro sensors and micro actuators
- To introduce the concepts of quantum mechanics and nano systems

Course Outcomes

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

1. Interpret the basics of micro/nano electromechanical systems including their applications and advantages
2. Recognize the use of materials in microfabrication and describe the fabrication processes including surface micromachining,bulk micromachining and LIGA.
3. Analyze the key performance aspects of electromechanical transducers including sensors and actuators
4. Comprehend the theoretical foundations of quantum mechanics and Nano systems.

Unit 1 –Introduction To MEMS And NEMS **9**

Introduction to Design of MEMS and NEMS,Overview of Nano and Microelectro mechanical Systems, Applications of Micro and Nano electromechanical systems, Materials for MEMS andNEMS:Silicon,siliconcompounds,polymers,metals.

Unit 2 – MEMS Fabrication Technologies **9**

Photolithography,Ion Implantation, Diffusion, Oxidation, CVD, Sputtering Etching techniques, Micromachining:Bulk Micromachining,Surface Micromachining, LIGA.

Unit 3 – Micro Sensors **9**

MEMS Sensors: Design of Acoustic wave sensors, Vibratory gyroscope, Capacitive Pressure sensors,Case study:Piezoelectric energy harvester.

Unit 4 – Micro Actuators **9**

Design of Actuators: Actuation using thermal forces,Actuation using shape memory Alloys,Actuation using piezoelectric crystals,Actuation Using Electrostaticforces,Case Study:RF Switch.

Unit 5-Nano Devices **9**

Atomic Structures and Quantum Mechanics, Shrodinger Equation, ZnO nano rods based NEMS device:Gas sensor.

Total Hours: 45

Text Books

1. Marc Madou,"Fundamentals of Micro fabrication",CRC press1997.
2. Stephen D.Senturia,"Micro system Design",Kluwer Academic Publishers,2001.

References

1. Tai Ran Hsu,"MEMS andMicro systems Design and Manufacture", Tata Mcraw Hill, 2002.
2. Chang Liu,"Foundations of MEMS",Pearson education India limited,2006,
3. Sergey Edward Lyshevski," MEMS and NEMS: Systems,Devices,and Structures"CRC Press,2002.

21ECE39	PHOTONIC NETWORKS	L	T	P	C
		3	0	0	3

Course Objectives

- To enable the student to understand the importance of the backbone infrastructure for our present and future communication needs and familiarize them with the architectures and the protocol stack in use.
- To enable the student to understand the differences in the design of data plane and the control plane and therouting, switching and there source allocation methods and the network management and protection methods in vogue.

Course Outcomes

At the end of the course,the student would be able to:

1. Use the backbone infrastructure for our present and future communication needs
2. Analyze the architectures and the protocol stack
3. Compare the differences in the design of data plane,control plane,routing,switching,resource allocation methods,network management and protection methods in vogue.

Unit 1-Optical System Components **9**

LightPropagationinoptical fibers–Loss & bandwidth,System limitations, Nonlinear effects;Solitons;Optical Network Components–Couplers,Isolators & Circulators,Multiplexers &Filters,Optical Amplifiers,Switches,Wavelength Converters.

Unit 2-Optical Network Architectures **9**

Introduction to Optical Networks; SONET / SDH, Metropolitan-Area Networks, Layered Architecture; Broadcast and Select Networks – Topologies for Broadcast Networks, Media-Access Control Protocols,Wavelength Routing Architecture.

Unit 3-Wavelength Routing Networks **9**

The optical layer, Optical Network Nodes, Routing and wavelength assignment, Traffic Grooming in Optical Networks,Architectural variations-Linear Light wave networks,Logically Routed Networks.

Unit 4-Packet Switching And Access Networks **9**

Photonic Packet Switching– OTDM, Multiplexing and Demultiplexing, Synchronization,Broadcast OTDM networks,Switch-based networks,Contention Resolution Access Networks–Network Architecture overview,Optical Access Network Architectures and OTDM networks.

Unit 5-Network Design And Management **9**

Transmission System Engineering – System model, Power penalty - transmitter, receiver,Optical amplifiers , crosstalk, dispersion, Wavelength stabilization,Over all design considerations, Control and Management – Network management functions, Configuration management, Performance management,Fault management,Optical safety,Service interface.

Total Hours: 45

Text Books

1. Rajiv Ramaswami and Kumar N. Sivarajan, “Optical Networks: A Practical Perspective”,Harcourt Asia Pte Ltd.,SecondEdition2004.
2. C. Siva Ram Moorthy and Mohan Gurusamy, “WDM Optical Networks: Concept, Design and Algorithms”,Prentice Hall of India,Ist Edition,2002.

References

1. P.E.Green, Jr., “Fiber Optic Networks”,Prentice Hall, NJ,1993.
2. Biswanath Mukherjee, “Optical WDM Networks”,Springer Series,2006.

21ECE40	ELECTROMAGNETIC INTERFERENCE AND COMPATIBILITY	L	T	P	C
		3	0	0	3

Course Objectives

The student should be made to:

- To introduce the basic concepts of Electromagnetic Interference
- To teach the importance of Electromagnetic Compatible designs
- To explain the existing standards for Electromagnetic Compatibility

Course Outcomes

At the end of the course,the student would be able to:

1. Identify the various types and mechanisms of Electromagnetic Interference.
2. Propose a suitable EMI mitigation technique.
3. Describe the various EMC Standards and methods to measure them.

Unit 1-Introduction **9**

EMI-EMC definitions; Sources and Victims of EMI; Conducted and Radiated EMI Emission and Susceptibility;Case Histories;Radiation Hazards to humans.

Unit 2-EMI Coupling Principles **9**

Conducted, radiated and transient coupling; Common ground impedance coupling; Common mode and ground loop coupling; Differential mode coupling; Near field cable to cable coupling; Field to cable coupling;Power mains and Power supply coupling;Transient EMI,ESD.

Unit 3-EMI Control **9**

Shielding; EMI filters; grounding; bonding; Isolation transformers; transient Suppressors ; EMI suppression cables.

Unit 4- EMC Design For Circuits And PCBs **9**

Noise from Relays and Switches; Nonlinearities in Circuits; Cross talk in transmission line andcross talk control; Component selection and mounting; PCB trace impedance; Routing; Powerdistributiondecoupling;Zoning;Grounding;VIAs;Terminations.

Unit 5- EMI Measurements And Standards **9**

Open area test site; TEM cell; EMI test shielded chamber and shielded ferrite lined anechoic chamber;Line impedance stabilization networks;EMI Rx and spectrum analyzer;Civilian standards -CISPR,FCC,IEC,EN;Military standards-MIL461E/462.

Total Hours: 45

Text Books

1. V.P.Kodali,"Engineering EMC Principles,Measurements and Technologies",IEEE Press,Newyork,1996.(UnitI–V)
2. Henry W.Ott.,Noise Reduction Techniques in Electronic Systems",Awiley Inter Science Publications,John Wiley and Sons, Newyork,1988.(Unit–IV)

References

1. C.R.Paul,"Introduction to Electromagnetic Compatibility",John Wiley and Sons,Inc,1992.
2. Bemhard Keiser,"Principles of Electromagnetic Compatibility",3rd Ed,Artechhouse, Norwood,1986.
3. Don R.J.White Consultant Incorporate,"Hand book of EMI/EMC",VolI-V,1988.

21ECE41	MIXED SIGNAL IC DESIGN	L	T	P	C
		3	0	0	3

Course Objectives

The student should be madeto:

- Study the mixed signal of submicron CMOS circuits.
- Understand the various integrated based filters and topologies.
- Learn the dataconverters architecture, modeling and signal to noise ratio.
- Study the integrated circuit of oscillators and PLLs.

Course Outcomes

At the end of the course,the student would be able to:

1. Apply the concepts for mixed signal MOScircuit.
2. Analyze the characteristics of IC based CMOS filters.
3. Design of various data converter architecture circuits.
4. Analyze the signal to noise ratio and modeling of mixed signals.
5. Design of oscillators and phase lock loop circuit.

Unit 1-Sub Micronc Mos Circuit Design **9**

Submicron CMOS: Overview and Models, CMOS process flow, Capacitors and Resistors.Digital circuit design:The MOSFET Switch,Delay Elements,An Adder.Analog Circuit Design:Biasing,Op-Amp Design,Circuit Noise.

Unit 2-Integrator Based Cmos Filters **9**

Integrator Building Blocks- low pass filter, Active RC integrators, MOSFET-C Integrators, gm-C integrators, Discrete time integrators. Filtering Topologies: The Bilinear transfer function,The Biquadratic transfer function,Filters usingNoise shaping.

Unit 3-Data Converter Architectures **9**

DAC Architectures- Resistor string, R-2R ladder Networks, Current Steering, Charge Scaling DACs,Cyclic DAC, and Pipeline DAC. ADC Architectures- Flash, Two-step flash ADC,Pipeline ADC,Integrating ADC's,Successive Approximation ADC. LC Oscillators, Voltage controlled oscillators, simple PLL, charge pumps PLLs, Non ideal effects in PLLs, Delay locked Loops

Unit 4-Data Converter Modeling And SNR **9**

Sampling and Aliasing: A modeling approach, Impulse sampling, The sample and Hold, Quantization noise. Data converter SNR: An overview, Clock Jitter, Improving SNR usingAveraging, Decimating filter for ADCs, Interpolating filter for DACs, Band pass and High passs in c filters-Using feedback to improve SNR.

Unit 5-Oscillators And PLL **9**

LC oscillators, Voltage controlled oscillators, simple PLL, charge pumps PLLs, Non ideal effects in PLLs, Delay Locked Loops.

Total Hours: 45

Text Books

1. CMOS Mixed Signal Circuit Design by R.Jacob Baker, Wiley India, IEEE Press, reprint 2008.

References

1. CMOS Circuit Design, Layout and Simulation by R.Jacob Baker,Wiley India,IEEE Press,Second Edition,reprint 2009.
2. Design of Analog CMOS Integrated Circuits by Behzad Razavi, McGrawHill,33rdRe-print,2016.

21ECE42	DSP ARCHITECTURE AND PROGRAMMING	L	T	P	C
		3	0	0	3

Course Objectives

The student should be made to:

- Basics on Digital Signal Processors
- Programmable DSP's Architecture,On-chip Peripherals and Instruction set
- Programming for signal processing applications
- Advanced Programmable DSP Processors.

Course Outcomes

At the end of the course,the student would be able to:

1. Analyze the concepts of Digital Signal Processors
2. Demonstrate their ability to program the DSP processor for signal processing applications
3. Discuss,compare and select the suitable Advanced DSP Processors for real-time signal processing applications

Unit 1-Fundamentals Of Programmable Dsps **9**

Introduction to Programmable DSPs, Architectural Features of PDSPs - Multiplier and Multiplieraccumulator – Modified Bus Structures and Memory access – Multiple access memory – Multi-port memory–VLIW architecture- Pipelining–Special Addressing modes in P-DSPs –On chip Peripherals,Applications of Programmable DSPs.

Unit 2-TMS320C5X Processor **9**

Architecture of C5X Processor – Addressing modes – Assembly language Instructions - Pipelinestructure, On-chip Peripherals – Block Diagram of DSP starter kit (DSK) – Software Tools, DSKon-board peripherals,Application Programs for processing real time signals.

Unit 3-TMS320C6X Processor **9**

Architecture of the C6x Processor - Instruction Set – Addressing modes, Assembler directives, On-chip peripherals, DSP Development System: DSP Starter Kit - Code Composer Studio – Support Files – Introduction to AIC23 codec and other on-board peripherals, Real-Time Programming Examples for Signals and Noise generation,Frequency analysis,Filter design**.**

Unit 4-ADSP Processors **9**

Architecture of ADSP-21XX and ADSP-210XX series of DSP processors- Addressing modes andassembly language instructions–Application programs–Filter design,FFT calculation.

Unit 5-Advanced Processors **9**

Study of TI's advanced processors - TMS320C674x and TMS320C55x DSPs, ADSP's Blackf in and Sigma DSP Processors, NXP's DSP56Fxx Family of DSP Processors, Comparison of the features of TI,ADSP and NXPDSP familyprocessors**.**

Total Hours: 45

Text Books

1. B. Venkataramani and M. Bhaskar, "Digital Signal Processors – Architecture, Programming and Applications"–Tata McGraw–Hill Publishing Company Limited. New Delhi,2003.

References

1. Avtar Singh and S. Srinivasan, Digital Signal Processing – Implementations using SP Microprocessors with Examples from TMS320C54xx, Cengage Learning India Private Limited, Delhi 2012.
2. Rulph Chassaing and Donald Reay, Digital Signal Processing and Applications with the C6713 and C6416DSK, John Wiley & Sons, Inc.,Publication,2012(Reprint).
3. User guides Texas Instruments,Analog Devices and NXP.

PROFESSIONAL ELECTIVE V

21ECE43	COMPRESSIVE SENSING	L	T	P	C
		3	0	0	3

Course Objectives

The student should be made to:

- To present the basic theory and ideas showing when it is possible to reconstruct sparse ornearly sparse signals from undersampled data
- To expose students to recent ideas in modern convex optimization allowing rapid signalrecovery
- To give students a sense of real time applications that might benefit from compressivesensing ideas

Course Outcomes

At the end of the course,the student would be able to:

1. Appreciate the motivation and the necessity for compressed sensing technology.
2. Design a new algorithm or modify an existing algorithm for different application areas in wireless sensor network.

Unit 1-Introduction To Compressed Sensing **9**

Introduction; Motivation; Mathematical Background; Traditional Sampling; Traditional Compression; Conventional Data Acquisition System; Drawbacks of Transform coding; Compressed Sensing (CS).

Unit 2-Sparsity And Signal Recovery **9**

Signal Representation; Basis vectors; Sensing matrices; Restricted Isometric Property; Coherence; Stable recovery; Number of measurements.

Unit 3-Recovery Algorithms **9**

Basis Pursuit algorithm: L1 minimization; Matching pursuit: Orthogonal Matching Pursuit(OMP), Stagewise OMP, Regularized OMP, Compressive Sampling Matching Pursuit (CoSaMP); Iterative Thresholding algorithm: Hard thresholding, Soft thresholding; Model based : Model based CoSaMP, Model based HIT.

Unit 4-Compressive Sensing For WSN **9**

Basics of WSN; Wireless Sensor without Compressive Sensing; Wireless Sensor with Compressive Sensing; Compressive Wireless Sensing: Spatial compression in WSNs, Projections in WSNs, Compressed Sensing in WSNs.

Unit 5-Applications Of Compressive Sensing **9**

Compressed Sensing for Real-Time Energy-Efficient Compression on Wireless Body Sensor Nodes; Compressive sensing in video surveillance; An Application of Compressive Sensing for Image Fusion; Single-Pixel Imaging via Compressive Sampling.

Total Hours: 45

Text Books

1. Radha S, Hemalatha R, Aasha Nandhini S, “Compressive Sensing for Wireless Communication: Challenges and Opportunities”, River publication, 2016. (UNIT I-V)
2. Mark A. Davenport, Marco F. Duarte, Yonina C. Eldar and Gitta Kutyniok, “Introduction to Compressed Sensing,” in Compressed Sensing: Theory and Applications, Y. Eldar and G. Kutyniok, eds., Cambridge University Press, 2011 (UNIT I)

References

1. Duarte, M.F.; Davenport, M.A.; Takhar, D.; Laska, J.N.; Ting Sun; Kelly, K.F.; Baraniuk, R.G.; , "Single-Pixel Imaging via Compressive Sampling," Signal Processing Magazine, IEEE, vol.25, no.2, pp.83-91, March 2008.
2. Tao Wan.; Zengchang Qin.; , "An application of compressive sensing for image fusion", CIVR'10 Proceedings of the ACM International Conference on Image and Video Retrieval, Pages 3-9.
3. H. Mamaghanian , N. Khaled , D. Atienza and P. Vandergheynst "Compressed sensing for real-time energy-efficient ecg compression on wireless body sensor nodes", IEEE Trans. Biomed. Eng., vol. 58, no. 9, pp.2456 -2466 2011.
4. Mohammadreza Balouchestani.; Kaamran Raahemifar.; and Sridhar Krishnan.;, "COMPRESSED SENSING IN WIRELESS SENSOR NETWORKS: SURVEY" , Canadian Journal on Multimedia and Wireless Networks Vol. 2, No. 1, February 2011.

21ECE44	FUZZY LOGIC AND NEURAL NETWORK	L	T	P	C
		3	0	0	3

Course Objectives

The student should be made to:

- Master the various fundamental concepts of fuzzy logic and artificial neural networks. This will help you to get sufficient knowledge to analyze and design the various intelligent control systems.

Course Outcomes

At the end of the course,the student would be able to:

1. To understand the basic concept of fuzzy sets, fuzzy logic & defuzzification
2. To learn basics of Artificial Neural of theory and programming of micfroprocessors
3. To analyze various techniques in feedback and feed forward Neural Networks
4. To learn the architecture and algorithm of Cognitron, Neo cognitron and the concepts of fuzzy associative memory and fuzzy systems.

Unit 1- Fundamentals Of Fuzzy Logic **9**

Basic concepts: fuzzy set theory- basic concept of crisp sets and fuzzy sets- complements-unionintersection- combination of operation- general aggregation operations- fuzzy relations-compatibility relations-orderings- morphisms- fuzzy relational equations-fuzzy set and systems.

Unit 2- Architecture Of Neural Networks **9**

Architectures: motivation for the development of natural networks-artificial neural networks-biological neural networks-area of applications-typical Architecture-setting weights-common activations functionsBasic learning rules- Mcculloch-Pitts neuron- Architecture, algorithm, applications-single layer net for pattern classification- Biases and thresholds, linear separability - Hebb'srule- algorithm -perceptron - Convergence theorem-Delta rule.

Unit 3- Basic Neural Network Techniques **9**

Back propagation neural net:standard back propagation-architecture algorithm- derivation of learning rulesnumber of hidden layers--associative and other neural networks- hetro associative memory neural net, auto associative net- Bidirectional associative memory-applications-Hopfield nets-Boltzman machine.

Unit 4- Competitive Neural Networks **9**

Neural network based on competition: fixed weight competitive nets- Kohonen self organizing maps and applications-learning vector quantization-counter propagation nets and applications adaptive resonance theory: basic architecture and operation-architecture, algorithm, application and analysis of ART1 & ART2 .

Unit 5- Special Neural Networks **9**

Cognitron and Neocognitron - Architecture, training algorithm and application-fuzzy associate memories, fuzzy system architecture- comparison of fuzzy and neural systems.

Total Hours: 45

Text Books

1. T1. Kliryvan- Fuzzy System & Fuzzy logic Prentice Hall of India, First Edition.
2. Lawrence Fussett- fundamental of Neural network Prentice Hall , First Edition.

References

1. Bart Kosko, ―Neural network and Fuzzy System- Prentice Hall-1994.
2. J.Klin and T.A.Folger, ―Fuzzy sets‖ University and information- Prentice Hall - 1996.
3. J.M.Zurada, ―Introduction to artificial neural systems‖-Jaico Publication house,Delhi 1994.
4. VallusuRao and HayagvnaRao , ―C++ Neural network and fuzzy logic‖-BPB and Publication, New Delhi,1996.
5. Intelligent Systems and Control-http://nptel.ac.in/courses/108104049/16

21ECE45	CAD FOR VLSI CIRCUITS	L	T	P	C
		3	0	0	3

Course Objectives

The student should be made to:

- The design of all VLSI circuits is carried out by making extensive use Computer Aided Design (CAD) VLSI design tool.
- The VLSI design professional needs to have a good understanding of the operation of these CAD VLSI design tools as these are developed primarily for and by the VLSI design professionals.
- These include the design flow organization for VLSI, the standard cell based synthesis methodologies for digital VLSI, floor planning and placement principles and related topics will all be covered.

Course Outcomes

At the end of the course,the student would be able to:

1. students are expected to have completed one of the important prerequisites for professionals in the area of VLSI design

Unit 1- VLSI Design Methodologies **9**

Introduction to VLSI Design methodologies - Review of Data structures and algorithms - Review of VLSI Design automation tools - Algorithmic Graph Theory and Computational Complexity - Tractable and Intractable problems - general purpose methods for combinatorial optimization.

Unit 2-Design Rules **9**

Layout Compaction - Design rules - problem formulation - algorithms for constraint graph compaction - placement and partitioning - Circuit representation - Placement algorithms - partitioning

Unit3- Floor Planning **9**

Floor planning concepts - shape functions and floor plan sizing - Types of local routing problems - Area routing - channel routing - global routing - algorithms for global routing.

Unit 4- Simulation **9**

Simulation - Gate-level modeling and simulation - Switch-level modeling and simulation - Combinational Logic Synthesis - Binary Decision Diagrams - Two Level Logic Synthesis

Unit 5- Modelling And Synthesis **9**

High level Synthesis - Hardware models - Internal representation - Allocation assignment and scheduling - Simple scheduling algorithm - Assignment problem - High level transformations.

Total Hours: 45

Text Books

1. S.H. Gerez, "Algorithms for VLSI Design Automation", John Wiley & Sons,2002. ACC.NO: B133734
2. N.A. Sherwani, "Algorithms for VLSI Physical Design Automation", Kluwer Academic Publishers, 2002.

References

1. Behzad Razavi, “Design of Analog CMOS Integrated Circuits”, Tata McGraw Hill, 2001 ACC.NO:B133833
2. Willey M.C. Sansen, “Analog Design Essentials”, Springer, 2006.
3. Grebene, “Bipolar and MOS Analog Integrated circuit design”, John Wiley & sons,Inc., 2003.

21ECE46	SATELLITE COMMUNICATION	L	T	P	C
		3	0	0	3

Course Objectives

The student should be made to:

- Understand the basics of satellite orbits.
- Understand the satellite segment and earth segment.
- Analyze the various methods of satellite access.
- Understand the applications of satellites.
- Understand the basics of satellite Networks

Course Outcomes

At the end of the course,the student would be able to:

1. Analyze the satellite orbits.
2. Analyze the earth segment and space segment.
3. Analyze the satellite Link design.

Unit 1-Satellite Orbits **9**

Kepler‟s Laws, Newton‟s law, 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.

Unit 2-Space Segment **9**

Spacecraft Technology- Structure, Primary power, Attitude and Orbit control, Thermal control and Propulsion, communication Payload and supporting subsystems, Telemetry, Tracking and command-Transponders-The Antenna Subsystem.

Unit 3-Satellite Link Design **9**

Basic link analysis, Interference analysis, Rain induced attenuation and interference, Ionospheric characteristics, Link Design with and without frequency reuse.

Unit 4-Satellite Access And Coding Methods **9**

Modulation and Multiplexing: Voice, Data, Video, Analog – digital transmission system, Digital video Broadcast, multiple access: FDMA, TDMA, CDMA, DAMA Assignment Methods, compression – encryption, Coding Schemes.

Unit 5-Satellite Applications **9**

INTELSAT Series, INSAT, VSAT, Mobile satellite services: GSM, GPS, INMARSAT, LEO, MEO, Satellite Navigational System. GPS Position Location Principles, Differential GPS, Direct Broadcast satellites (DBS/DTH).

Total Hours: 45

Text Books

1. Dennis Roddy, “Satellite Communication”, 4th Edition, Mc Graw Hill International, 2006.
2. Timothy,Pratt,Charles,W.Bostain,JeremyE.Allnutt,"SatelliteCommunication”, 2nd Edition,Wiley Publications,2002.

References

1. Wilbur L.Pritchard, Hendri G. Suyderhoud, Robert A. Nelson, “Satellite Communication Systems Engineering”, Prentice Hall/Pearson, 2007.
2. N.Agarwal, “Design of Geosynchronous Space Craft”, Prentice Hall, 1986.
3. Bruce R. Elbert, “The Satellite Communication Applications”, Hand Book, Artech House Bostan London, 1997.
4. Tri T. Ha, “Digital Satellite Communication”, II nd edition, 1990.
5. Emanuel Fthenakis, “Manual of Satellite Communications”, Mc Graw Hill Book Co., 1984.
6. Robert G. Winch, “Telecommunication Trans Mission Systems”, Mc

Graw-Hill Book Co., 1983.
7. Brian Ackroyd, "World Satellite Communication and earth station Design", BSP professional Books, 1990.
8. G.B.Bleazard, "Introducing Satellite communications", NCC Publication, 1985.
9. M.Richharia, "Satellite Communication Systems-Design Principles", Macmillan 2003.

21ECE47	VIRTUAL AND AUGMENTED REALITY	L	T	P	C
		3	0	0	3

Course Objectives

The student should be made to:

- To introduce the relevance of this course to the existing technology through demonstrations, case studies and applications with a futuristic vision along with socio-economic impact and issues .
- To understand virtual reality, augmented reality and using them to build Biomedical engineering applications.
- To know the intricacies of these platform to develop PDA applications with better optimality.

Course Outcomes

At the end of the course,the student would be able to:

1. Analyse & Design a system or process to meet given specifications with realistic engineering constraints.
2. Identify problem statements and function as a member of an engineering design team.
3. Utilize technical resources
4. Propose technical documents and give technical oral presentations related to design mini project results.

Unit1-Introduction **9**

The three I‘s of virtual reality-commercial VR technology and the five classic components of a VR system - Input Devices: (Trackers, Navigation, and Gesture Interfaces): Three-dimensional position trackers, navigation and manipulation-interfaces and gesture interfaces-Output Devices: Graphics displays-sound displays & haptic feedback.

Unit 2-VR Development Process **9**

Geometric modeling - kinematics modeling- physical modeling - behaviour modeling - model Management.

Unit 3- Content Creation Considerations For VR **9**

Methodology and terminology-user performance studies-VR health and safety issues-Usability of virtual reality system- cyber sickness -side effects of exposures to virtual reality environment

Unit 4- VR On The Web & VR On The Mobile **10**

JS-pros and cons-building blocks (WebVR, WebGL, Three.js, device orientation events)-frameworks (A-frame, React VR)-Google VR for Android-Scripts, mobile device configuration, building to android-cameras and interaction-teleporting-spatial audio-Assessing human parameters-device development and drivers-Design Haptics

Unit 5-Applications **8**

Medical applications-military applications-robotics applications- Advanced Real time Trackingother applications- games, movies, simulations, therapy

Total Hours: 45

Text Books

1. C. Burdea & Philippe Coiffet, ―Virtual Reality Technology‖, Second Edition, Gregory, John Wiley & Sons, Inc.,2008
2. Jason Jerald. 2015. The VR Book: Human-Centred Design for Virtual Reality. Association for Computing Machinery and Morgan & Claypool, New York, NY, USA.

References

1. Augmented Reality: Principles and Practice (Usability) by Dieter Schmalstieg & Tobias Hollerer, Pearson Education (US), Addison-Wesley Educational Publishers Inc, New Jersey, United States, 2016. ISBN: 9780321883575
2. Practical Augmented Reality: A Guide to the Technologies, Applications, and Human Factors for AR and VR (Usability),Steve Aukstakalnis, Addison-Wesley Professional; 1 edition, 2016.
3. The Fourth Transformation: How Augmented Reality & Artificial Intelligence Will Change Everything, Robert Scoble & Shel Israel, Patrick Brewster Press; 1 edition, 2016.
4. Learning Virtual Reality: Developing Immersive Experiences and Applications for Desktop, Web, and Mobile, Tony Parisi, O'Reilly Media; 1 edition, 2015.
5. Programming 3D Applications with HTML5 and WebGL: 3D Animation and Visualization for Web Pages, Tony Parisi, O'Reilly Media; 1 edition, 2014.
6. Learning Three.js: The JavaScript 3D Library for WebGL - Second Edition, Jos Dirksen, Packt Publishing - ebooks Account; 2nd Revised ed. Edition 2015.

21ECE48	PRINCIPLES OF SPEECH PROCESSING	L	T	P	C
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Course Objectives

The student should be made to:

- To understand the speech production mechanism and the various speech analysistechniques and speech models
- To understand the speech compression techniques
- To understand the speech recognition techniques
- To know the speaker recognition and text to speech synthesis techniques

Course Outcomes

At the end of the course,the student would be able to:

1. Design speech compression techniques
2. Configure speech recognition techniques
3. Design speaker recognition systems
4. Design text to speech synthesis systems

Unit 1-Speech Signal Characteristics & Analysis **11**

Speech production process - speech sounds and features- - Phonetic Representation of Speech -- representing= speech in time and frequency domains - Short-Time Analysis of Speech - Short- Time Energy and Zero-Crossing Rate - Short-Time Autocorrelation Function - Short-Time Fourier Transform (STFT) - Speech Spectrum - Cepstrum - Mel-Frequency Cepstrum Coefficients - Hearing and Auditory Perception - Perception of Loudness - Critical Bands - Pitch Perception

Unit 2-Speech Compression **12**

Sampling and Quantization of Speech (PCM) - Adaptive differential PCM - Delta Modulation - Vector Quantization- Linear predictive coding (LPC) - Code excited Linear predictive Coding (CELP)

Unit 3-Speech Recognition **12**

LPC for speech recognition- Hidden Markov Model (HMM)- training procedure for HMM-subword unit model based on HMM- language models for large vocabulary speech recognition - Overall recognition system based on subword units - Context dependent subword units- Semantic post processor for speech recognition

Unit 4-Speaker Recognition **5**

Acoustic parameters for speaker verification- Feature space for speaker recognition-similarity measures- Text dependent speaker verification-Text independent speaker verification techniques

Unit 5-Speaker Recognition And Text To Speech Synthesis **5**

Text to speech synthesis(TTS)-Concatenative and waveform synthesis methods, sub-word units for TTS, intelligibility and naturalness-role of prosody

Total Hours: 45

Text Books

1. L. R. Rabiner and R. W. Schafer, Introduction to Digital Signal Processing, Foundations andTrends in Signal Processing Vol. 1, Nos. 1–2 (2007) 1–194
2. Ben Gold and Nelson Morgan “Speech and Audio signal processing-processing andperception of speech and music”, John Wiley and sons 2006

References

1. Lawrence Rabiner, Biiing and– Hwang Juang and B.Yegnanarayana "Fundamentals of Speech Recognition", Pearson Education, 2009
2. Claudio Becchetti and Lucio Prina Ricotti, "Speech Recognition", John Wiley and Sons, 1999
3. Donglos O shanhnessy "Speech Communication: Human and Machine ", 2nd Ed. University press 2001.