B. Tech. Degree

IN

ELECTRONICS AND COMMUNICATION ENGINEERING

DEPARTMENT OF ELECTRONICS AND COMMUNICATION ENGINEERING

SYLLABUS
FOR
CREDIT BASED CURRICULUM

NATIONAL INSTITUTE OF TECHNOLOGY PUDUCHERRY
KARAIKAL – 609609
INDIA

SEMESTER III

Code	Course of Study	Type	C
MA205	Transformation Techniques	Maths	3
EC201	Signals and Systems	DC	3
EC203	Network Theory	DC	3
EC205	Engineering Electromagnetics	DC	3
EC207	Semiconductor Physics and Devices	DC	3
EC209	Digital Circuits and Systems	DC	3
EC211	Devices and Networks Laboratory	DC	2
EC213	Digital Electronics Laboratory	DC	2
Maths-1, C-3; DC (T)-5, C -15; DC (L)-2, C-4;		**TOTAL credits**	**22**

SEMESTER IV

Code	Course of Study	Type	C
MA206	Statistical and Numerical Methods	Maths	3
EC202	Digital Signal Processing	DC	3
EC204	Control Systems	DC	3
EC206	Fundamentals to Transmission Lines and Antennas	DC	3
EC208	Electronics Circuits	DC	3
EC210	Microprocessor and microcontroller	DC	3
EC212	Electronic Circuits Laboratory	DC	2
EC214	Microprocessor and microcontroller Laboratory	DC	2
Maths-1, C-3; DC (T)-5, C -15; DC (L)-2, C-4;		**TOTAL credits**	**22**

SEMESTER V

Code	Course of Study	Type	C
EC301	Communication Theory	DC	3
EC303	Analog Integrated Circuits	DC	2
ECXXX	Dept. Elective	DE	3
ECXXX	Dept. Elective	DE	3
ECXXX	Dept. Elective	DE	3
ECXXXX	Global Elective	GE	3
EC305	Analog Integrated Circuits and Laboratory	DC	2
EC307	Digital Signal Processing Laboratory	DC	2
DC (T)-2, C -5; DC (L)-2, C-4; DE-3, C-9; GE-1, C-3		**TOTAL credits**	**21**

SEMESTER VI

Code	Course of Study	Type	C
EC302	Digital Communication	DC	3
EC304	VLSI Design	DC	3
ECXXX	Dept. Elective	DE	3
ECXXX	Dept. Elective	DE	3
ECXXXX	Global Elective	GE	3
HM302	Professional Ethics and Human Values	HM	2
EC306	Communication Engineering Laboratory	DC	2
EC308	VLSI Design Laboratory	DC	2
HM-1, C-2; DC (T)-2, C-6; DC (L)-2, C-4; DE-2, C-6; GE-1, C-3		**TOTAL credits**	**21**

SEMESTER VII

Code	Course of Study	Type	C
HM401	Industrial Economics and Management	HM	3
EC401	Microwave Electronics	DC	3
ECXXX	Dept. Elective	DE	3
ECXXX	Dept. Elective	DE	3
ECXXXX	Global Elective	GE	3
EC403	Microwave and Optical Communication Laboratory	DC	2
EC491	Project Work - Phase 1	Project	2

HM-1, C-3; DC (T)-1, C-3; DC (L)-1, C-2; DE-2, C-6; GE-1, C-3; Project , C-2

TOTAL credits 19

SEMESTER VIII

Code	Course of Study	Type	C
ECXXX	Dept. Elective	DE	3
ECXXX	Dept. Elective	DE	3
ECXXX	Dept. Elective	DE	3
ECXXX	Dept. Elective	DE	3
EC492	Project Work - Phase 2	Project	4

DE-4, C-12; Project , C-4 **TOTAL credits 16**

List of Dept. Electives

SEMESTER - V

Code	Course of Study	C
EC501	Statistical Theory of Communication	3
EC503	Digital Signal Processors and Applications	3
EC505	Advanced Microprocessors	3
EC507	Information Theory and coding	3
EC509	Advanced Microcontrollers	3
EC511	Antennas and Wave Propagation	3

SEMESTER-VI

Code	Course of Study	C
EC502	Microwave Components and Circuits	3
EC504	Networks and Protocols	3
EC506	Speech Processing	3
EC508	Embedded System Design	3
EC510	Adaptive Signal processing	3

SEMESTER-VII

Code	Course of Study	C
EC513	Fiber Optic Communication	3
EC515	Mobile Communication	3
EC517	Digital Image Processing	3
EC519	Analog CMOS Design	3
EC521	Microwave Integrated Circuit Design	3

SEMESTER-VIII

Code	Course of Study	C
EC512	Communication Switching Systems	3
EC514	Pattern Recognition	3
EC516	Broadband Access Technologies	3

EC518	Principles of Radar	3
EC520	Satellite Communication	3
EC522	Design of Cognitive Radio	3
EC524	Introduction to MEMS	3
EC526	Biomedical Signal and Image Processing	3
EC528	RF and Microwave Engineering	3
EC530	Wireless networks	3
EC532	Robotics Engineering	3

List of Global Electives

Code	**Course of Study**	**C**
EC1001	Applied Electronics	3
EC1002	Communication Systems	3
EC1003	Electronic Devices	3
EC1004	CMOS VLSI Design	3
EC1005	Digital Electronics	3
EC1006	Digital Image processing	3
EC1007	Digital Signal Processing	3
EC1008	Embedded Systems	3
EC1009	Communication Networks	3
EC1010	Introduction to Robotics	3
EC1011	Satellite Communication	3
EC1012	Wireless Communication	3
EC1013	Optical Communication	3
EC1014	Microprocessors and its Applications	3
EC1015	Information Theory and Coding	3

SEMESTER III

MA205 TRANSFORMATION TECHNIQUES (3 - 1 - 0) 3

Pre-Requisite: None

Objectives:

The objective of this subject is to expose student to understand the importance of transform techniques and complex variables to solve real world problems. It also focuses the partial differential equations and its applications in science and engineering.

Topics Covered:

Unit 1:

Fourier series**:** Expansion of a function in Fourier series for a given range - Half range sine and cosine expansions.

Unit 2:

Fourier Transforms: Complex form of Fourier series- Fourier sine and cosine transformations - simple illustrations. Finite Fourier sine and Cosine transforms.

Unit 3:

Two-dimensional steady state heat flow equation. Heat equation, Wave equation - Fourier series solution.

Unit 4:

Z- Transforms, Inverse Z- transform, properties, Damping rule, Shifting rule, initial and final value theorems, convolution theorem.

Unit 5:

Applications of Z-Transforms-Solution of difference equations using Z- transforms

Course Outcomes:

Apply mathematics and science for solving / troubleshooting electrical and electronics engineering problems.

Text Books:

1. Erwyn Kreyszig, "Advanced Engineering Mathematics", John Wiley and Sons, 8th Edition, 2010.
2. Gupta.S.C and Kapoor.V.K, "Fundamentals of Mathematical Statistics", Sultan Chand, 2000.
3. W. FELLER, An Introduction to Probability Theory and its Applications, Vol. 1, Wiley Eastern, New Delhi.

Reference Books:

1. Grewal.B.S, "Higher Engineering Mathematics", Khanna Publications, 42nd Edition, 2013.
2. K. S. TRIVEDI, Probability and Statistics with Reliability and Queueing and Computer Science Applications, Prentice Hall of India, 1988.
3. O. ALLEN, Introduction to Probability, Statistics and Queueing Theory with Computer Science Applications, Academic Press, 2006 reprint.

EC201 SIGNALS AND SYSTEMS (3 - 0 - 0) 3

Pre-Requisite: None

Objectives:

The aim of the course is for:

1. Understanding the fundamental characteristics of signals and systems.
2. Understanding the concepts of vector space, inner product space and orthogonal series.
3. Understanding signals and systems in terms of both the time and transform domains, taking advantage of the complementary insights and tools that these different perspectives provide.
4. Development of the mathematical skills to solve problems involving convolution, filtering, modulation and sampling.

Topics Covered:

Unit-1: Mathematical Preliminaries
Vector spaces - Inner Product spaces - Schwartz inequality - Hilbert spaces - Orthogonal expansions - Bessel's inequality and Parseval's relations
Unit-2: Signals
Continuous-time signals, classifications - Periodic signals - Fourier series representation - Hilbert transform and its properties
Unit-3: Laplace and Fourier transforms
Continuous - time systems - LTI system analysis using Laplace and Fourier transforms
Unit-4: Sampling and Filters
Sampling and reconstruction of band limited signals - Low pass and band pass sampling theorems - Aliasing, Anti-aliasing filter - Practical Sampling-aperture effect
Unit-5: Z-transform
Discrete-time signals and systems - Z-transform and its properties - Analysis of LSI systems using Z - transform.

Course Outcomes:

Students will be able to

1. Apply the knowledge of linear algebra topics like vector space, basis, dimension, inner product, norm and orthogonal basis to signals.
2. Analyse the spectral characteristics of continuous-time periodic and a periodic signals using Fourier analysis.
3. Classify systems based on their properties and determine the response of LSI system using convolution. Analyze system properties based on impulse response and Fourier analysis.
4. Apply the Laplace transform and Z- transform for analyze of continuous-time and discrete-time signals and systems.

Text Books:

1. A.V. Oppenheim et al, Signals and Systems (2/e), Pearson 2003.
2. M. Mandal and A. Asif, "Continuous and Discrete Time Signals and Systems, Cambridge, 2007.

Reference Books:

1. D.C. Lay, Linear Algebra and its Applications (2/e), Pearson, 2000.
2. K. Huffman & R. Kunz, Linear Algebra (2/e), Pearson, 1971.
3. S.S. Soliman& M.D. Srinath, Continuous and Discrete Signals and Systems, Prentice- Hall, 1990.

EC203 NETWORK THEORY (3 - 0- 0) 3

Pre-Requisite: None

Objectives:

1. To make the students capable of analysing any given electrical network.
2. To make the students learn how to synthesize an electrical network from a given impedance/admittance function.
3. To make the student learn to apply network theorems.

Topics Covered:

Unit -1:Introduction

Network concept-Elements and sources. Kirchoff's laws. Tellegen's theorem. Network quilibrium equations. Node and Mesh method. Source superposition. Thevenin's and Norton's theorems.

Unit -2:Network Theorems

First and second order networks-State equations-Transient response. Network functions. Determination of the natural frequencies and mode vectors from network functions. Millman Theorem.

Unit -3:Steady state analysis

Sinusoidal steady-state analysis. Maximum power-transfer theorem. Resonance. Equivalent and dual networks. Design of equalizers, Substitution Theorem.

Unit -4:Two port networks

Two-port network parameters. Interconnection of two port networks. Barlett's bisection theorem. Image and Iterative parameters. Design of attenuators. Network graph theory, Tree, Cutset, Incident Matrix.

Unit -5:RLC Networks

Two-terminal network synthesis. Properties of Hurwitz polynomial and Positive real function. Synthesis of LC, RC and RL Networks, Foster Forms and Cauer Forms.

Course Outcomes:

1. Able to analyze and synthesize electrical circuits
2. Understand the concept of Resonance phenomena.
3. Implement networks in various forms.

Text Book:

1. Hayt W. H., Kemmerly J. E. and Durbin S. M., "Engineering Circuit Analysis", 6th Ed., Tata McGraw-Hill Publishing Company Ltd.,2008.

Reference Books:

1.Valkenberg V., "Network Analysis", 3rd Ed., Prentice Hall International Edition. 2007.
2.Kuo F. F., "Network Analysis and Synthesis", 2nd Ed., Wiley India., 2008.

EC205 ENGINEERING ELECTROMAGNETICS (3 - 0 - 0) 3

Pre-Requisite: None

Objectives:

To impart core concepts of Electromagnetics and wave propagation which is essential for subsequent courses on transmission line and waveguides, antennas and wireless communication, microwave engineering.

Topics Covered:

Unit -1: Electrostatics

Coulomb's law – Vector Form - Electric Field Intensity - flux Density - Gauss's law and applications - Electrostatic potential - Poisson's and Laplace equations - Method of images.

Unit -2: Electrostatic fields in matter

Electric properties of matter – Electric current – Current density – point form of ohm's law – continuity equation for current. Dielectrics and dielectric polarization - Capacitors with dielectric substrates - Boundary conditions for electric fields - Force and energy in dielectric systems.

Unit-3: Magnetostatics

Magnetic fields of steady currents -Biot- Savart's and Ampere's laws and simple applications - Magnetic flux density, Inductance of loops and solenoids, The Lorentz force equation for a moving charge and applications – Magnetic moment – Magnetic vector potential - Magnetic boundary conditions, Magnetic properties of matter.

Unit-4: Electrodynamics

Flux rule for motional emf - Faraday's law - Self and mutual inductances - Maxwell's equations in integral form and differential form - Poynting theorem -Poynting Vector

Unit-5: Electromagnetic wave propagation

Wave Equation -Uniform plane waves - Reflection and refraction - Wave polarization –types - Dependence on Polarization - Brewster angle.

Course Outcomes:

Students are able to

1. Understand basic Electrostatic theorems and laws and to derive them.
2. Discuss the behaviour of Electric fields in matter and Polarization concepts.
3. Understand the basic Magnetostatic theorems and laws and to derive them, to infer the magnetic properties of matter.
4. To derive and discuss the Maxwell's equations. and familiar with Electromagnetic wave propagation and wave polarization.

Text Books:

1. Hayt,WH. And Buck,J.A.,"EngineeringElectromagnetics",7thEdition,TMH, 2009.
2. D.J. Griffiths, Introduction to Electrodynamics (4/e), Addison-Wesley, 2012

Reference Books:

1. R.E. Collin, "Foundations for Microwave Engineering", 2nd edition, Mc Graw–Hill, 2009.
2. R.E. Collin, "Antennas and Radio wave Propagation", Mc Graw-Hill, 1985.
3. E.C. Jordan & K.G. Balmain "Electromagnetic Waves and Radiating Systems" PHI Learning, 2ndedition 2011.
4. MathewN.O.Sadiku,"ElementsofEngineeringElectromagnetics",5thEdition, Oxford University Press, 2009.
5. Narayana Rao, N., "Elements of Engineering Electromagnetics", 6th Edition, Pearson Education, 2009.

EC207 SEMICONDUCTOR PHYSICS AND DEVICES (3 - 0 - 0) 3

Pre-Requisite: None

Objectives:

1. To make the students understand the fundamentals of electronic devices.
2. To train them to apply these devices in mostly used and important applications.

Topics Covered:

Unit-1: Semiconductors
Semiconductor materials- crystal growth- film formation- lithography- etching and doping- Conductivity- charge densities - E-K relation- Fermi level- Continuity equation- Hall Effect and its applications.
Unit-2: Semiconductor Diodes
P-N junction diodes - biasing-diode equation -V-I characteristics- Capacitances-Diode model- Various types of diodes -Zener diode, Varactor diode, photo diode and LED.
Unit-3: Transistors
BJT- modes of operation - CE, CB and CC configuration and I/O characteristics - BJT models- BJT switch- Breakdown mechanisms.UJT - VI Characteristics
Unit-4: Field Effect Transistor
JFET - operation- V-I characteristics, MOSFET- operation- V-I characteristics - MOSFET as amplifier and switch- Capacitance-equivalent model.
Unit-5:Power devices
Operation and characteristics-Thyristor family-Power diodes-Power transistors-GTOs and IGBTs.

Course Outcomes:

Students are able to

1. Apply the knowledge of basic semiconductor material physics and understand fabrication processes.
2. Analyze the characteristics of various electronic devices like diode, transistor etc.
3. Classify and analyze the various circuit configurations of Transistor and MOSFETs.
4. Illustrate the qualitative knowledge of Power electronic Devices.

Text Books:

1. J. Millman and C.C. Halkias: Electronic devices and Circuits, McGraw Hill, 1976.
2. S.M. Sze, Semiconductors Devices, Physics and Technology, (2/e), Wiley, 2002.
3. A.S. Sedra& K.C. Smith, Microelectronic Circuits (6/e), Oxford, 2010.

Reference Books:

1. Adir Bar-Lev: Semiconductors and Electronic Devices, (3/e), Prentice Hall, 1993.
2. B.G. Streetman, S.K. Banerjee: Solid state Electronic devices, (6/e), PHI, 2010.

EC209 DIGITAL CIRCUITS AND SYSTEMS (3 - 0 - 0) 3

Pre-Requisite: None

Objectives:

Modern electronics is based on digital logic design, in this course basics of digital logic designing are covered which includes Boolean algebra, propositions, truth tables, minimization of combinational circuits. Karnaugh maps and tabulation procedure, implementation of sum of product and product of sum in hardware.

Topics Covered:

Unit-1: Boolean algebra
Review of number systems- representation- conversions, error detection and error correction. Review of Boolean algebra- theorems, sum of product and product of sum simplification, Simplification of Boolean expressions- Implementation of Boolean expressions using universal gates.
Unit-2: Combinational logic circuits
Adders, subtractors, parity generator, decoders, encoders, multiplexers, demultiplexers, Realisation of boolean expressions- using decoders-using multiplexers. Memories – ROM-Types of RAMs – Basic structure, organization, Static and dynamic RAMs, PLDs, PLAs.
Unit-3: Sequential circuits
Latches, flip flops, edge triggering, asynchronous inputs. Shift registers, Universal shift register, applications. Binary counters – Synchronous and asynchronous up/down counters, mod-N counter, Counters for random sequence.
Unit-4:Synchronous circuit analysis and design:
Synchronous circuit analysis and design: structure and operation, analysis-transition equations, state tables and state diagrams, Modelling- Moore machine and Mealy machine
Unit-5:Logic families:
Introduction to TTL and ECL logic families: Basic working of a TTL NAND gate-characteristics of a TTL NAND gate- important specifications – Basic working of ECL gate-–DTL- RTL- CMOS and ECL family of logic circuits.

Course Outcomes:

The expected outcome after learning this course are that a student must be able to design a digital circuit, understand the differences between combinational and sequential circuits and will be able to implement the circuit.

Text Books:

1. Wakerly J F, Digital Design: Principles and Practices, Prentice-Hall, 4thEd.
2. R P Jain, Modern Digital Electronics 4th Edition, Tata Mcgraw Hill Education Private Limited
3. D. D. Givone, Digital Principles and Design, Tata Mc-Graw Hill, New Delhi, 2008.

Reference Books:

1. D.P. Leach, A. P. Malvino, Goutam Guha, Digital Principles and Applications, Tata Mc-Graw Hill, New Delhi, 2011
2. M. M. Mano, Digital Design, 3rd ed., Pearson Education, Delhi, 2003
3. R.J. Tocci and N.S. Widner, Digital Systems - Principles& Applications, PHI, 10th Ed., 2007
4. T. L. Floyd and Jain ,Digital Fundamentals, 8th ed., Pearson Education, 2003

EC211 DEVICES AND NETWORKS LABORATORY (0 - 0 - 3) 2

List of Experiments:

1. PN Junction Diode and Zener diode Characteristics
2. Characteristics study of Bipolar Junction Transistor (BJT)
3. Characteristics study of UJT
4. Characteristics study of JFET
5. Thevenin and Substitution theorems
6. Superposition and Maximum power transfer theorems
7. Frequency Response study of RLC circuits
8. Constant K High pass and low pass Filter
9. Attenuators
10. Equalizers

EC213 DIGITAL ELECTRONICS LABORATORY (0 – 0 – 3) 2

List of Experiments:

1. Study of logic gates and verification of Boolean Laws.
2. Design and implementation of adders and subtractors
3. Design and implementation of code converters.
4. Design and implementation of Multiplexers and De-multiplexers
5. Design and implementation of Encoder and Decoder.
6. Design and implementation of parity generator and checker.
7. Design and implementation of 2-bit , 4 bit and 8-bit magnitude comparators.
8. Study of flip-flops.
9. Design and implementation of synchronous counters using flip-flops.
10. Design and implementation of asynchronous counters using flip-flops.
11. Design and implementation of ring and Johnson counter using flip-flops.
12. Design and implementation of shift registers.
13. Simulation of combinational logic circuits using Verilog.
14. Simulation of sequential logic circuits using Verilog

SEMESTER IV

MA206 STATISTICAL AND NUMERICAL METHODS (3-0-0) 3

Pre-Requisite: None

Objective:

The objective of this subject is to expose student to understand the basic importance of numerical methods to tackle the problems which cannot be solved analytically. It also focuses the probability theory and its applications in science and Engineering.

Topics Covered:

Unit 1:
Definitions of Probability - Notion of sample space - Events - Basics of Combinatorial Analysis - Posing Probability problems mathematically – Examples, Conditional Probability - Baye's Rule - Random variable - Probability mass function, Density function, Distribution Function - Bernoulli Trials - Binomial Distribution - Poisson Approximation - Poisson Distribution - Normal Distribution - Moment Generating Function

Unit - 2:
Numerical solution of algebraic and transcendental equations by Bisection method, Regula-Falsi method, Newton - Raphson's method, muller method- Order of convergence.

Unit - 3:
Lagrange interpolation, Forward, backward and central differences, Newton's forward and backward interpolation formulae, Stirling and Bessel's interpolation formulae, Newtons divided difference formulae, Numerical differentiation at the tabulated points with forward backward and central differences.

Unit - 4:
Curve fitting by the method of least squares. Fitting of Straight line, Second and higher order linear and nonlinear fit, exponential fit, etc…,. Weighted least squares approximation, linear Weighted least squares approximation, Non-linear weighted least squares approximation.

Unit - 5:
Numerical Integration with Trapezoidal rule, Simpson's 1/3 rule, Simpson's 3/8 rule. Numerical solution of order ordinary differential equations with Taylor series method, Euler's method, modified Euler's method, Runge-Kutta method of 4^{th} order.

Course Outcomes:

Students will be able to

1. Understand the axiomatic formulation of modern Probability Theory and think of random variables as an intrinsic need for the analysis of random phenomena.
2. Characterize probability models and function of random variables based on single & multiples random variables.
3. Evaluate and apply moments & characteristic functions and understand the concept of inequalities and probabilistic limits.
4. Understand the concept of random processes and determine covariance and spectral density of stationary random processes.
5. Demonstrate the specific applications to Poisson and Gaussian processes and representation of low pass and band pass noise models.

Text Books:

1. S.C. Gupta and V.K. Kapoor, "Fundamentals of Mathematical Statistics", Sultan Chand, 2011.
2. Erwyn Kreyszig, "Advanced Engineering Mathematics", John Wiley and Sons, 9^{th} Edition, 2011.

Reference Books:

1. B.S. Grewal, "Higher Engineering Mathematics", Khanna Publications, 42^{nd} Edition,2012.

EC202 DIGITALSIGNAL PROCESSING (3 - 0 - 0) 3

Pre-Requisite: EC201

Objective:

The subject aims to introduce the mathematical approach to manipulate discrete time signals, which are useful to learn digital tele-communication.

Topics Covered:

Unit-1: Signals and Systems
Review of LSI system theory- DTFT-Frequency response of discrete time systems-All pass inverse and minimum phase systems.
Unit-2: Discrete Fourier Transform
Relationship of DFT to other transforms- FFT- DIT and DIF FFT algorithm-Linear filtering using DFT and FFT.
Unit-3: FIR and IIR
Frequency response-FIR filter types- Design of FIR filters- Mapping formulas-Frequency transformations-Direct form realization of FIR systems-Lattice structure for FIR systems.
IIR filter types-IIR filter design- Bilinear transformation- impulse invariance transformation-Structures of IIR filters-Finite word length effects- Limit cycle oscillations
Unit-4 Multi-rate signal processing and Applications of DSP
Sampling rate conversion by an integer and rational factor-Poly phase FIR structures for sampling rate conversion-interpolation- decimation-Homomorphic filtering-Applications of DSP in speech and image processing-Homomorphic de-convolution, Applications in speech and image processing
Unit-5 Introduction to DSP Processor
Difference between DSP and other microprocessor architectures, Analog Device DSPs. TMS320C54X architecture

Course Outcomes:

Students will be able to

1. Analyse discrete-time systems in both time & transform domain and also through pole-zero placement.
2. Analyse discrete-time signals and systems using DFT and FFT.
3. Design and implement digital finite impulse response (FIR) filters.
4. Design and implement digital infinite impulse response (IIR) filters.
5. Understand and develop multirate digital signal processing systems.

Text Books:

1. Alan V. Oppenheim, Ronald W. Schafer, and John R. Buck (2/e), Discrete Time Signal Processing, Prentice Hall Publication New Jersey
2. Dimitris G Manolakis, and John G. Proakis, Digital Signal Processing : Principles, Algorithms, and Applications (4/e), Pearson
3. Sen M. Kuo and Woon-seng Gan, Digital signal Processor. Architectures, Implementations, and Applications, Pearson and Prentice Hall (2005)

Reference Books:

1. Doug Smith, Digital Signal Processing Technology: Essentials of the Communications Revolution, ARRL
2. S. Salivahanan, A Vallavaraj, and C Gnanapriya, Digital Signal Processing, TMG Publication
3. Sophocles J. Orfanidis, Introduction to Signal Processing, Prentice Hall Signal Processing Series

EC204 CONTROL SYSTEMS (3 - 0- 0) 3

Objectives:

1. To teach the mathematical modelling of control system.
2. To familiarize the students with the need for modelling of systems.
3. To represent the system in various ways mathematically.
4. To teach them the various techniques of stability analysis.

Topics Covered:

Unit -1: Introduction
Block-diagram algebra. Time response of poles. Ruth – Hurwitz criterion. Basic feedback loop. Asymptotic tracking and performance.
Unit -2: Stability analysis
Root loci. Properties. Stability range from the loci, Sensitivity of system Design using root loci, proportional controller, phase lead controller and PD controller. Mechanical Systems-Electrical Systems
Unit -3: Frequency domain analysis
Frequency domain techniques. Bode and Nyquist plots. Phase and gain margins. Frequency domain specifications. Controller design.
Unit-4: State Space analysis
State - space techniques. Canonical form for SISO continuous-time and discrete-time systems. Solution of state equations. State models of MIMO systems. Stability analyses-Lyapunov criterion for stability.
Unit-5: Controller design
Controllability and observability. Design of state feedback controllers. Full order and reduced order observers. Design of observers for continuous-time and discrete-time systems.

Course Outcomes:

1. Able to model the control systems.
2. Able to test the stability of control system using various methods
3. Able to design stable systems.

Text Books:

1. K. Ogata : Modern Control Engineering, (5/e), PHI, 2009.
2. R.C. Dorf& R.H. Bishop, Modern Control Systems (8/e), Pearson, 1999.

Reference Books:

1. B.C. Kuo : Automatic Control Systems, (9/e), PHI, 2009.
2. K. Morris : An Introduction to Feedback Control, Academic Press, 2001

EC206 FUNDAMENTALS TO TRANSMISSION LINES AND ANTENNAS (3 - 0 - 0) 3

Pre-Requisite: EC205

Objective:

To impart knowledge on fundamentals of transmission line and its significance in microwave circuits and to impart knowledge on basics of antenna.

Topics Covered:

Unit 1: Transmission line
Transmission line equations -Voltage and current waves - Characteristic impedance–SWR – Reflection Coefficient - Solutions for different terminations - Transmission-line loading.
Unit-2: Impedance Matching Techniques
Impedance transformation and matching - Quarter-wave and half-wave transformers - Binomial and Tchebeyshev transformers - Single, double and triple stub matching.
Unit-3 Graphical Tool
The circle diagram for the dissipationless line – The Smith Chart – Application of the Smith Chart
Unit-4: Radiation fundamentals
Radiation mechanism, Current distribution on a thin wire antenna, Fundamental Parameters of Antennas – Radiation pattern, Radiation power density, Radiation intensity, Directivity, Antenna efficiency, Gain, Bandwidth, Input impedance, Effective length, Antenna temperature, Friis transmission equation.
Unit-5: Antenna Types
Linear Wire Antennas, Loop Antennas, Travelling wave antennas, Introduction to Antenna Arrays

Course Outcomes:

Students are able to

1. To understand the fundamentals of Transmission lines and waveguides.
2. To apply the knowledge to understand various Microwave components
3. Find and analyze the transmission lines and their parameters using the Smith Chart
4. To understand the antenna radiation mechanism
5. To know the different types of antennas

Text Books:

1. J.D. Ryder "Networks, Lines and Fields", 2nd edition, PHI Learning, New Delhi, 2011.
2. Balanis, "Antenna Theory", 3rd edition, Wiley Publishers, 2012.

References:

1. D.M. Pozar, "Microwave Engineering", 4thedition, Wiley,2011.
2. R.E. Collin, "Foundations for Microwave Engineering", 2nd edition, Mc Graw–Hill, 2009.
3. E.C. Jordan & K.G. Balmain "Electromagnetic Waves and Radiating Systems" PHI Learning, 2ndedition 2011.

EC208 ELECTRONIC CIRCUITS (3 - 0 - 0) 3

Pre-Requisite: None

Objectives:

The aim of the course is for:

1. Understanding the fundamental characteristics of Rectifiers.
2. Understanding the working principle of BJT and MOSFET transistor models.
3. Understanding the concepts of MOSFET and BJT biasing.
4. Understanding the working principle of BJT and MOSFET amplifiers.
5. Development of the mathematical skills to solve problems involving analysis of amplifier gain, output voltage and current.

Topics Covered:

Unit 1: Rectifiers and Transistor Biasing

Diode Circuits-Clippers and Clampers-Rectifier circuits and filters-Voltage Regulators-BJT Biasing Circuits:Types, Q Point , Bias stability, Stability factors-Concept of DC and AC load lines- Fixing of operating point. Low and high frequency models Small signal analysis of CE, CB and CC configurations using small signal hybrid π model

Unit 2: BJT Amplifiers

Transistor Amplifying action-small signal analysis of CE amplifier-AC load line-Voltage swing limitations, common collector and common base amplifiers-Differential amplifiers-CMMR-Darlington amplifier-Cascaded stages-Cascode amplifier-Frequency response of CE amplifier-Emitter follower.

Unit 3: JFET and MOSFET Amplifiers

Small signal analysis of JFET amplifiers- Small signal analysis of MOSFET and JFET-Common source amplifiers-Voltage swing limitations- -Source follower and common gate amplifiers-BiMOS amplifiers.

Unit 4: Feedback Amplifiers

Feedback amplifiers : Effect of positive and negative feedback on gain, frequency response and distortion, feedback topologies and its effect on input and output impedance, feedback amplifier circuits,Tuned amplifiers.

Unit 5: Oscillators

Oscillators-Classification of oscillators , Barkhausen criterion,Analysis of RC phase shift and wein bridge oscillators,Working of Hartley, Colpitts and Crystal oscillators- Square wave and triangular wave generators.

Course Outcomes:

Students will be able to

1. Apply the knowledge of diode, BJT and MOSFET to electronics circuit analysis.
2. Analyze the characteristics of BJT and MOSFET based biasing circuits and their stability conditions.
3. Classify basic amplifier circuits based on their properties and determine their output voltage, current, resistance and gain. Analyze amplifier circuits by the use of small signal and large signal transistor models. Study analyze the oscillator circuits.

Text Book:

1. A.S. Sedra & K.C. Smith, Microelectronic Circuits (5/e), Oxford, 2004.

Reference Books:

1. Floyd, Electronic Devices, 9th ed, Pearson, 2012.
2. Millman J. and Halkias C.C., 2002 ‘Integrated Electronics”, McGraw Hill. India.
3. David A.Bell, 1998 “Electronic Devices and Circuits”, Prentice Hall of India.
4. G.K.Mithal, 2000 “Electronic devices and circuits”, khanna publishers, Delhi, India.
5. Allen mottershead, 2002 “Electronic devices and circuits”, Prentice Hall of India.

EC208 MICROPROCESSORS AND MICROCONTROLLERS (3 - 0 - 0) 3

Pre-Requisite: EC209

Objective:

This subject deals about the basic 8 bit (8085) &16-bit (8086) processor and an 8-bit (8051) controllers, their architecture, internal organization and their functions, interfacing an external device with the processors/ controllers.

Topics Covered:

Unit-1:8085 Microprocessor
Architecture- Addressing modes- Instruction set- Programming 8085-Interrupts
Unit-2:8086 Microprocessor
Programmer's model for 8086-Segmented memory operation- Addressing modes- instruction set- Assembly language programming
Unit-3: Interfacing
Memory interfacing- I/O interfacing- parallel and serial data transfer methods- 8255 PPI chip-8251serial communication interface- 8259 Interrupt controller- 8237 DMA controller.
Unit-4: 8051 Microcontroller
Programming model - Instruction set of 8051 Microcontroller- Addressing mode supported by 8051- instruction set-Assembly language programming.
Unit-5: 8051 Programming
Programming timer-serial port- I/O and interrupts-DAC- ADC- Stepper motor interfacing to 8051.

Course Outcomes:

Students are able to

1. Recall and apply a basic concept of digital fundamentals to Microprocessor based personal computer system.
2. Identify a detailed s/w & h/w structure of the Microprocessor.
3. Illustrate how the different peripherals (8255, 8251 etc.) are interfaced with Microprocessor.
4. Distinguish and analyze the properties of Microprocessors & Microcontrollers.
5. Analyze the data transfer information through serial & parallel ports.

Text Books:

1. Ramesh S. Gaonkar, "Microprocessor-Architecture, Programming and Applications with the 8085" Penram International Publisher, 5th Ed.,2006.
2. J.L. Antonakos, An Introduction to the Intel Family of Microprocessors, Pearson, 1999.
3. Barry B. Brey, The Intel Microprocessors, (7/e), Eastern Economy Edition , 2006.
4. M.A. Mazidi & J.C. Mazidi Microcontroller and Embedded systems using Assembly & C. (2/e), Pearson Education, 2007.

Reference Books:

1. Kenneth J Ayala, The 8051 Microcontroller , (3/e), Thomson Delmar Learning, 2004.
2. I. Scott MacKenzie and Raphael C.W. Phan. The 8051 Microcontroller.(4/e), Pearson education, 2008.

EC212 ELECTRONIC CIRCUITS LAB (0 – 0 – 3) 2

List of Experiments:

1. Full wave rectifier with filters
2. Bridge rectifier with filters
3. Stability of Q point
4. Single stage RC coupled CE amplifier
5. UJT Characteristics
6. UJT Relaxation Oscillator
7. Integrator and Differentiator
8. Darlington emitter follower
9. RC phase shift oscillator
10. Wien Bridge Oscillator
11. Differential Amplifier
12. Clipper and Clamper
13. Transistor as a Switch

EC214 MICROPROCESSORS AND MICROCONTROLLER LABORATORY (0 - 0 - 3) 2

List of Experiments:

1. Programming with 8085
    i. Addition, Subtraction, Multiplication and Division of 8 bit numbers.
    ii. Addition, Subtraction, Multiplication and Division of 16 bit numbers.
    iii. Arranging an array in ascending order.
    iv. Arranging an array in descending order.
    v. Finding a smallest number in an array.
    vi. Finding a largest number in an array.
    vii. Binary to BCD conversion.
    viii. BCD to Binary conversion.
    ix. BCD to Excess-3 Conversion.
    x. Excess-3 to BCD Conversion.
2. Programming with 8086
    i. Addition, Subtraction, Multiplication and Division of 16 bit numbers.
    ii. Sorting an array in ascending order.
    iii. Sorting an array in descending order.
    iv. Copying a string
    v. Compare two strings
    vi. Scan a character ina string
    vii. Finding square and square root of a number.
3. Interfacing with 8085/8086- 8251
4. Interfacing with 8085/8086, 8237, 8259
5. Programming with 8051 microcontroller
    i. Addition of two 8 bit numbers.
    ii. Subtraction of two 8 bit numbers.
    iii. Multiplication of two 8 bit numbers.
    iv. Division of two8 bit numbers.
6. Interfacing with 8051- ADC, DAC, Stepper motor

SEMESTER V

EC301 COMMUNICATION THEORY (3 - 0 - 0) 3

Pre-Requisite: EC201 & MA206

Objective:

To develop a fundamental understanding on communication systems with emphasis on analog modulation techniques.

Topics Covered:

Unit -1: Amplitude Modulation.
Basic blocks of Communication System. AM, Linear Modulation - DSB-SC, SSB and VSB. Super heterodyne receiver. Noise in CW modulation systems - SNR calculations for synchronous detection of DSB and SSB and envelope detection of AM.
Unit -2: Angle Modulation
Frequency and Phase modulation. Transmission Bandwidth of FM signals, Methods of generation and detection. SNR calculations for angle modulation system. Pre-emphasis and de-emphasis. Threshold effect.
Unit -3: Power amplifiers
Design of Class A, B, AB, C, D, S and E power amplifiers. Use of power amplifiers in Transmission.
Unit - 4: Circuits for Modulation and Demodulation
Circuits for generation and detection of AM, DSBSC, SSBSC - Collector modulator class C amplifier, Balanced modulator, switching modulator, ring modulator and envelope detector. Circuits for generation and detection of FM signal - Varactor diode FM modulator, Armstrong Method of FM Generators and FM discriminators.
Unit - 5: Information Theory
Entropy - Discrete Memoryless channels - Channel Capacity -Hartley - Shannon law - Source coding theorem. Hultman & Shannon - Fano codes

Course Outcomes:

Students are able to

1. Apply the basic knowledge of signals and systems and understand the basics of communication system and analog modulation techniques.
2. Apply the basic knowledge of transistor and describe the power amplifiers.
3. Evaluate the communication system performance in the presence of noise and summarize the merits and demerits of all the conventional analog modulation system.
4. Design as well as conduct experiments, analyze and interpret the results to provide valid conclusions for modulators, demodulator and communication systems using CAD tool.

Text Books:

1. S. Haykins, "Communication Systems" (4/e), Wiley, 2001.
2. B. Carlson, "Introduction to Communication Systems" (4/e), McGraw-Hill, 2009.

Reference Books:

1. Kennedy, Davis, "Electronic Communication Systems" (4/e), McGraw Hill, 1999.
2. J. Smith, Modern, "Communication Circuits" (2/e), McGraw Hill, 1997.
3. J. S Beasley & G.M. Miler, "Modern Electronic Communication" (9/e), Prentice-Hall, 2008

EC303 ANALOG INTEGRATED CIRCUITS (3 - 0 - 0) 2

Pre-Requisite: EC208

Objective:

This subject introduces the theoretical & circuit aspects of Op-amp, which is the backbone for the basics of Linear integrated circuits.

Topics Covered:

Unit-1:Operational Amplifiers
Differential amplifiers, DC and AC characteristics. Applications-Inverting and Non Inverting amplifiers, Differentiators and Integrators, Summing and Difference amplifier, Voltage to current converters, Precision rectifiers. Log and antilog amplifiers. Four quadrant multipliers. Instrumentation amplifier.
Unit-2:Active filters.
Filter classification. Standard approximations. Butterworth, Chebyshev and Bessel filters. Switched capacitor filter.
Unit-3:Oscillators using opamps
Schmitt trigger, Astable, Monostable and Bistable Multivibrators using opamps and 555 timer. Triggering circuits for bistable and monostable multivibrators.Programmable timer.
Unit-4:Data converters.
Analog multiplexer .A/D and D/A converters and its type. PLL-Applications of PLL. Frequency synthesizers. Coherent synthesizers using PLL. Direct digital synthesis. Phase noise in oscillators.
Unit-5:Voltage regulators.
Regulators using opamps. IC regulators. Protection circuits. Foldback current limiting. Current boosting of IC regulators. Switching regulators.

Course Outcomes:

The expected outcome after learning this course are that a student must be able to design a op amp based circuits as per requirements.

Text Books:

1. S. Franco, Design with Operational Amplifiers and Analog Integrated Circuits (3/e) TMH, 2003
2. R. Gayakwad, Op-amps and Linear Integrated Circuits (4/e), PHI

Reference Books:

1. D.A. Bell, Solid state Pulse Circuits (4/e), PHI
2. D. Roy Choudhry, Shail Jain, "Linear Integrated Circuits", New Age International Pvt. Ltd., 2000

EC305 ANALOG INTEGRATED CIRCUITS LABORATORY (0 – 0 – 3) 2

List of Experiments:

1. Differential amplifier
2. Measurement of Op-Amp parameters
3. Inverting non-inverting amplifiers, Adder, Subtractor
4. Integrator, Differentiator
5. Instrumentation Amplifier using Op-amps
6. Op-amp in comparator application
7. Waveform Generators –Sine, square, Triangular and Ramp
8. Astable and Monostable Multivibrators using op-amp and 555IC
9. Low Pass Filter and High Pass Filter realizations using op-amps
10. Band Pass Filter and Band Stop Filter realizations using op-amps

EC315 DIGITAL SIGNAL PROCESSING LABORATORY (0 - 0 - 3) 2

List of Experiments:

1. Generation of various discrete time signals.
2. Study of linear and circular convolution.
3. Study of auto and cross correlation.
4. Finding DFT and IDFT using FFT algorithm
5. Spectrum analysis using FFT
6. Design of FIR filter using window method.
7. Design of FIR filter using frequency sampling method
8. Design of IIR filter using bilinear and impulse invariance method.
9. Study of up sampler and down sampler
10. Study of equalizers.

SEMESTER VI

EC302 DIGITAL COMMUNICATION (3 - 0 - 0) 3

Pre-Requisite: EC301

Objectives:

1. To understand the key modules of digital communication systems with emphasis on digital modulation techniques.
2. To get introduced to the concept and basics of information theory and the basics of source and channel coding/decoding.

Topics Covered :

Unit -1: Pulse Modulation
Base band transmission. Pulse Modulation techniques – PAM, PPM, PDM. Pulse code modulation (PCM), DM, Destination SNR in PCM systems with noise.

Unit -2: Baseband Pulse Transmission
Matched filter, Nyquist criterion for zero ISI, Baseband M-ary PAM Transmission, Optimum transmit and receive filters, Correlative Coding, Equalization; zero-forcing and adaptive linear equalizers.

Unit -3: Passband Digital Transmission
Digital modulation techniques – binary ASK, FSK, and PSK. Signal space diagram. Error probabilities. M-ary PSK, M-ary FSK, QAM, MSK and GMSK. Optimum detector. Signal constellation, error probability.

Unit -4: Error Control Coding
Linear block codes, Encoding and decoding. Cyclic codes. Convolutional codes. Viterbi decoding. TCM.

Unit -5: Spread-Spectrum Modulation
Spread spectrum (SS) techniques; direct S.S and frequency hop S.S. Processing gain and jamming margin. CDMA

Course Outcomes :

Students are able to

1. Apply the knowledge of statistical theory of communication and explain the conventional digital communication system.
2. Apply the knowledge of signals and system and evaluate the performance of digital communication system in the presence of noise.
3. Apply the knowledge of digital electronics and describe the error control codes like block code, cyclic code.
4. Describe and analyze the digital communication system with spread spectrum modulation.
5. Design as well as conduct experiments, analyze and interpret the results to provide valid conclusions for digital modulators and demodulator using hardware components and communication systems using CAD tool.

Text Books:

1. J.G. Proakis, “Digital Communications” (5/e), McGraw – Hill,2007.
2. S. Haykin, “Communication Systems” (4/e), Wiley,2001.

Reference Books:

1. B. Sklar, “Digital Communications: Fundamentals & Applications”, (2/e),Pearson Education, 2001.
2. A.B. Carlson :“Communication Systems”, (5/e), McGraw Hill, 2009.
3. R.E. Zimer& R.L. Peterson: “Introduction to Digital Communication”, (2/e), Prentice Hall, 2001.

EC304 VLSI DESIGN (3 - 0 - 0) 3

Pre-Requisite:EC209

Objectives:

1. To introduce various aspects of Digital VLSI circuits
2. To teach the layout issues for CMOS Digital circuits.
3. To make them understand the testing issues.

Topics Covered:

Unit -1: Introduction
VLSI design methodology, VLSI technology- NMOS, CMOS and BICMOS circuit fabrication. Layout design rules. Stick diagram. Latch up, Non-idealities of MOSFET.
Unit -2: Combinational circuits
Characteristics of MOS and CMOS switches. Implementation of logic circuits using MOS and CMOS technology, multiplexers and memory, MOS transistors, threshold voltage, MOS device design equations. CMOS inverters, propagation delay of inverters, Pseudo NMOS, Dynamic CMOS logic circuits, power dissipation.
Unit -3: Memory System
Memory cell: Layout of SRAM, DRAM.ROM Implementation, Timing constraints, Min-Max Delay, Computation of interconnect delay, Techniques for driving large off-chip capacitors, long lines, Implementation of PLD, EPROM, EEPROM,
Unit -4: FPGAs and ASICs
An overview of the features of advanced FPGAs, LUTs, Comparison of ASICs, FPGAs, PDSPs and CBICs . Fault tolerant VLSI architectures
Unit -5: Testing
VLSI testing -need for testing, Fault Modelling, Single and Multiple stuck at fault, manufacturing test principles, design strategies for test, chip level and system level test techniques.

Course Outcomes:

1. Able to design CMOS Digital Circuits.
2.Able to Layout CMOS Circuits.
3.Understand the timing issues related to combinational and sequential circuits.

Text Books:

1. N.H.E. Weste et al, CMOS VLSI design, (3/e), Pearson , 2005.
2. J. Smith, Application Specific Integrated Circuits, Pearson, 1997.

Reference Books:

1. Pucknell & Eshraghian, Basic VLSI Design, PHI, (3/e).
2. Uyemura, Introduction to VLSI Circuits and Systems, Wiley, 2002.

HM302-PROFESSIONAL ETHICS AND HUMAN VALUES (2 - 0 - 0) 2

Objectives

To create an awareness on Engineering Ethics and Human Values.
To understand social responsibility of an engineer.
To appreciate ethical dilemma while discharging duties in professional life.

Topics Covered:

Unit 1: Human Values
Morals, Values and Ethics – Integrity- Work Ethics- Honesty-t Courage –Empathy - Self-Confidence- - Character.
Unit 2: Engineering Ethics
Senses of 'Engineering Ethics' - variety of moral issue - types of inquiry moral dilemmas – moral autonomy - Kohlberg's theory - Gilligan's theory - consensus and controversy Models of Professional Roles - theories about right action - Self-interest - customs and religion - uses of ethical theories. Valuing Time - Co-operation –Commitment.
Unit 3: Engineering as Social Experimentation
Engineering as experimentation – engineers as responsible experimenters - codes of ethics - a balanced outlook on law - the challenger case study.
Unit 4: Safety, Responsibilities and Rights
Safety and risk - assessment of safety and risk – risk benefit analysis and reducing risk - the three mile island and chernobyl case studies.
Unit 5: Global Issues
Multinational Corporations - Environmental Ethics - Computer Ethics - weapons development – engineers as managers-consulting engineers-engineers as expert witnesses and advisors moral leadership

Reference Books:

1. Mike Martin and Roland Schinzinger, Ethics in Engineering, McGrawHill, New York, 1996.
2. M. Govindarajan, S. Natarajan and V. S. Senthil Kumar, Engineering Ethics, Prentice Hall of India, New Delhi, 2004.

EC306 COMMUNICATION ENGINEERING LABORATORY (0 - 0 - 3) 2

List of Experiments:

1. Generation and Demodulation of AM signal
2. Generation and Demodulation of DSB-SC signal
3. Generation and Demodulation PAM signal
4. Generation and Demodulation of PWM signal.
5. Generation of PPM signal.
6. Generation and Demodulation ASK signal.
7. Generation and Demodulation of FSK signal.
8. Encoding and decoding of Pulse Code Modulation
9. Simulation of Analog Modulation Systems.
10. Simulation of Pulse Modulation Systems.
11. Simulation of Digital Modulation Systems.
12. Design of Mixer
13. Encoding and decoding of Delta Modulation
14. Study and analysis of Line Encoding Techniques

EC308 VLSI DESIGN LAB (0 - 0 - 3) 2

List of Experiments:

1. MOSFET characteristics
2. Oscillator design using Inverters
3. Logic gate implementation using CMOS Logic.
4. Combinational circuit implementation using CMOS Logic
5. Sequential Circuit implementation using CMOS Logic
6. Timing and Power dissipation Adders and subtractors
7. Timing and Power dissipation Mux & Demux
8. Timing and Power dissipation Encoders & Decoders
9. Implementation of Counters.
10. Implementation of FSM

SEMESTER VII

HM402 INDUSTRIAL ECONOMICS AND MANAGEMENT (3 - 0 - 0) 3

Pre-Requisite: None

Objective:

This course is intended for the students to understand the economic concepts that are in vogue in industries and this course also facilitates the students to understand about the functional areas of management.

Topics Covered:

Unit-1: Microeconomics
Microeconomics - Demand and supply - Forecasting techniques - Cost and revenues - Competitive nature of firms. Keynesian economics - Aggregate demand and supply.
Unit- 2:Impact of LPG and Fiscal policy
Impact of liberalization - privatization and globalization - Locating the firm in a global economy - Fiscal policy - Taxation-principles - Functions of banks.
Unit 3 - Introduction of Management principles
Introduction to management, evolution of scientific management, modern management. Principles. Elements of management, planning, organizing, staffing, directing, coordinating, reporting, budgeting.
Unit 4: Technology and Production Management
Technology management. Product design .Types of production system. Plant location-factors to be considered. Plantlayout. Types of layout. Inventory management
Unit 5: HR Management
Significance of HRM.HR planning job evaluation. Recruitment and selection. Placement and induction. Training. Performance appraisal. Compensation. Industrial relations.

Course Outcomes:

1. Know the concepts of Microeconomics and Keynesian economics.
2. Know the Impact of liberalization, privatization and globalization.
3 Equip with the nuances of management functions
4. Gain the insights of Marketing strategies and expertise in analyzing the risk and return of an investment.

Text Books:

1. M. Adhikari, Business Economics, Excel Books, 2004
2. S.K. Misra & V.K. Puri, Economic Environment of Business, HPH, 2003
3. P. Kotler, Marketing Management (12/e), Pearson, 2005.
4. L.M. Prasad, Priciples and Practice of Management, S.Chand& Sons.

Reference Books:

1. Dewett, K. K: Modern Economic Theory,Chand.S&co,1998.
2. Gupta C.B: Business Organisation and Management, Chand, S. & co,1998.
3. Philip Kotler: Marking Management, PHI, 1999.
4. P. Chandra, Financial Management Theory and Practice (3/e), TMH, 2004.
5. K. Ashwathappa, Human Resources and Personnel Management (3/e), TMH, 2005.
6. E.S. Buffa& R.K. Sarin, Modern Production/Operation Management (8/e), Wiley, 1994.

EC401 MICROWAVE ELECTRONICS (3 - 0 - 0) 3

Pre-Requisite: EC206

Objective:

To impart knowledge on microwave electron beam devices and their applications in X band frequency and to expose basics of microwave measurements.

Topics Covered:

Unit-1: Microwave measurements
Frequency – wavelength – VSWR - Insertion loss - Attenuation measurement - Impedance determination - Antenna Radiation pattern measurement - S-parameter measurements - Network analyzer
Unit-2: Klystrons
Two-cavity and multi cavity – klystrons -Reflex klystron – modes - admittance spiral - power output and efficiency.
Unit-3: Travelling Wave Tube
Slow-wave structures - Helix and coupled cavity TWTs - Amplification process - convection current - Wave modes and gain - Backward wave oscillators.
Unit-4: Cross field devices
Magnetrons - Principle of operation and characteristics - Hull cut-off condition - Hartree Condition – Carcinotron - Gyrotron.
Unit-5: Microwave Solid State Devices
Microwave transistors and FETs - Physical structures - Microwave characteristics - High electron-mobility transistors - Tunnel Diode - PIN diodes - Transferred electron devices - Gunn effect diodes - Gunn diode as an oscillator - Avalanche transit time devices – IMPATT - TRAPATT - BARITT

Course Outcomes:

Students are able to

1. Apply the basic knowledge of waveguide and microwave resonator circuits.
2. Asses the methods used for generation and amplification of the microwave power
3. Distinguish between the linear and cross field electron beam microwave tubes.
4. Critically analyze the operating principles and performances of the microwave semiconductor devices.
5. Identify the suitable microwave power sources of given specification for the selected application.
6. Aware of current technological changes in the engineering aspects of microwave components.

Text Books:

1. S.Y. Liao, "Microwave Devices and Circuits", 3rd edition,PHI, 2008
2. Annapurna Das, Sisir K. Das, "Microwave Engineering", 2nd edition, TMHCo,Ltd, 2010.

References:

1. R.E. Collin, "Foundations for Microwave Engineering", 2nd edition, Mc Graw–Hill, 2009.

EC409 MICROWAVE AND OPTICAL COMMUNICATION LABORATORY (0 - 0 - 3) 2

List of Experiments:

The following List of experiments but not limited to

1. Mode Characteristics of Klystron Oscillator.
2. Characteristics of Gunn diode Oscillator.
3. Determination of guide wavelength, frequency measurement.
4. Characteristics of Variable Attenuator.
5. Characteristics of Directional Coupler
6. Characteristics of Tee Junctions
7. Radiation Pattern of Antenna.
8. CAD of Microstrip Antenna
9. Handling of Fibers
10. Numerical Aperture Measurement
11. Characteristics of Laser Diode
12. Characteristics of Photo detector
13. Characteristics of APD
14. Measurement of Attenuation and Bending Loss
15. LED Modulation

DEPARTMENT ELECTIVES

SEMESTER-V

EC501 STATISTICAL THEORY OF COMMUNICATION (3 - 0 - 0) 3

Pre-Requisite: MA206

Objective:

The subject aims to make the students to understand the statistical theory of telecommunication, which are the basics to learn analog and digital tele-communication.

Topics Covered:

Unit - 1: Introduction
Information measure. Discrete entropy. Joint and conditional entropies. Uniquely decipherable and instantaneous codes. Kraft-Mc millan inequality. Noiseless coding theorem. Construction of optimal codes.
Unit - 2: Fundamental Limits in Information Theory
Discrete Memoryless Channels. Mutual information and channel capacity. Shannon's fundamental theorem. Entropy in the continuous case. Shannon-Hartley law.
Unit -3: Parameter Estimation
Binary hypothesis testing. Baye's, minimax and Neyman-Pearson tests. Random parameter estimation-MMSE, MMAE and MAP estimates. Non-random parameters – ML estimation.
Unit -4: Coherent signal detection
Coherent signal detection in the presence of additive white and non-white Gaussian noise. Matched filter.
Unit -5: Filters used in Communication systems
Discrete optimum linear filtering. Orthogonality principle. Spectral factorization. FIR and IIR Wiener filters.

Course Outcomes:

Students are able to

1. Show how the information is measured and able to use it for effective coding.
2. Summarize how the channel capacity is computed for various channels.
3. Use various techniques involved in basic detection and estimation theory to solve the problem.
4. Summarize the applications of detection theory in telecommunication.

Text Books:

1. R.B. Ash, Information Theory, Wiley, 1965.
2. Thomas Thomas M. Cover, Joy A. Thomas Elements of Information Theory, John Wiley and Sons, 2nd Edition 2006.

Reference Books:

1. H.V. Poor: An Introduction to Signal Detection and Estimation, (2/e), Spring Verlag.1994.
2. M. Mansuripur: Introduction to Information Theory, Prentice Hall. 1987.
3. J.G. Proakis et al: Digital Signal Processing, (4/e), Pearson Education, 2007.

EC502 DIGITAL SIGNAL PROCESSORS AND APPLICATIONS (3 - 0 - 0) 3

Pre-Requisite: EC202

Objective:

To give an exposure to the various fixed point & a floating point DSP architectures and to develop applications using these processors.

Topics Covered:

Unit-1: Introduction
Difference between DSP and other microprocessor architectures-An overview of Motorola and Analog Device DSPs.
Unit-2: Fixed and Floating Point DSP
TMS320C54X fixed point architecture- TMS320C3X floating point DSP architecture- CPU-memory- buses and peripherals- Addressing mode..
Unit-3: Programming Concepts
Instruction set- Repeat operations - Pipeline operation-Pipeline conflicts- Interrupts.
Unit-4: Interfacing
Interfacing- serial interface- parallel interface- DMA operations- A/D and D/A converter interfaces.
Unit-5: Applications
DSP tools-DSP applications-MAC- filter design- implementation of DFT- echo cancellation-spectrum analyzer.

Course Outcomes:

Students are able to

1. Recognize the fundamentals of fixed and floating point architectures of various DSPs.
2. Learn the architecture details and instruction sets of fixed and floating point DSPs
3. Infer about the control instructions, interrupts, and pipeline operations.
4. Illustrate the features of on-chip peripheral devices and its interfacing along with its programming details.
5. Analyze and learn to implement the signal processing algorithms in DSPs
6. Learn the DSP programming tools and use them for applications

Text Books:

1. B. Venkataramani & M. Bhaskar, Digital Signal Processor, Architecture, Programming and Applications,(2/e), McGraw- Hill,2010
2. S. Srinivasan &Avtar Singh, Digital Signal Processing, Implementations using DSP Microprocessors with Examples from TMS320C54X, Brooks/Cole, 2004.

Reference Books:

1. Sen M. Kuo & Woon-Seng S. Gan, Digital Signal Processors: Architectures, Implementations, and Applications, Prentice Hall, 2004
2. C. Marven & G. Ewers: A Simple approach to digital signal processing, Wiley Inter science, 1996.
3. R.A. Haddad & T.W. Parson: Digital Signal Processing: Theory, Applications and Hardware, Computer Science Press NY, 1991.

EC503 ADVANCED MICROPROCESSORS (3 - 0 - 0) 3

Pre-Requisite: EC210

Objective:

To make the students to learn the advanced techniques in designing the advanced Microprocessors and give exposure to the cache organization, memory management, multitasking and bus interfacing.

Topics Covered:

Unit-1: Introduction
Software model for Pentium-Real and protected mode of operation- Instruction set-Addressing modes- Interrupts.
Unit-2: Hardware details of Pentium
Signal description- Pipelining-Branch prediction-.Cache memories-Floating point unit.
Unit-3: Memory Management
Segmentation-Memory management-Paging-Protection-Multitasking.Exceptions-Interrupts-Virtual 8086 mode-Protected mode applications.
Unit-4: Special Processors
Introduction-Power PC architecture –Organization-.Programming model- Instruction set.
Unit-5: Bus Interface
Introduction-ISA bus-Extended ISA and VESA local bus-PCI bus-USB bus-Serial bus standards- Parallel printer interface standards.

Course Outcomes:

Students are able to

1. Ability to design a high speed & high performance microprocessors.
2. Analyze and design the cache memory and pipelining structures.
3. Identify and apply various protected mode concepts like paging, multitasking etc. in high speed processors.
4. Recognize the need for recent Bus standards like PCI Express, USB etc.

Text Books:

1. John P Hayes, Computer Architecture and organization, McGraw-Hill 1998.
2. James L. Antonakos, The Pentium Microprocessor, (2/e), Pearson, 2002.

Reference Books:

1. John L. Hennessy & David A. Patterson Computer Architecture (3/e), Elsevier, 2003.
2. Barry B. Brey, The Intel Microprocessors, (7/e), Eastern Economy Edition , 2006.
3. A.K. Ray & K.M. Bhurchandi, Advanced Microprocessors and Peripherals, (2/e), Tata McGraw Hill, 2007.

EC 504 INFORMATION THEORY AND CODING

Pre-Requiste: None

Objectives

To provide basic concepts of Information
To enable the students to propose, design and analyse suitable coding/decoding scheme for a particular digital communication application

Unit 1
Information theory- information and entropy-properties of entropy of a binary memory less source-source coding theorem-Shannon fano coding-Huffman coding –Lempel ziv coding-discrete memory less source-binary symmetric channel –mutual information-properties-channel capacity –channel coding theorem
Unit 2
Introduction to algebra-groups-fields-binary field arithmetic-construction of Galois field-basic Properties-computations-vector spaces-matrices-BCH codes-description-coding & decoding –Reed Solomon codes-coding & decoding
Unit 3
Coding –linear block codes-generator matrices-parity check matrices-encoder-syndrome and error correction-minimum distance-error correction and error detection capabilities-cyclic codes-coding and decoding
Unit 4
Coding –convolutional codes-encoder –generator matrix-transform domain Representation-state Diagram-distance properties-maximum likelihood decoding-Viterbi decoding-sequential decoding
Unit 5
Burst errors -Interleaved codes-Turbo coding- coding & decoding -Trellis codes- coding & decoding

Text Books

1. Simon Haykins,Communication Systems,John Wiley
2. Shi Lin,Costello D.J ., Errpr Control Coding-Fundamentals amd Applications,Prentice Hall Inc. Eaglewood Cliffs

Reference Books

1. Das J.Malik A.K., Chatterjee P. K. .,Principles of Digital Communications,New Age International
2. Simon Haykin,Digital Communications,John Wiley
3. Taub& Schilling, Principles of Communication System,TATA MC Graw Hill
4. Tomasi,Electronic Communications,Fundamentals Through Advanced,Pearson education
5. Sklon, Digital Communications Pearson education
6. Couch,Digital and Analog Communication System, Pearson education

EC505 ADVANCED MICROCONTROLLERS (3 – 0 - 0) 3

Pre-Requisite: EC210

Objective

This course is intended for the students to know more about the practical microcontrollers

Topics Covered:

Unit - 1: PIC Microcontroller
CPU Architecture – Instruction set – interrupts- Timers- I2C Interfacing –UART- A/D Converter – PWM and introduction to C-Compilers
Unit - 2: AVR microcontroller
Internal Architectural - Block diagram of controller (Atmega 8) - Functions - Configuration of Two 8-bit and One 16-bit Timers and Counters - 6-channel ADC Working - Initial programming configurations of Atmega8: port, counter, timer - Bootloader Circuit - ISP of Atmega
Unit - 3: Open Source Embedded Development Board (Arduino)
Arduino: Birth, Open Source community - Functional Block Diagram of Arduino - Functions of each Pin of Arduino - Arduino Development Board diagram - Designing of 1st sketch - Programming of an Arduino (Arduino ISP) - Arduino Boot loader - Serial port Interfacing - Initialization of Serial Port using Functions - Basic Circuit For Arduino
Unit - 4: Arduino Interfacing
Basic Interfacing and I/O Concept - Interfacing LED,Switch,7seg LED its and Code - Interfacing POT,LM35,Acelerometer (ADXL3C5C) and its Code - Interfacing keypad and Code for it - Initialization for serial port and code for it - Interfacing DC motor and its Code –
Interfacing 16x2 LCD and its code
Unit - 5: Embedded system Applications (Arduino)
Motor Driver L293D, IR Sensor - Interfacing L293D - Code for Line Follower Robot - Interfacing Accelerometer - Record Gestures, Code For Accelerometer based Robot - Interfacing of RF Tx/RF Rx - Interfacing of Relay Driver ULN2803 - Code for Home automation and its Control

Course Outcomes:

1. To know the architecture and programming of PIC microcontroller
2. To know the architecture and programming of AVR microcontroller
3. To know the programming, interfacing and applications of Aurduino

Text Books

1. John .B.Peatman , “Design with PIC Microcontroller”, Prentice Hall, 1997.
2. Steven F. Barrett**,** Daniel J. Pack**,** Atmel AVR Microcontroller Primer: Programming and Interfacing, Second Edition, Morgan & Claypool Publishers series
3. John Nussey, Arduino For Dummies 1st Edition, John Wiley & Sons
4. John Baichtal , Arduino for Beginners: Essential Skills Every Maker Needs, Pearson Education, Inc.

EC506 ANTENNAS AND PROPAGATION (3 - 0 - 0) 3

Pre-Requisite: EC205 & EC206

Objective:

To impart knowledge on fundamentals of antenna theory and to analyze and design a state of art antenna for wireless communications.

Topics Covered:

Unit-1: Radiation fundamentals
Review on antenna parameters, Radiation Integrals, Auxiliary Potential Functions, Reciprocity relations, Duality, Linear antennas – Small dipole, Finite length dipole, Half-wavelength dipole. Loop Antennas.
Unit-2: Antenna array
Array factorization - Array parameters - Broad side and end fire arrays - Yagi-Uda arrays - Log-periodic arrays - Phased Array Antenna
Unit-3: Antennas types
Fields as sources of radiation - Horn antennas - Babinet's principle - Parabolic reflector antenna - Lens Antenna - Microstrip antennas.
Unit-4: Wave Propagation
Propagation in free space - Propagation around the earth, surface wave propagation - structure of the ionosphere - propagation of plane waves in ionized medium - Determination of critical frequency – MUF – Fading - tropospheric propagation - Super refraction.
Unit-5: Antenna Measurements
Antenna Ranges, Measurement of Radiation Patterns, Gain, Directivity, Radiation Efficiency, Impedance, Current, Polarization, Scale Model.

Course Outcome:

Students are able to

1. Select the appropriate portion of electromagnetic theory and its application to antennas.
2. Distinguish the receiving antennas from transmitting antennas, analyze and justify their characteristics.
3. Assess the need for antenna arrays and mathematically analyze the types of antenna arrays.
4. Distinguish primary from secondary antennas and analyze their characteristics by applying optics and acoustics principles.
5. Outline the factors involved in the propagation of radio waves using practical antennas.
6. Understand measurement of antenna parameters.

Text Books:

1. Balanis, "Antenna Theory", 3rd edition, Wiley Publishers, 2012.
2. R.E. Collin, "Antennas and Radio Wave Propagation", McGraw - Hill, 1985.
3. W.L. Stutzman & G.A. Thiele : Antenna Theory and Design, 3rd edition, Wiley Publishers, 2012

Reference Books:

1. K.F. Lee, Principles of Antenna Theory, Wiley, 1984.
2. Frederick Emmons Terman , Electronic Radio Engineering (4/e). McGraw Hill.
3. J.R. James etal, Microstrip Antenna Theory and Design, IEE, 1981.

SEMESTER-VI

EC507 MICROWAVE COMPONENTS AND CIRCUITS (3 - 0 - 0) 3

Pre-Requisite: EC206

Objective:

To impart knowledge on the essential Microwave Circuit Theory and the design aspects of Microwave Integrated Circuit components.

Topics Covered:

Unit-1: Microwave Network Basics & Devices
Microwave network parameters - The Scattering matrix – Properties – formulation - Signal flow graph - Passive microwave devices – terminations – bends – corners – attenuators - phase changers - directional couplers - hybrid junctions - Ferrite devices.
Unit-2 Basic circuit elements & Theorems
Transmission line sections and stubs - Richard transformation - Kuroda identities.
Unit-3: MIC filter design
Low pass to high pass - band pass and band stop transformations - Realization using microstrip lines and strip lines.
Unit-4: MIC Couple design
Design and realization of MIC components - 3 dB hybrid design - Directional coupler – circulator - power divider – Wilkinson power divider - realization using microstrip lines and strip lines.
Unit-5 Applications and Hazards of Microwaves
Applications of microwaves – RADAR - Communication Systems – Industrial – Medical - Radio Modem - Microwave Radiation Hazards – HERP – HERO – HERF - Standards.

Course Outcomes:

Students are able to

1. Know the basics of S parameters and use them in describing the components
2. Realize the importance of the theory of Microwave circuit theory.
3. Work out the complete design aspects of various M.I.C. filters
4. Confidently design all M.I.C. components to meet the industry standard
5. Know the applications and realize the hazards of microwaves

Text Books:

1. D.M. Pozar, "Microwave Engineering", 4th edition, Wiley,2011.
2. Annapurna Das, Sisir K. Das, "Microwave Engineering", 2nd edition, TMHCo.,Ltd.,2010.

References:

1. I.J. Bhal & P. Bhartia, "Microwave Solid state Circuit Design", 2nd edition, Wiley Publishers, 2003
2. R.E. Collin, "Foundations for Microwave Engineering", 2nd edition, Mc Graw–Hill, 2009.

EC508 NETWORKS AND PROTOCOLS (3 - 0 - 0) 3

Pre-Requiste: None

Objectives:

To get an understanding on the fundamentals of networks and issues involved.
To acquire an understanding on the set of rules and procedures that mediates the exchange of information between communicating devices.

Topics Covered:

Unit 1: Layered architecture & Data Link Layer
General issues in networking – Delays – Throughput- Architectural concepts in ISO's OSI layered model- Data link layer - Direct Link Networks- Error detection- Reliable Transmission- MAC Protocols – ALOHA- CSMA - LANs – IEEE 802.3- IEEE 802.5 - IEEE 802.11
Unit 2 Network layer
Datagram and Virtual circuit service – Routers – ICMP.- IPV4 and IPV6 - IP addressing- Sub netting- CIDR- DHCP – NAT – ARP - Routing Principles
Unit 3: Transport layer
Transport layer services - Connection Management - Transmission Control Protocol (TCP) - User Datagram Protocol (UDP) - Principles of reliable data transfer - Principles of congestion control - Flow control.
Unit-4: Application layer
Overview of HTTP, FTP, SMTP, DNS, Multimedia networking applications - streaming stored video and audio, internet phone, RTP.
Unit-5: Queuing theory
Discrete time and continuous time Markov chains- Poisson process- Queuing models for Datagram networks- Little's law - M/M/1 queuing systems

Course Outcome:

Compare and examine, OSI and TCP/IP protocol stacks Categorize services offered by all layers in TCP/IP protocol stack Analyze a network under congestion and propose solutions for reliable data transfer,examine the protocols operating at different layers of TCP/IP model.

Text Books:

1. J.F.Kurose&K.W.Ross, Computer Networking (3/e) Pearson.
2. W.Stallings, Wireless Communication and Networks, Pearson, 2003

EC509 SPEECH PROCESSING (3 - 0 - 0)3

Objectives:

1. The course covers the main aspects of speech processing by computer. Topics include: models of the vocal tract; identification and extraction of speech features; speech compression; the recognition of speech and speakers by computer; and control of speech synthesizers.
2. To understand the process of speech production and perception
3. Processing the speech for finding the speech and speaker information
4. Understand about the automatic recognition of speech

Topics Covered:

Unit-1: Digital models for the speech signal

Process of speech production - Acoustic theory of speech production - Lossless tube models - and Digital models for speech signals

Unit-2: Time domain models for speech processing

Time dependent processing of speech - Short time energy and average magnitude - Short time average zero crossing rate - Speech vs silence discrimination using energy & zero crossings - Pitch period estimation - Short time Autocorrelation function - Short time average magnitude difference function - Pitch period Estimation using autocorrelation function

Unit-3: Short time Fourier analysis

Linear Filtering interpretation - Filter bank summation method - Overlap addition method - Design of digital filter banks - Implementation using FFT - Spectrographic displays - Pitch detection - Analysis by synthesis -Analysis synthesis systems.Homomorphic speech processing: Homomorphic systems for convolution - Complex cepstrum - Pitch detection - Formant estimation – Homomorphic vocoder

Unit-4: Linear predictive coding of speech

Basic principles of linear predictive analysis - Solution of LPC equations - Prediction error signal - Frequency domain interpretation - Relation between the various speech parameters - Synthesis of speech from linear predictive parameters - Applications

Unit-5: Speech Enhancement

Spectral subtraction & filtering -Adaptive noise cancellation - Speech Synthesis: Principles of speech synthesis - Synthesizer methods - Synthesis of intonation - Speech synthesis for different speakers - Speech synthesis in other languages – Evaluation - Practical speech synthesis - Automatic Speech Recognition -Audio Processing: Auditory perception and psychoacoustics – Masking - frequency and loudness perception - spatial perception - Digital Audio, Audio Coding - High quality -lowbit- rate audio coding standards – MPEG - AC-3 - Multichannel audio - Stereo, 3D binaural and Multichannel surround sound.

Course Outcome:

Students know about the necessity of speech processing for finding speech information or speaker information

Text Books:

1. L. R. Rabiner and R. W. Schafer, “Digital Processing of Speech Signals," Pearson Education (Asia) Pte. Ltd., 2004.
2. L. R. Rabiner and B. Juang, “Fundamentals of Speech Recognition,” Pearson Education (Asia) Pte. Ltd., 2004.

Reference Books:

1. C Becchetti& L P Ricotti, “Speech Recognition Theory & C++ Implementation” John Wiley & Sons
2. D. O’Shaughnessy, “Speech Communication Human & Machine”, Universities Press.
3. B. Gold & N. Morgan “Speech & Audio Signal Processing”, John Wiley & Sons
4. D. O’Shaughnessy, “Speech Communications: Human and Machine,” Universities Press, 2001.
5. Z. Li and M.S. Drew, “Fundamentals of Multimedia,” Pearson Education (Asia) Pvt. Ltd., 2004.

EC510 EMBEDDED SYSTEM DESIGN (3 - 0 - 0) 3

Pre-Requisite: EC210

Objectives:

To introduce students to the modern embedded systems and to show how to understand and program such systems using a concrete platform.

Topics Covered:

Unit-1: Introduction
Overview of various types of microcontrollers -.Processor selection for embedded system- Selection of memory for embedded system- Devices and buses for device networks.
Unit-2: 8 and 16 bit microcontroller
Motorola 68HC11/ 68HC12 family of microcontrollers-Internal architecture- Addressing modes and instruction set- Interrupts.
Unit-3: Software development
Introduction- Integrated Development Environment-High speed I/O interfacing-Memory interfacing- Modem communication.
Unit-4: Real time operating systems
Introduction- OS services-I/O subsystems-Network operating system- Real time embedded system OS- Interrupt routine in RTOS- OS security.
Unit-5: 32 bit microcontroller
Intel 16 and 32 bit microcontroller- 8096/80196 family-Architecture- Addressing modes-Instruction set- Introduction to ARM processor.

Course Outcomes:

Students are able to

1. Describe the differences between the general computing system and the embedded system, also recognize the classification of embedded systems..
2. Become aware of interrupts, hyper threading and software optimization.
3. Design real time embedded systems using the concepts of RTOS.
4. Analyze various examples of embedded systems.

Text Books:

1. Raj Kamal, Embedded Systems Architecture, Programming, and Design. (2/e), Tata McGraw Hill, 2008.
2. K.V. Shibu, Introduction To Embedded Systems, Tata McGraw, 2009.
3. Peter Barry and Patric Crowley, Intel architecture for Embedded system .

Reference Books:

1. Jonathan. W. Valvano, Embedded Microcomputer Systems, Real Time Interfacing, Published by Thomson Brooks/Col, 2002.
2. G.H. Miller, Microcomputer Engineering, 3d edition, Pearson Education.

EC511 ADAPTIVE SIGNAL PROCESSING (3 - 0 - 0-3)

Objective:

The course Adaptive Signal Processing presents its algorithms and architectures and explains their use in real world applications. As prerequisites it is assumed that students have studied discrete and continuous signals and systems, and introductory linear algebra.

Topics Covered:

Unit-1: General Introduction
Adaptive systems: Definition and characteristics, areas of applications - general properties - Open and closed loop adaptation - applications of closed loop adaptation. The adaptive liner combiner: General description -input signal and weight vectors - desired Response and error - the performance function - gradient and minimum mean square error - Example of performance surface - alternative expression of the gradient - de-correlation of Error and input components
Unit-2: Theory of adaptation with stationary signals
Properties of the quadratic performance surface: Normal form of the input correlation Matrix - eigen values and eigen vectors of the input correlation matrix - an example with two weights - geometrical significance ofeigen vectors and eigen values. Searching the performance surface: Methods of searching the performance surface - basic ideas of gradient search methods - a simple gradient search algorithm and its solution - stability and rate of convergence
Unit-3: Gradient estimation and its effects on adaptation
Gradient component estimation by derivative measurement - the performance penalty - derivative measurement and performance penalties with multiple weights - variance of the gradient estimate
Unit-4: Partial Characterization of a Discrete-Time Stochastic
Process - Mean Ergodic Theorem - Correlation Matrix - Correlation Matrix of Sine Wave Plus Noise - Stochastic Models - Asymptotic Stationary of an Autoregressive Process - Yule-Walker Equations - Complex Gaussian Process - Power Spectral Density - Properties of Power Spectral Density - Transmission of a Stationary Process Through a Liner Filter - Cramer Spectral Representation for a Stationary Process - Power Spectrum Estimation - Other Statistical Characteristics of a Stochastic Process - Wiener filters:Linear Optimum Filtering - Statement of the problem - Principle of Orthogonally
Unit-5: Minimum Mean-Square Error Adaptive algorithms and structures
The LMS algorithms - RLS adaptive filters: Some Preliminaries - The Matrix Inversion Lemma - The Exponentially Weighted Recursive Least-Squares Algorithm - Selection of The Regularizing Parameter - Update Recursion for the sum of weighted Error Squares convergence analysis of the RLS Algorithm - Computer Experiment on Adaptive Equalization - Robustness of RLS filter

Course Outcomes:

Students will learn about the real world applications of signal Processing

Text Books:

1. Adaptive Filter Theory- S. Haykin,4th Edition, Pearson Education, 2008
2. Adaptive Filters, A. H. Sayed, John Wiely and Sons, 2008

Reference Books:

1. Adaptive filtering primer with MATLAB, Alexander D. Poularikas, Zayed M. Ramadan, CRC Press, 2006
2 Adaptive Signal Processing, B. Widrow and S.D. Stearns,Prentice Hall, Englewood Cliffs, NJ, 1985.

SEMESTER - VII

EC512 FIBER OPTIC COMMUNICATION (3 - 0 - 0) 3

Pre-Requisite: EC301

Objective:

To expose the students to the basics of signal propagation through optical fibers, fiber impairments, components and devices and system design.

Topics Covered:

Unit-1: Introduction
Optical Fibers: Structure, Wave guiding, Step-index and graded index optical fibers, Modal analysis, Classification of modes, Single mode fibers.
Unit-2: Dispersion
Pulse dispersion: Material and waveguide dispersion, Polarization mode dispersion, Absorption, Scattering and bending losses, dispersion shifted fibers, dispersion compensating fibers.
Unit-3: Fiber Connectors and Couplers
Optical Power Launching and Coupling: Lensing schemes for coupling improvement, Fiber-to-fiber joints, Splicing techniques, Optical fiber connectors, OTDR.
Unit-4: Sources and detectors
Optical sources and detectors: Laser fundamentals, Semiconductor Laser basics, LEDs, PIN and Avalanche photodiodes, Noise and Detection, Thermal and shot noise, Signal to Noise Ratio.
Unit-5: Design Considerations
Design considerations of fiber optic systems: Analog and digital modulation, , Bit error rate, Optical receiver operation, Power Budget and rise time Budget, WDM.

Course Outcomes:

1. Able to understand propagation of signal through Fiber cable.
2. Able to understand the various modes of propagation and its importance.
3. Able to implement Fiber optics systems.

Text Books:

1. G. Keiser, Optical Fiber Communications (4/e), TMH, 2008.
2. Optical Fibre Communication: Principals and Techniques", John M. Senior, PHI New Delhi 3/e,2008

Reference Books:

1. MMK. Liu, Principles and Applications of Optical Communications, TMH, 2010.
2. G.P. Agrawal, Fiber Optic Communication Systems, (3/e), Wiley, 2002.
3. J. Gowar, Optical Communication Systems, (2/e), PHI, 2001.

EC513 MOBILE COMMUNICATION (3 – 0 - 0) 3

Pre-Requisite: EC301

Objective:

To understand the basics of wireless digital communication used for mobile telephony. To study the basic methodologies of cellular system designing. To study various modulation mechanisms.To understand the wireless channel characterization.To understand the various multiplexing mechanisms.To understand the interference measurement and reduction techniques.

Topics Covered:

Unit-1: Cellular concept
Frequency reuse – co-channel interference - adjacent channel interference - power control for reducing interference - improving capacity in cellular systems - cell splitting - sectoring - hand off strategies - channel assignment strategies - call blocking in cellular networks
Unit-2: Mobile Radio Propagation
Reflection, Diffraction, Fading. Multipath propagation. Statistical characterization of multipath fading.Diversity techniques for mobile wireless radio systems concept of diversity branch and signal paths - combining methods - selective diversity combining - maximal ratio combining- equal gain combining
Unit-3: Propagation models
Path loss prediction over hilly terrain. Practical link budget design using Path loss models. Indoor and outdoor Propagation models
Unit-4: Multiple access techniques
FDMA, TDMA, SDMA and CDMA. Spread spectrum. Power control. WCDMA. Capacity of multiple access schemes
Unit-5: Mobile communication Standards
Overview of second generation cellular wireless systems: GSM and IS-95 standards, 3G systems: UMTS & CDMA 2000 standards and specifications OFDM and MC-CDMA. WLAN technology. Ad hoc networks. Bluetooth.

Course Outcome:

Describe the cellular concept and analyze capacity improvement Techniques. Mathematically analyze mobile radio propagation mechanisms. Summarize diversity reception techniques. Analyze and examine the multiple access techniques and its application.

Text Books:

1. Kamilo Feher, ‘Wireless Digital Communications’, PHI
2. Rapport T.S., ‘Wireless Communications, Principles and Practice’, Prentice Hall

Reference Books:

1. Lee W.C.Y., ‘Mobile Cellular Telecommunication’, MGH
2. Proakis J.G., ‘Digital Communications’, MGH

EC 514 DIGITAL IMAGE PROCESSING (3 - 0 - 0) 3

Objective:

1. This course develops an overview of the field of image processing and help to understand the fundamental algorithms and how to implement them.
2. Provide an experience in applying image processing algorithms to real problems.

Topics Covered:

Unit-1: Digital Image Processing
Examples of Digital Image Processing - Components of image processing -Elements of Visual perception - Image sensing and acquisition using single sensor - sensor strips and sensor arrays - Image sampling and quantization: Basic concepts of sampling and quantization - Spatial and Gray level representation - Aliasing and Moire Patterns
Unit-2: Image Enhancement
Spatial Domain: Grey level transformation - Image negatives - Log transformations - Power law transformations - Piecewise linear transformation - Histogram Processing - Enhancement using Arithmetic and Logic operation - Smoothing Spatial Filter - Linear filter, Order Statistics filter - Sharpening Spatial Filters. Frequency Domain:Introduction to the Fourier Transform and the Frequency Domain - Smoothing Frequency Domain Filters - Sharpening Frequency Domain Filters - Homomorphic Filtering
Unit-3: Color image processing and image Restoration:
Noise Models - Restoration in the Presence of Noise Only - Spatial Filtering - Mean Filters, Order-Statistics Filters - Adaptive Filters - Periodic Noise Reduction by Frequency Domain Filtering Linear - Position Invariant Degradations - Estimating the Degradation Function. Color Image Processing: Color Fundamentals - Color Models, Pseudo-color Image Processing - Intensity Slicing - Gray Level to Color Transformations - Basics of Full- Color Image Processing - Color Transformations - Smoothing and Sharpening - Color Segmentation
Unit-4: Wavelets and Multi-resolution Processing
Image Pyramids - Sub-band Coding -TheHaar Transform - Multi-resolution Expansions - Wavelet Transforms in One Dimension - Wavelet Transforms in Two Dimension
Unit-5: Image Compression, Segmentation and Morphological Image Processing
Compression: Redundancy - Image Compression Models - Elements of Information Theory - Error-Free Compression -Lossy Compression - Image Compression Standards. Segmentation: Detection of Discontinuities - Edge Linking and Boundary Detection Thresholding - Region-Based Segmentation - Segmentation by Morphological Watersheds. Morphological Image Processing: Basic Concepts from Set Theory - Logic Operations Involving Binary Images - Dilation and Erosion - Opening and Closing, Hit-or-Miss Transformation - Basic Morphological Algorithms -Gray-Scale Morphology

Outcomes:

1. Students learn about image processing tools
2. Apply the image processing for practical applications

Text Books:

1. R. C. Gonzalez and R. E. Woods, Digital Image Processing, 3rd ed, Prentice Hall, 2008
2. R. C. Gonzalez, R. E. Woods, and S. L. Edins, Digital Image Processing with MATLAB, Prentice Hall, 2004
3. The FundamentalsImage Processing, Maria Petrou, Costas Petrou, Wiley Publisher, 2nd Edition, 2010
4. Fundamentals on Digital Image Processing, A. K. Jain, PHI, 2005

EC515 ANALOG CMOS DESIGN (3 - 0 - 0) 3

Pre-Requisite: EC304

Objectives:

1. To teach MOSFET Amplifier issues
2. To make student to learn design issues related to various MOS amplifiers

Topics Covered:

Unit-1: Introduction
MOS Capacitor-CV characteristics, Ideal MOSFET equation-Small Signal Model-AC Analysis-MOS Models-Spice Model, 2^{nd} order effects.
Unit-2: Current source
Current source and Sinks-Current Mirror-Cascode Connection-Temperature Analysis, transient Response.
Unit-3: Voltage source
Voltage References, MOSFET Divider-Threshold Voltage References-Diode referenced, Bandgap Voltage References.
Unit -4: Feedback Amplifier
MOS Amplifiers-Feedback Amplifier-Various Topologies-Negative Feedback-Open loop and closed loop analysis.
Unit -5: Operational Amplifier
Differential Amplifier, Source coupled pair, Operational Amplifier, Characteristics, Cascode Input Op-Amp, Operational Transconductance Amplifier

Course Outcomes:

1. Able to design analog circuits**.**
2. Able to understand design issues related to stability of Opamps
3. Able implement designs using spice tool.

Text Books:

1. Design of Analog CMOS Integrated Circuits, by Behzad Razavi, McGraw-Hill 2000
2. CMOS Analog Circuit Design, Phillip E. Allen and Douglas R. Holberg, Oxford University Press

Reference Books:

1. Pucknell & Eshraghian, Basic VLSI Design, PHI, (3/e).
2. Uyemura, Introduction to VLSI Circuits and Systems, Wiley, 2002.

EC516 MICROWAVE INTEGRATED CIRCUIT DESIGN (3 - 0 - 0) 3

Pre-Requisite: EC206

Objective:

To impart knowledge on design and analysis of various MIC components and circuits.

Topics Covered:

Unit-1: Power dividers design:
Design and realization of power dividers, hybrids, directional couplers etc using strip lines and microstrip lines.
Unit-2 Advanced Filter design Techniques
Kuroda identities. K and J inverters. Filter transformations. Realization using strip lines and microstrip lines.
Unit-3: Transistor amplifiers design
Power gain equations - Stability considerations – Analysis - Design using MICs.
Unit-4: Transistor oscillators design
Active devices for microwave oscillators - Three port S parameter characterization of transistors - Oscillation and stability conditions.
Unit-5: Mixers & Phase Shifters design
Single ended mixer - Balanced mixer -Image rejection mixer - Phase shifter design - PIN diode - Phase shifter.

Course Outcome:

1. Know the design of MIC Circuit.
2. Perform the complete design and layout of MIC components.

Text Books:

1. I.J.Bhal & P.Bhartia, "Microwave Solid state Circuit Design", 2nd edition, Wiley Publishers, 2003
2. George D. Vendelin, Anthony M. Pavio & Ulrich L. Rohde "Microwave Circuit Design using Linear and Nonlinear Techniques", 2nd edition, Wiley Publishers, 2005.

SEMESTER-VIII

EC517 COMMUNICATION SWITCHING SYSTEMS (3 - 0 - 0) 3

Pre-Requisite: EC301

Objective:

To understand the working principles of switching systems from manual and electromechanical systems to stored program control systems.

Topics Covered :

Unit -1: Switching Systems and Signalling
Basic elements of communication network. Switching systems. Signaling and signaling functions.
Unit -2: Digital Telephone Network
Digital telephone network.T1 Carrier systems. TDM hierarchy. Data under voice. Digital switching. Echo cancellers.
Unit -3: Synchronous and Asynchronous Transmission
Synchronous versus asynchronous transmission. Line coding .Error performance. TDM. TDM loops and rings.
Unit -4: Switches
Space and time divided switches. Multistage switches. Design examples. Path finding. Switching matrix control. Digital time division switch. Time Space switching. Time Space Time switching. Digital Switching in analog environment.
Unit -5: ISDN, ADSL and Traffic Analysis
Digital subscriber access - ISDN -ISDN services, ISDN architecture, ISDN channels and ISDN protocols - ADSL - Line code standards, ADSL MODEM - Traffic analysis

Course Outcomes :

Students are able to

1. Explain the working principle of switching systems involved in telecommunication switching
2. Assess the need for voice digitization and T Carrier systems
3. Compare and analyze Line coding techniques and examine its error performance
4. Design multi stage switching structures involving time and space switching stages
5. Analyze basic telecommunication traffic theory

Text Books:

1. J.C. Bellamy, Digital Telephony, (3/e), Wiley, 2000.
2. E. Keiser & E. Strange, Digital Telephony and Network Integration, (2/e), Van Nostrand, 1995.

Reference Books:

1. Thiagarajan Viswanathan, Telecommunication Switching Systems and Networks, PHI, 2006.
2. J.E. Flood, Telecommunications Switching, Traffic and Networks, Prentice Hall, 1995.
3. M.T. Hills, Telecommunication Switching Principles, London : Allen and Unwin, 1979.

EC518 PATTERN RECOGNITION (3 - 0 - 0) 3

Pre-Requisite: EC202

Objectives:

1. This course is named due to its historical reasons. The term Machine Learning is more widely used to denote the general body of statistical techniques for automatically detecting and modelling patterns in data. *Pattern Recognition* may at times refer to the use of a more conventional subset of these techniques, such as Neural Networks.
2. This course is used as an introduction to Machine Learning.
3. The course is tell about things involves understanding the principles behind machine learning machine learning.
4. Over time of this course we will consider the issues of representation, modelling, learning through conditioning, inference through marginalisation, inference and learning algorithms and application to data.

Topics Covered:

Unit-1: Introduction
Introduction: Pattern Similarity and PR Tasks (Classification, Regression and Description) - Classes Patterns and Features - PR approaches (Data Clustering, Statistical Classifier -Neural network)
Unit-2: Revision of Probability Theory and Distributions
Probability densities - Expectations and covariance - Bayesian probabilities - The Gaussian distribution - Decision Theory - Minimizing the misclassification rate - Relative entropy and mutual information - The beta distribution - Gaussian distribution - Bayes' theorem for Gaussian variables
Unit-3: Supervised Learning
Linear Regression Models: Linear Basis Function Models - Bias-Variance Decomposition - Bayesian Linear Regression - Bayesian Model Comparison
Unit-4: Linear Discriminant Analysis
Discriminant Functions -Probabilistic Generative Models - Probabilistic Discriminative Models- Neural Networks: Deep Learning: Feed-forward Network Functions - Network Training - Error Back propagation -Kernels, Support Vector Machines -Naïve Bayes - Graphical Models: Bayesian Networks - Conditional Independence - Markov Random Fields
Unit-5: Unsupervised Learning
Clustering, Mixture Models, Expectation-Maximisation: *K*-means Clustering, Mixtures of Gaussians, Latent Variables, Component Analysis: Principal Component Analysis, Probabilistic PCA, Kernel PCA, SVD, Hidden Markov Models: Markov Models, Hidden Markov Models

Course Outcome:

1. Students will learn about pattern recognition techniques by machines
2. Learn the applications about pattern Recognition

Text Books:

1. Pattern Recognition Concepts, Methods and Application,J. P. Marques De Sa,Springer. 2001
2. Pattern Recognition and Machine Learning, Christopher M. Bishop, Springer, 2006

EC519 BROADBAND ACCESS TECHNOLOGIES (3 - 0 - 0)3

Pre-Requisite:EC401

Objective:

To impart fundamentals and latest technologies related to the design of broadband last mile-Access technologies for multimedia communication

Topics Covered:

Unit -1: Introduction to Broadband technologies
Phone line modem-ISDN.Broadband technologies. Cable, DLS, fiber and wireless access technologies.
Unit -2: Digital subscriber lines
ADSL,RADSL,IDSL,HDSL,SDSL,VDSL, Standards for XDSL and comparison.
Unit -3: Cable modems
Cable modems,DOCSIS, Hub operation, Access control, Framing, Security, data link and higher layers. ATM and IP-centric modem.
Unit -4: Fiber access technologies and architectures
Hybrid fiber-coax systems, SDV, EPON, GPON.FTTX comparison.
Unit -5: Broadband wireless systems
Direct broadcast satellite.MMDS.LMDS. WIDIS. 3G wireless systems. IMT2000.

Course Outcomes:

Students are able to

1. Recall and identify the basics of broadband technology systems and differentiate the differences between the various wired and wireless technology system
2. Illustrate the aspects of last mile data transport on copper wire networks and flavors of DSL
3. Summarize the versions of cable network standard and MAC protocols for HFC networks Distinguish he cost effective broadband services for residential users and ATM based and Ethernet based passive optical networks
4. Outline the types of broadband wireless access technologies and their characteristics.

Text Books:

1. NikilJayant, Broadband last mile - Taylor and Francis group, 2005
2. N. Ransom & A.A. Azzam, Broadband Access Technologies, McGraw Hill, 1999.
3. M.P. Clarke, Wireless Access Network, Wiley, 2000.

Reference Books:

1. W.J. Woralski, ADSL and DSL Technologies, McGraw Hill, 1998.
2. S. Mervana& C. Le, Design and Implementation of DSL-based Access Solutions, Cisco Press, 2001.
3. W. Vermillion, End-to-End DSL Architecture, Cisco Press, 2003.

EC520 PRINCIPLES OF RADAR (3 - 0 - 0) 3

Pre-Requisite: EC501 & EC506

Objective:

To expose the students to the working principles of a radar from a signal processing perspective.

Topics Covered :

Unit-1: Introduction
Radar Block diagram and Operation, Radar equation. Prediction of Range Performance, Minimum Detectable Signal, Receiver Noise, Signal to Noise Ratio, Matched filter impulse response, Integration of radar Pulses, Radar cross section, Cross section of small targets. Target scattering matrices, Area and volume targets. Radar Clutter-surface clutter, sea clutter and Land clutter, weather clutter, Transmitter Power, Pulse Repetition Frequency and Range ambiguities.

Unit-2: Radar signals
Radar signals Ambiguity function and its properties. Uncertainty principle. Pulse compression. linear FM pulse. Pulse compression by Costas FM and binary phase coding.

Unit-3: Radar detection
Optimum Bayesian decision rules. Detection criteria for different target models. Detector characteristics.

Unit-4: Range and Doppler measurements
Range and Doppler measurements and tracking, Range and Doppler frequency resolutions. Optimum receivers. Optimum filters for Doppler measurements. Coherent and non-coherent implementations.

Unit -5: Angle measurement and tracking
Angle measurement and tracking by conical scan and mono pulse. Optimum mono pulse systems.

Course Outcomes:

1. At the end of learning the course, one should be able to apply his mind in developing radar for any given frequency and apply practically.
2. Students are expected to be familiar with various radar detection and tracking systems.

Text Books:

1. P.Z. Peebles, Radar Principles, Wiley, 1998.
2. Merrill I. Skolink, Introduction to Radar Systems, (3/e), Tata MG Graw Hill, 2001

Reference Books:

1. N. Levanon, Radar Signals, Wiley, 2005.
2. D. Wehnar: High Resolution, Artech House Radar (1987).
3. D.K. Barton: Radar systems Analysis, Prentice Hall(1976).

EC521 SATELLITE COMMUNICATION (3 - 0 - 0) 3

Pre-Requisite: EC301

Objective:

To impart knowledge on various aspects in the design of systems for satellite communication.

Topics Covered :

Unit-1: Orbital Mechanics
Frequency allocation for Satellite services - Elements of orbital mechanics - Equations of motion - Tracking and orbit determination. Orbital correction/control. Satellite launch systems. Multistage rocket launchers and their performance.
Unit-2 Satellite Subsystems
Orbital correction/control – Attitude Control - Station keeping - Thermal Control - TT&C Systems – Transponders - Satellite antennas. Reliability considerations
Unit-3: Elements of communication satellite design.
Satellite link design: Performance requirements and standards. Design of satellite links – DOMSAT, INSAT, INTELSAT and INMARSAT. Satellite - based personal communication.
Unit-4: Multiple access techniques
FDMA,TDMA,CDMA. Random access techniques - Satellite onboard processing.
Unit - 5: Earth Station design and tracking antennas
Earth station design - Configuration. Antenna and tracking systems. Satellite broadcasting.

Course outcomes:

Students are able to

1. Able to understand how analog and digital technologies are used for satellite communication networks.
2. Able to understand the radio propagation channel for Earth station to satellite.

Text Books:

1. D. Roddy, "Satellite Communication", 4thedition, McGraw- Hill, 2009.
2. T. Pratt & C.W. Bostain, "Satellite Communication", 2nd edition, Wiley Publishers, 2008.

Reference Book:

1. B.N. Agrawal, Design of Geo-synchronous Spacecraft, Prentice- Hall,1986.

EC522 DESIGN OF COGNITIVE RADIO (3 - 0 - 0) 3

Pre-Requisite: EC201& EC202

Objective:

This subject introduces the fundamentals of multi rate signal processing and cognitive radio.

Topics Covered:

Unit-1: Filter banks
Uniform filter bank. direct and DFT approaches. Introduction to ADSL Modem. Discretemultitone modulation and its realization using DFT. QMF.STFT.Computation of DWT using filter banks.
Unit-2: DDFS
ROM LUT approach. Spurious signals, jitter. Computation of special functions using CORDIC. Vector and rotation mode of CORDIC. CORDIC architectures.
Unit-3: Block diagram of a software radio
Digital down converters and demodulators Universal modulator and demodulator using CORDIC. Incoherent demodulation - digital approach for I and Q generation, special sampling schemes. CIC filters. Residue number system and high speed filters using RNS. Down conversion using discrete Hilbert transform. Under sampling receivers, Coherent demodulation schemes.
Unit-4: Concept of Cognitive Radio
Benefits of Using SDR, Problems Faced by SDR, Cognitive Networks, Cognitive Radio Architecture. Cognitive Radio Design, Cognitive Engine Design,
Unit-5: OFDM
Basic OFDM System Model, OFDM based cognitive radio, Cognitive OFDM Systems, MIMO channel estimation, Multi-band OFDM, MIMO-OFDM synchronization and frequency offset estimation. Spectrum Sensing to detect Specific Primary System, Spectrum Sensing for Cognitive OFDMA Systems.

Course Outcomes:

Students are able to

1. Gain knowledge on multirate systems.
2. Develop the ability to analyze, design, and implement any application using FPGA.
3. Be aware of how signal processing concepts can be used for efficient FPGA based system design.
4. Understand the rapid advances in Cognitive radio technologies.
5. Explore DDFS, CORDIC and its application.

Text Books:

1. S. K. Mitra, Digital Signal processing, McGrawHill, 1998
2. J. H. Reed, Software Radio, Pearson, 2002.
3. U. Meyer-Baese , Digital Signal Processing with FPGAs, Springer, 2001.
4. Cognitive Radio, Software Defined Radio and Adaptive Wireless Systems by HüseyinArslan, University of South Florida, USA, Springer.

Reference Books:

1. Cognitive Radio Networks by Kwang-Cheng Chen, Ramjee Prasad, Wiley, 2009-06-15.
2. Artificial Intelligence in Wireless Communications by Thomas W. Rondeau, Charles W. Bostian.

EC523 INTRODUCTION TO MEMS (3 - 0 - 3) 3

Pre-Requisite: EC207

Objective:

Micro **E**lectro **M**echanical **S**ystems (MEMS) are miniature devices that are widely used in consumer products such as accelerometers used in cars to activate the airbags and in smart phones to flip images and play video games. This course will introduce the basics of MEMS design, fabrication, sensing and actuation mechanisms, characterization and reliability testing. The MEMS concepts are reinforced through labs that involve design and simulation of MEMS devices using an advanced MEMS simulation tool and testing of actual MEMS devices. The applications and challenges of existing MEMS devices will be discussed.

Topics Covered:

Unit-1: Micro fabrication
Silicon as MEMS material, Silicon doping and oxidation, Deposition and etching
Unit-2: Micro machining
Bulk micromachining, wet etching, Bulk micromachining-dry etching, Surface micromachining-processes, LIGA and electroplating
Unit-3: Actuation and Sensing
Electrostatic actuation (parallel plate), Electrostatic actuation (comb drive), Electrostatic sensing, Piezoelectric sensing, Thermoelectric sensing and actuation
Unit-4: Design and Modelling
Design considerations, Scaling in miniaturization, Finite Element analysis, Packaging & Assembly: wire bonding and encapsulation, Surface bonding and 3D packaging, Wafer level packaging, Signal integrity
Unit-5: MEMS Testing and Reliabilities
Accelerated testing, MEMS characterization: characterization techniques, Applications: Acoustic MEMS: Microphones, Opitcal MEMS: micro-mirrors, Microfluidics

Course Outcomes:

Upon completion of this course, you will have gained the following:

1. An ability to apply knowledge of mathematics, science, and engineering
2. An ability to design a system, component, or process to meet desired needs within realistic constraints such as economic, environmental, social, political, ethical, health and safety, manufacturability, and sustainability
3. An ability to identify, formulate, and solve engineering problems
4. An ability to use the techniques, skills, and modern engineering tools necessary for engineering practice

Text Books:

1. Fundamental of MEMS by N.P.G.S Mahalik, TMH
2. Foundations of MEMS by Chang Liu (2nd edition), 2012, PHI

Reference Books:

1. MEMS and Microsystems (2nd edition) by Tai-Ran Hsu, 2008. Wielly& sons
2. Microsystem design by Stephen Senturia, Springers

EC524 BIOMEDICAL SIGNAL AND IMAGE PROCESSING (3-0-1-3)

Pre-Requisite: EC201& EC514

Objective:

1. This course emphasis on fundamentals of digital signal processing and problems in biomedical research and clinical medicine, which includes principles and algorithms for processing both deterministic and random signals. Topics include data acquisition, imaging, filtering, coding, feature extraction, and modelling.
2. The aim of the course is a series of labs that provide practical experience in processing physiological data, with examples from cardiology, speech processing, and medical imaging. The labs are done in MATLAB® during weekly lab sessions that take place in an electronic classroom. Lectures cover signal processing topics relevant to the lab exercises, as well as background on the biological signals processed in the labs.

Topics Covered:

Unit-1: Biomedical Signals and Images
ECG - Speech Signals - Speech Coding - Imaging Modalities - X-ray – MRI – fMRI - Fundus Image
Unit-2: Fundamentals of Deterministic Signal and Image Processing
Data Acquisition - Digital Filtering - DTFT -DFT - Image Processing
Unit-3: Probability and Random Signals
PDFs Classification: Bayes' rule - detection, statistical classification - Time averages - Ensemble averages - Autocorrelation Functions - Cross-correlation Functions - Random signals and linear systems - power spectra - cross spectra - Wiener filters - Blind source separation - PCA – EVD – SVD - ICA
Unit-4: Image Segmentation and Registration
Image Segmentation (statistical classification, morphological operators, connected components) - Image Registration (Rigid and non-rigid transformations, objective functions, Joint entropy, optimization methods)
Unit-5: Laboratory Projects, Tools: MATLAB
1. ECG Filtering and Frequency Analysis of the Electro-gram Design filter to remove noise from electrocardiogram (ECG) signals and then design a system to detect life-threatening ventricular arrhythmias. The detector is tested on normal and abnormal ECG signals.
2. Speech Coding Implement, test, and compare two speech analysis-synthesis systems. These systems utilize a pitch detector and a speech synthesizer based on the source-filter model of speech production.
3. Image Segmentation Process clinical MRI scans of the human brain to reduce noise, label tissue types, extract brain contours, and visualize 3-D anatomical structures.
4. Image Registration Explore the co-registration of medical images, focusing on 2-D to 2-D (slice to slice) registration and using non-linear optimization methods to maximize various measures of image alignment.
5. ECG: Blind Source Separation Separate fetal and maternal ECG signals using techniques based on second- and higher-order statistical methods. Techniques include Wiener filtering, principal component analysis, and independent component analysis.

Outcomes:

1. After studying this course student will learn about the biomedical signals and the method for processing them for the wellbeing of the human being.
2. Students will learn more about the signal processing tools.

Text Books:

1. Clifford, G., F. Azuajae, and P. McSharry. Advanced Methods and Tools for ECG Data Analysis. Norwood, MA: Artech House, 2006. ISBN: 9871580539661.

2. Rabiner, L. R., and R. W. Schafer. Digital Processing of Speech Signals. Upper Saddle River, NJ: Prentice-Hall, 1978. ISBN: 9780132136037.
3. Gonzalez, R., and R. E. Woods. Digital Image Processing. 2nd ed. Upper Saddle River, NJ: Prentice-Hall, 2002. ISBN: 9780201180756.
4. Epstein, C. L. Mathematics of Medical Imaging. Upper Saddle River, NJ: Prentice Hall, 2003. ISBN: 9780130675484.

Reference Books:

1. Webb, S. The Physics of Medical Imaging. New York, NY: Taylor & Francis, 1988. ISBN: 9780852743492.
2. Westbrook, C., C. Kaut Roth, and T. Talbot. MRI in Practice. 3rd ed. Malden, MA: Blackwell Science, Inc., 2005. ISBN: 9781405127875
3. Macovski, A. Medical Imaging Systems. Upper Saddle River, NJ: Prentice Hall, 1983. ISBN: 9780135726853.

EC525 RF AND MICROWAVE ENGINEERING

Objectives:

1. To study about multi- port RF networks and RF transistor amplifiers
2. To study passive microwave components and their S- Parameters.
3. To study Microwave semiconductor devices & applications.
4. To study Microwave sources and amplifiers.

Topics Covered

Unit 1: Two Port Network Theory

Review of Low frequency parameters: Impedance, Admittance, Hybrid and ABCD parameters, Different types or interconnection of Two port networks, High Frequency parameters, Formulation of s parameters, Properties of s parameters, Reciprocal and lossless Network, Transmission matrix, RF behavior of Resistors, Capacitors and Inductors

Unit 2: RF Amplifiers and Matching Networks

Characteristics of Amplifiers, Amplifier power relations, Stability considerations, Stabilization Methods, Noise Figure, Constant VSWR, Broadband, High power and Multistage Amplifiers, Impedance matching using discrete components, Two component matching Networks, Frequency response and quality factor, T and Pi Matching Networks, Microstrip Line Matching Networks.

Unit 3: Passive and Active Microwave Devices

Terminations, Attenuators, Phase shitters, Directional couplers, Hybrid Junctions, Power dividers, Circulator, Isolator, Impedance matching devices: Tuning screw, Stub and quarter wave transformers. Crystal and Schottkey diode detector and mixers, PIN diode switch, Gunn diode oscillator, IMPATT diode oscillator and amplifier, Varactor diode, Introduction to MlC.

Unit 4: Microwave Generation

Review of conventional vacuum Triodes, Tetrodes and Pentodes, High frequency effects in vacuum Tubes, Theory and application of Two cavity Klystron Amplifier, Reflex Klystron oscillator, Traveling wave tube amplifier, Magnetron oscillator using Cylindrical, Linear, Coaxial Voltage tunable Magnetrons, Backward wave Crossed field amplifier and oscillator.

Unit 5: Microwave Measurements

Measuring Instruments - Principle of operation and application of VSWR meter, Power meter, Spectrum analyzer, Network analyzer, Measurement of Impedance, Frequency, Power, VSWR, Q-factor, Dielectric constant, Scattering coefficients, Attenuation, S-parameters.

Text Books:

1. Samuel Y Liao, "Microwave Devices & Circuits" , Prentice Hall of India, 2006.
2. Reinhold.Ludwig and Pavel Bretshko 'RF Circuit Design", Pearson Education, Inc., 2006

Reference Books:

1. Robert. E.Collin-Foundation of Microwave Engg –Mc Graw Hill.
2. Annapurna Das and Sisir K Das, "Microwave Engineering", Tata Mc Graw Hill Inc., 2004.
3. M.M.Radmanesh , RF & Microwave Electronics Illustrated, Pearson Education, 2007.
4. Robert E.Colin, 2ed "Foundations for Microwave Engineering", McGraw Hill, 2001
5. D.M.Pozar, "Microwave Engineering.", John Wiley & sons, Inc., 2006.

EC 526: WIRELESS NETWORKS (3-0-0) 3

Objectives

- To understand the concepts of sensor networks
- To understand the MAC and transport protocols for wireless networks
- To understand the concepts of MANETs
- To understand the applications of ad-hoc and sensor networks

Topics Covered

Unit-I Wireless Local Area Networks (WLAN)
Wireless LANs: IEEE 802.11 WLANs - protocol architecture, physical layer, MAC layer, analysis, deployment of 802.11 infrastructures – IEEE 802.11ah for Internet of Things
Unit-II Mobile Ad-hoc Networks (MANETs)
Introduction to MANETs: Characteristics of MANETs, Applications of MANETs, Challenges. MAC Protocols - Routing in MANETs: reactive and proactive routing, power-aware routing, performance comparison; Quality of Service - Other Routing Protocols.
Unit-III Wireless Sensor Networks (WSNs)
Wireless Sensor Networks (WSNs): Overview/Architectures; Data Gathering; MAC Protocols; Power control; Localization – Under Water Sensor Networks – Body Area Networks
Unit- IV Wireless Personal Area Networks (WPAN)
IEEE 802.15.4. WPANs- Bluetooth- ZigBee - protocol architecture, physical layer, MAC layer, analysis - Introduction to IEEE 802.15.4e
Unit-V Mobile TCP & IP
Mobile Network and Transport Layer protocols - Mobile IP; Traditional TCP, Mobile TCP, Indirect TCP, Snooping TCP, TCP/IP protocol stack over IEEE 802.11b

Text Books

1. C. Siva Ram Murthy, and B. S. Manoj, "AdHoc Wireless networks", Prentice Hall Education, 2012.
2. Holger Karl and Andreas Willig, Protocols and Architectures for Wireless Sensor Networks, John Wiley & Sons, 2005.
3. Charles E Perkins, “Ad Hoc Networking”, Addison Wesley, 2001.
4..D. Bertsekas and R. Gallager, “Data Networks”, Prentice Hall of India, 2/e, 2000.
5 Recent IEEE, Elsevier and Springer Journal papers

EC527 ROBOTICS ENGINEERING (3- 0- 0) 3

Objectives:

1. To study the various parts of robots and fields of robotics.
2. To study the various kinematics and inverse kinematics of robots.
3. To study the Euler, Lagrangian formulation of Robot dynamics.
4. To study the trajectory planning for robot.
5. To study the control of robots for some specific applications.

Topics Covered

Unit - 1: Basic Concepts

Definition and origin of robotics – different types of robotics – various generations of robots – degrees of freedom – Asimov‟s laws of robotics – dynamic stabilization of robots.

Unit -2: Power Sources And Sensors

Hydraulic, pneumatic and electric drives – determination of HP of motor and gearing ratio – variable speed arrangements – path determination – micro machines in robotics – machine vision – ranging – laser – acoustic – magnetic, fiber optic and tactile sensors.

Unit -3: Manipulators, Actuators And Grippers

Construction of manipulators – manipulator dynamics and force control – electronic and pneumatic manipulator control circuits – end effectors – U various types of grippers – design considerations.

Unit -4: Kinematics And Path Planning

Solution of inverse kinematics problem – multiple solution Jacobian work envelop – hill Climbing Techniques – robot programming languages

Unit -5: Case Studies

Mutiple robots – machine interface – robots in manufacturing and non- manufacturing applications – robot cell design – selection of robot.

Course Outcomes:

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

1. Explain the basic concepts of working of robot
2. Analyze the function of sensors in the robot
3. Write program to use a robot for a typical application
4. Use Robots in different applications

Text Books:

1. Mikell P. Weiss G.M., Nagel R.N., Odraj N.G., “Industrial Robotics”, Mc Graw-Hill Singapore, 1996.
2. Ghosh, Control in Robotics and Automation: Sensor Based Integration, Allied Publishers, Chennai, 1998.

References:

1. Deb. S.R.,“Robotics Technology and flexible Automation”, John Wiley, USA 1992.
2. Klafter R.D., Chimielewski T.A., Negin M., “Robotic Engineering – An integrated approach”, Prentice Hall of India, New Delhi, 1994.
3. Mc Kerrow P.J. “Introduction to Robotics”, Addison Wesley, USA, 1991.
4. Issac Asimov “Robot”, Ballantine Books, New York, 1986.
5. Barry Leatham – Jones, “Elements of industrial Robotics” PITMAN Publishing, 1987.
6. Mikell P.Groover, Mitchell Weiss, Roger N.Nagel Nicholas G.Odrey, “Industrial Robotics Technology, Programming and Applications “, McGraw Hill Book Company 1986.
7. Fu K.S. Gonzaleaz R.C. and Lee C.S.G., “Robotics Control Sensing, Vision and Intelligence”

Any electives can be added at any time with approval of HOD (has to approved by Senate)

GLOBAL ELECTIVES

EC1001 APPLIED ELECTRONICS (3-0-0) 3

Objective:

1. To make the students understand the fundamentals of various electronic devices.
2. To train them to apply these devices in mostly used and important applications.

Topics Covered :

Unit-1: Amplifier Circuits
Introduction- R.C Coupled , Transformer coupled, Direct coupled amplifiers, Differential amplifiers, Concept of negative feedback, Feedback amplifiers.
Unit-2: Operational Amplifiers
Applications of operational amplifiers-Inverting and non-inverting amplifiers, Differentiator, Integrator, V to I and I to V converters, Comparator, Oscillator types.
Unit-3: Digital Circuits
Intoduction-Multiplexers, Demiltiplexers, Decoder and encoder, D/A and A/D converter types, sample and hold circuit.
Unit-4: Microprocessor
8085 Architecture, Interfacing, System design, Overview of MEMS and Microsystems, Materials, Fabrication Processes and Micro system Packaging.
Unit-5: Power Semiconductor Devices
Power diodes, Power transistors, SCR-TRIAC- GTO- IGBT-Principles of operation and characteristics, Introduction to choppers, Inverters, Phase controlled rectifiers and cyclo converters.

Course Outcomes:

1. Analyze the characteristics of various electronic devices.
2. Classify and analyze the various amplifier circuits.
3. Able to construct and design the digital circuit.
4. Illustrate and qualitative knowledge of power electronic devices.

Text Books:

1. Sedra, A.S. and Smith, K.C., Micro Electronic Circuits, Oxford University Press, 2004.
2. Millman and Halkias, Integrated Electronics, Tata McGraw -Hill, 1998.
3. Ramesh Gaonkar, Microprocessor Architecture, Programming, and Applications with the 8085, 5th Edition
4. Tai – Ran Hsu, MEMS and Microsystems Design and Manufacture, Tata-McGraw Hill, New Delhi, 2002.
5. Rashid, M.H. ,'Power Electronics - circuits, devices and applications', Prentice Hall India, New Delhi, 2006.

Reference Books:

1. Donald A. Neamen, Electronic Circuit Analysis and Design, Tata McGraw- Hill, 2002.
2. M.D.singh and K.B.Khanchandani, "Power Electronics", Tata Mc Graw Hills Publishing Company Limited, New Delhi 2006.

EC1002 COMMUNICATION SYSTEMS

Course Objectives

The objective of this course is

1. To introduce different methods of analog communication and their significance
2. To introduce Digital Communication methods for high bit rate transmission
3. To introduce the concepts of source and line coding techniques for enhancing rating of transmission of minimizing the errors in transmission.
4. To introduce various media for digital communication

Topics Covered:

Unit -1: Analog Modulation

Principles of Amplitude Modulation, single and double side band - suppressed carrier system and frequency modulation - varactor diode and reactance modulator - AM detectors - FM discriminators - AM and FM transmitters and receivers.

Unit - 2: Digital communication

Sampling theorem - pulse modulation techniques - PAM, PWM and PPM concepts - PCM encoder and decoder - Data transmission using analog carriers (FSK, PSK, QPSK, MSK and QAM).

Unit -3: Synchronous and Asynchronous transmission:

Transmission - error control techniques - data communication protocols link oriented protocols - asynchronous protocols – computer communication networks .

Unit - 4: Modern Communication Systems:

Microwaves and optical communication system, Satellite communication system, Mobile communication system.

Unit - 5: Principles of television engineering:

Requirements and standards - need for scanning - types of camera tubes and picture tubes - B/W and colour systems - PAL - CCTV -Cable TV – Introduction to analog television engineering – Digital television – fundamentals – HDTV .

Course Outcomes

The students will be able

1. To have an overview of various analog modulation schemes.
2. Understand the principle operation of various modulator and demodulator circuits.
3. Illustrate the different types of digital modulation techniques.
4. To have an overview of various communication systems.
5. Explain the basic operation of B/W and colour TV systems.
6. Understand the various data communication protocols.

Text Books

1. Kennedy.G, “Electronic Communication System”, Tata McGraw Hill, 1987.
2. Roddy.D and Coolen.J, “Electronic Communications”, Prentice Hall of India, 4th Edition.
3. Simon Haykins, “Electronic Communications”, John Wiley, 3rd Edition, 1995.

Reference Books

1. Taub and Schiling “Principles of communication systems” Tata McGraw Hill 2007.
2. Das.J, “Principles of Digital Communication”, New Age International, 2011.
3. Theodore S. Rappaport, “Wireless Communications - Principles and Practice”, Pearson, 2nd Edition, 2010
4. Bernard Sklar, “Digital communication fundamentals and applications”, Pearson Education, 2nd edition, 2009.

EC1003 ELECTRONIC DEVICES (3-0-0) 3

Objective:

1. To make the students understand the fundamentals of various electronic devices.
2. To train them to apply these devices in mostly used and important applications.

Topics Covered :

Unit-1: Semiconductor Diodes
PN junction diode –operation and VI characteristics, diode current equation, diffusion and transient capacitance, Zener diode characteristics, Zener diode as regulator.
Unit-2: Bipolar Junction Transistors
Introduction- PNP and NPN transistor, Operation and characteristics, Analysis of CB, CE and CC configuration, Transistor as switch.
Unit-3: Field effect Transistors
Operation and characteristics of JFET and MOSFET, MOSFET as switch and amplifier, Introduction to CMOS circuits.
Unit-4: Special Semiconductor Devices
Metal semiconductor junction-MESFET, Schottky barrier diode, Varactor diode, LED, Laser diode, PIN diode and Photodiodes.
Unit-5: Power Semiconductor devices
Power diodes, Power transistors, Operation and characteristics of SCR, DIAC, TRIAC, GTO and IGBT.

Course Outcomes:

1. Analyze the characteristics of various electronic devices.
2. Classify and analyze the various circuit configurations of transistors.
3. Illustrate and qualitative knowledge of power electronic devices.

Text Books

1. Sedra, A.S. and Smith, K.C., Micro Electronic Circuits, Oxford University Press, 2004.
2. Millman and Halkias, Integrated Electronics, Tata McGraw -Hill, 1998.
3. Rashid, M.H. ,'Power Electronics - circuits, devices and applications', Prentice Hall India, New Delhi, 2006.

Reference Books:

1. Donald A. Neamen, Electronic Circuit Analysis and Design, Tata McGraw- Hill, 2002.
2. M.D.singh and K.B.Khanchandani, "Power Electronics", Tata Mc Graw Hills Publishing Company Limited, New Delhi 2006.

EC1004 CMOS VLSI DESIGN (3 - 0 - 0) 3

Pre-Requisite: Knowledge of Digital Electronics circuits

Objectives:

4. To introduce various aspects of Digital VLSI circuits
5. To teach the layout issues for CMOS Digital circuits.
6. To make them understand the testing issues.

Topics Covered:

Unit -1: Introduction
Introduction of Digital circuits, logic gates, basics of combinational logic, sequential logic, finite state machine
Unit -2: Design Methodology
VLSI design methodology, VLSI technology- NMOS, CMOS fabrication. Layout design rules. Stick diagram. Latch up, Non-idealities of MOSFET.
Unit -3: Combinational circuits
Characteristics of MOS and CMOS switches. Implementation of logic circuits using MOS and CMOS technology, multiplexers and memory, MOS transistors, threshold voltage, MOS device design equations. CMOS inverters, propagation delay of inverters, Pseudo NMOS, Dynamic CMOS logic circuits, power dissipation.
Unit -4: Memory System
Memory cell: Layout of SRAM, DRAM.ROM Implementation, Delay, Implementation of PLD, EPROM, EEPROM, An overview of the features of advanced FPGAs, LUTs, Comparison of ASICs, FPGAs, PDSPs and CBICs . Fault tolerant VLSI architectures
Unit -5: Testing
VLSI testing -need for testing, Fault Modelling, Single and Multiple stuck at fault, manufacturing test principles, design strategies for test, chip level and system level test techniques.

Course Outcomes:

1. Able to design CMOS Digital Circuits.
2. Able to Layout CMOS Circuits.
3. Understand the timing issues related to combinational and sequential circuits.

Text Books:

1. N.H.E. Weste et al, CMOS VLSI design, (3/e), Pearson , 2005.
2. J. Smith, Application Specific Integrated Circuits, Pearson, 1997.

Reference Books:

1. Pucknell & Eshraghian, Basic VLSI Design, PHI, (3/e).
2. Uyemura, Introduction to VLSI Circuits and Systems, Wiley, 2002

EC 1005 DIGITAL ELECTRONICS (3 - 0 - 0) 3

Objectives:

Modern electronics is based on digital logic design, in this course basics of digital logic designing are covered which includes Boolean algebra, propositions, truth tables, minimization of combinational circuits. Karnaugh maps and tabulation procedure, implementation of sum of product and product of sum in hardware.

Topics Covered:

Unit-1: Boolean algebra
Number systems- conversions, error detection and error correction. Review of Boolean algebra- theorems, sum of product and product of sum simplification, Simplification of Boolean expressions- Implementation of Boolean expressions using universal gates.

Unit-2: Combinational logic circuits
Memories – ROM- Types of RAMs – Basic structure, organization, Static and dynamic RAMs, PLDs, PLAs. Adders, subtractors, parity generator, decoders, encoders, multiplexers, demultiplexers, Realisation of boolean expressions- using decoders-using multiplexers.

Unit-3: Sequential circuits
Latches, flip flops, edge triggering, asynchronous inputs. Shift registers, Universal shift register, applications. Binary counters – Synchronous and asynchronous up/down counters, mod-N counter, Counters for random sequence.

Unit-4:Synchronous circuit analysis and design:
Synchronous circuit analysis and design: structure and operation, analysis-transition equations, state tables and state diagrams

Unit-5: Logic families:
Introduction to TTL and ECL logic families: Basic working of a TTL NAND gate-characteristics of a TTL NAND gate- important specifications – Basic working of ECL gate-–DTL- RTL.

Course Outcomes:

The expected outcome after learning this course are that a student must be able to design a digital circuit, understand the differences between combinational and sequential circuits and will be able to implement the circuit.

Text Books:

1. Wakerly J F, Digital Design: Principles and Practices, Prentice-Hall, 4thEd.
2. R P Jain, Modern Digital Electronics 4th Edition, Tata Mcgraw Hill Education Private Limited
3. D. D. Givone, Digital Principles and Design, Tata Mc-Graw Hill, New Delhi, 2008.

EC1006 DIGITAL IMAGE PROCESSING (3 - 0 - 0) 3

Objective:

3. This course develops an overview of the field of image processing and help to understand the fundamental algorithms and how to implement them.
4. Provide an experience in applying image processing algorithms to real problems.

Topics Covered:

Unit-1: Digital Image Processing
Examples of Digital Image Processing - Components of image processing -Elements of Visual perception - Image sensing and acquisition using single sensor - sensor strips and sensor arrays - Image sampling and quantization: Basic concepts of sampling and quantization - Spatial and Gray level representation - Aliasing and Moire Patterns
Unit-2: Image Enhancement
Spatial Domain: Grey level transformation - Image negatives - Log transformations - Power law transformations - Piecewise linear transformation - Histogram Processing - Enhancement using Arithmetic and Logic operation - Smoothing Spatial Filter - Linear filter, Order Statistics filter - Sharpening Spatial Filters. Frequency Domain: Introduction to the Fourier Transform and the Frequency Domain - Smoothing Frequency Domain Filters - Sharpening Frequency Domain Filters - Homomorphic Filtering
Unit-3: Color image processing and image Restoration:
Noise Models - Restoration in the Presence of Noise Only - Spatial Filtering - Mean Filters, Order-Statistics Filters - Adaptive Filters - Periodic Noise Reduction by Frequency Domain Filtering Linear - Position Invariant Degradations - Estimating the Degradation Function. Color Image Processing: Color Fundamentals - Color Models, Pseudo-color Image Processing - Intensity Slicing - Gray Level to Color Transformations - Basics of Full- Color Image Processing - Color Transformations - Smoothing and Sharpening - Color Segmentation
Unit-4: Wavelets and Multi-resolution Processing
Image Pyramids - Sub-band Coding –The Haar Transform - Multi-resolution Expansions -Wavelet Transforms in One Dimension - Wavelet Transforms in Two Dimension
Unit-5: Image Compression, Segmentation and Morphological Image Processing
Compression: Redundancy - Image Compression Models - Elements of Information Theory - Error-Free Compression -Lossy Compression - Image Compression Standards. Segmentation: Detection of Discontinuities - Edge Linking and Boundary Detection Thresholding - Region-Based Segmentation - Segmentation by Morphological Watersheds. Morphological Image Processing: Basic Concepts from Set Theory - Logic Operations Involving Binary Images - Dilation and Erosion - Opening and Closing, Hit-or-Miss Transformation - Basic Morphological Algorithms -Gray-Scale Morphology

Outcomes:

1. Students learn about image processing tools
2. Apply the image processing for practical applications

Text Books:

1. R. C. Gonzalez and R. E. Woods, Digital Image Processing, (3/e), Prentice Hall
2. R. C. Gonzalez, R. E. Woods, and S. L. Eddins, Digital Image Processing with MATLAB, Prentice Hall
3. Maria Petrou, Costas Petrou, Image Processing: The Fundamentals (2/e), Wiley Publisher
4. A. K. Jain, Fundamentals on Digital Image Processing, PHI

EC1007 DIGITAL SIGNAL PROCESSING (3 - 0 - 0) 3

Objective:

The subject aims to introduce the mathematical approach to manipulate discrete time signals, which are useful to learn digital tele-communication.

Topics Covered:

Unit-1: Signals and Systems
Review of LSI system theory- DTFT-Frequency response of discrete time systems-All pass inverse and minimum phase systems.
Unit-2: Discrete Fourier Transform
Relationship of DFT to other transforms- FFT- DIT and DIF FFT algorithm-Linear filtering using DFT and FFT.
Unit-3: Finite Impulse Response Filters
Frequency response-FIR filter types- Design of FIR filters- Mapping formulas-Frequency transformations-Direct form realization of FIR systems-Lattice structure for FIR systems.
Unit-4: Infinite Impulse Response Filters
IIR filter types-IIR filter design- Bilinear transformation- impulse invariance transformation-Structures of IIR filters-Finite word length effects- Limit cycle oscillations
Unit-5: Applications and Multi-rate signal processing
Sampling rate conversion byan integer and rational factor-Polyphase FIR structures for sampling rate conversion-interpolation- decimation-Homomorphic filtering

Course Outcomes:

Students will be able to

1. Analyze discrete-time systems in both time & transform domain and also through pole-zero placement.
2. Analyze discrete-time signals and systems using DFT and FFT.
3. Design and implement digital finite impulse response (FIR) filters.
4. Design and implement digital infinite impulse response (IIR) filters.
5. Understand and develop multirate digital signal processing systems.

Text Books:

1. J.G. Proakisetal, Digital Signal Processing, (4/e) Pearson, 2007.
2. A.V. Oppenheim & R.W. Schafer, "Discrete Time Signal processing", (2/e),Pearson Education, 2003.

EC1008 EMBEDDED SYSTEMS (3 -0 - 0) 3

Objectives:

This course concerns with Embedded systems basic knowledge, embedded architectures, Architectures and programming of microcontrollers, embedded system applications..

Topics Covered

Unit I: Introduction to Embedded Systems
Definition of Embedded System. Embedded Systems Vs General Computing Systems. History of Embedded Systems. Classification, Major Application Areas. Purpose of

Embedded systems, Characteristics and Quality Attributes of Embedded Systems Typical Embedded System: Core of the Embedded System: General Purpose and Domain Specific Processors, ASICs, PLDs, Commercial Off-The-Shelf Components (COTS), Memory: ROM. RAM. Memory according to the type of Interface. Memory Shadowing, Memory selection for Embedded Systems, Sensors and Actuators. Communication Interface: Onboard and External Communication Interfaces.

Unit II: Programming Embedded Systems in C

Introduction, Definition of embedded system, Choice of Processor, programming language, operating system, development of embedded software.

Embedded Firmware: Reset Circuit, Brown-out Protection Circuit, Oscillator Unit, Real lime Clock, Watchdog Timer. Embedded firmware Design Approaches and Development Languages.

Unit III: RTOS Based Embedded System Design:

Operating System Basics, Types of Operating Systems, Tasks, Process and Threads. Multiprocessing and Multitasking, Task Scheduling. Task Communication: Shared Memory. Message Passing. Remote Procedure Call and Sockets. Task Synchronization: Task Communication / Synchronization Issues. Task Synchronization Techniques, Device Drivers, How to Choose an RTOS.

Unit IV: ARM Architecture ARM Design

Philosophy, Registers, Program Status Register. Instruction Pipeline Interrupts and Vector Table. Architecture Revision, ARM Processor Families. ARM Programming Model – I: Instruction Set: Data Processing Instructions. Addressing Modes. Branch. Load. Store Instructions, PSR Instructions. Conditional Instructions.

Unit V: ARM Programming

Thumb Instruction Set: Register Usage, Other Branch Instructions. Data Processing Instructions. Single-Register and Multi Register Load -Store Instructions. Stack. Software Interrupt Instructions, Simple C Programs using Function Calls, Pointers, Structures, Integer and Floating Point Arithmetic, Assembly Code using Instruction Scheduling, Register Allocation. Conditional Execution and Loops

Course Outcomes:

Students will be able to

1. Describe the differences between the general computing system and the embedded system, also recognize the classification of embedded systems..
2. Become aware of interrupts, hyper threading and software optimization.
3. Design real time embedded systems using the concepts of RTOS.

Text Books:

1. Embedded System Design - Frank Vahid, Tony Givargis, John Wiley..
2. Embedded C - Michael J. Pont, 2nd Ed., Pearson Education, 2008.
3. ARM Systems Developer's Guides- Designing & Optimizing System Software Andrew N. Sloss. Dominic Symes. Chris Wright, 2008. Elsevier Reference Books

Reference Books:

1. Raj Kamal, Embedded Systems Architecture, Programming, and Design. (2/e), Tata McGraw Hill, 2008.
2. K.V. Shibu, Introduction To Embedded Systems, Tata McGraw, 2009.
3. Peter Barry and Patric Crowley, Intel architecture for Embedded system.

EC1009 COMMUNICATION NETWORKS (3 - 0- 0) 3

Objectives:

To get an understanding on the fundamentals of networks and issues involved.
To acquire an understanding on the set of rules and procedures that mediates the exchange of information between communicating devices.

Topics Covered:

Unit 1: Layered architecture
Overview of circuit and packet switching – message switching –virtual circuits - Comparison of OSI and TCP/IP Internet protocol stacks.
Unit 2 Data Link Layer
General issues in networking – Delays – Throughput- Architectural concepts in ISO's OSI layered model- Data link layer - Direct Link Networks- Error detection- Reliable Transmission- MAC Protocols – ALOHA- CSMA - LANs – IEEE 802.3- IEEE 802.5 - IEEE 802.11
Unit 3 Network layer
Datagram and Virtual circuit service – Routers – ICMP.- IPV4 and IPV6 - IP addressing- Sub netting- CIDR- DHCP – NAT – ARP - Routing Principles
Unit 4: Transport layer
Transport layer services - Connection Management - Transmission Control Protocol (TCP) - User Datagram Protocol (UDP) - Principles of reliable data transfer - Principles of congestion control - Flow control.
Unit-5: Application layer
Overview of HTTP, FTP, SMTP, MIME, DNS, Multimedia networking applications, streaming stored video and audio, Internet phone, RTP.

Course Outcome:

Compare and examine, OSI and TCP/IP protocol stacks Categorize services offered by all layers in TCP/IP protocol stack Analyze a network under congestion and propose solutions for reliable data transfer,examine the protocols operating at different layers of TCP/IP model.

Text Books:

1. J.F.Kurose&K.W.Ross, Computer Networking (3/e) Pearson.
2. W.Stallings, Wireless Communication and Networks, Pearson, 2003

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EC1010 INTRODUCTION TO ROBOTICS (3- 0- 0) 3

Objectives:

1. To study the various parts of robots and fields of robotics.
2. To study the various kinematics and inverse kinematics of robots.
3. To study the Euler, Lagrangian formulation of Robot dynamics.
4. To study the trajectory planning for robot.
5. To study the control of robots for some specific applications.

Topics Covered

Unit - 1: Basic Concepts

Definition and origin of robotics – different types of robotics – various generations of robots – degrees of freedom – Asimov‟s laws of robotics – dynamic stabilization of robots.

Unit -2: Power Sources And Sensors

Hydraulic, pneumatic and electric drives – determination of HP of motor and gearing ratio – variable speed arrangements – path determination – micro machines in robotics – machine vision – ranging – laser – acoustic – magnetic, fiber optic and tactile sensors.

Unit -3: Manipulators, Actuators And Grippers

Construction of manipulators – manipulator dynamics and force control – electronic and pneumatic manipulator control circuits – end effectors – U various types of grippers – design considerations.

Unit -4: Kinematics And Path Planning

Solution of inverse kinematics problem – multiple solution Jacobian work envelop – hill Climbing Techniques – robot programming languages

Unit -5: Case Studies

Mutiple robots – machine interface – robots in manufacturing and non- manufacturing applications – robot cell design – selection of robot.

Course Outcomes:

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

1. Explain the basic concepts of working of robot
2. Analyze the function of sensors in the robot
3. Write program to use a robot for a typical application
4. Use Robots in different applications

Text Books:

1. Mikell P. Weiss G.M., Nagel R.N., Odraj N.G., “Industrial Robotics”, Mc Graw-Hill Singapore, 1996.
2. Ghosh, Control in Robotics and Automation: Sensor Based Integration, Allied Publishers, Chennai, 1998.

References:

1. Deb. S.R.,“Robotics Technology and flexible Automation”, John Wiley, USA 1992.
2. Klafter R.D., Chimielewski T.A., Negin M., “Robotic Engineering – An integrated approach”, Prentice Hall of India, New Delhi, 1994.
3. Mc. Kerrow P.J. “Introduction to Robotics”, Addison Wesley, USA, 1991.
4. Issac Asimov “Robot”, Ballantine Books, New York, 1986.
5. Barry Leatham – Jones, “Elements of industrial Robotics” PITMAN Publishing, 1987.

EC1011 SATELLITE COMMUNICATION (3 - 0 - 0) 3

Objective:

To impart knowledge on various aspects in the design of systems for satellite communication.

Topics Covered :

Unit-1: Orbital Mechanics
Frequency allocation for Satellite services - Elements of orbital mechanics - Equations of motion - Tracking and orbit determination. Orbital correction/control. Satellite launch systems. Multistage rocket launchers and their performance.
Unit-2 Satellite Subsystems
Orbital correction/control – Attitude Control - Station keeping - Thermal Control - TT&C Systems – Transponders - Satellite antennas. Reliability considerations
Unit-3: Elements of communication satellite design.
Satellite link design: Performance requirements and standards. Design of satellite links – DOMSAT, INSAT, INTELSAT and INMARSAT. Satellite - based personal communication.
Unit-4: Multiple access techniques
FDMA,TDMA,CDMA. Random access techniques - Satellite onboard processing.
Unit - 5: Earth Station design and tracking antennas
Earth station design - Configuration. Antenna and tracking systems. Satellite broadcasting.

Course outcomes:

Students are able to

1. Able to understand how analog and digital technologies are used for satellite communication networks.
2. Able to understand the radio propagation channel for Earth station to satellite.

Text Books:

1. D. Roddy, "Satellite Communication", 4thedition, McGraw- Hill, 2009.
2. T. Pratt & C.W. Bostain, "Satellite Communication", 2nd edition, Wiley Publishers, 2008.

Reference Book:

1. B.N. Agrawal, Design of Geo-synchronous Spacecraft, Prentice- Hall,1986.

EC1012 WIRELESS COMMUNICATION (3- 0- 0) 3

Objective:

To understand the basics of wireless digital communication used for mobile telephony. To study the basic methodologies of cellular system designing. To understand the various multiplexing mechanisms. To understand the interference measurement and reduction techniques.

Topics Covered:

Unit-1:Cellular concept
Frequency reuse – co-channel interference - adjacent channel interference - power control for reducing interference - improving capacity in cellular systems - cell splitting - sectoring - hand off strategies - channel assignment strategies - call blocking in cellular networks
Unit-2:Mobile Radio Propagation
Reflection, Diffraction, Fading. Diversity techniques for mobile wireless radio systems concept of diversity branch and signal paths - combining methods - selective diversity combining - maximal ratio combining- equal gain combining
Unit-3: Propagation models
Path loss prediction over hilly terrain -Practical link budget design using Path loss models - Indoor and outdoor Propagation models
Unit-4:Multiple access techniques
FDMA, TDMA, SDMA and CDMA. Spread spectrum. Power control.WCDMA. Capacity of multiple access schemes
Unit-5: Mobile communication Standards
Overview of second generation cellular wireless systems: GSM and IS-95 standards, 3G systems: UMTS & CDMA 2000 standards WLAN technology. Ad hoc networks. Bluetooth.

Course Outcome:

Describe the cellular concept and analyze capacity improvement Techniques. Mathematically analyze mobile radio propagation mechanisms. Summarize diversity reception techniques. Analyze and examine the multiple access techniques and its application.

Text Books:

1. KamiloFeher, ‘Wireless Digital Communications’, PHI
2. Rapport T.S., ‘Wireless Communications, Principles and Practice’, Prentice Hall

Reference Books:

1. Lee W.C.Y., ‘Mobile Cellular Telecommunication’, MGH
2. Proakis J.G., ‘Digital Communications’, MGH

EC1013 OPTICAL COMMUNICATION (3-0-0)3

Objective:

To expose the students to the basics of signal propagation through optical fibers, fiber impairments, components and devices and system design.

Topics Covered:

Unit-1: Introduction
Ray theory transmission- Total internal reflection-Acceptance angle –Numerical aperture – Skew rays – Electromagnetic mode theory of optical propagation –EM waves – modes in Planar guide – phase and group velocity – cylindrical fibers –SM fibers.
Unit-2: Transmission characteristics of optical fibers
Attenuation – Material absorption losses in silica glass fibers – Linear and Non linear Scattering losses - Fiber Bend losses –Intra and inter Modal Dispersion – Polarization. Optical fiber connectors**,** Fiber alignment and Joint Losses – Fiber Splices– Fiber connectors – Expanded Beam Connectors – Fiber Couplers.
Unit-3: Sources and Detectors
Optical sources: Light Emitting Diodes - LED structures - surface and edge emitters, internal - quantum efficiency, injection laser diode structures - comparison of LED and ILD Optical Detectors: PIN Photo detectors, Avalanche photo diodes, construction, characteristics and properties.
Unit-4: Fiber Optic Receiver and Measurements
Fundamental receiver operation, Pre amplifiers, Error sources – Receiver Configuration – Probability of Error – Quantum limit. Fiber Attenuation measurements- Dispersion measurements – Fiber Refractive index profile measurements – Fiber cut- off Wave length Measurements – Fiber numerical Aperture Measurements – Fiber diameter measurements.
Unit-5: Optical Networks
Basic Networks – SONET / SDH – Broadcast – and –select WDM Networks –Wavelength Routed Networks – Non linear effects on Network performance –Performance of WDM , EDFA system – Solitons – Optical CDMA – Ultra High Capacity Networks.

Course Outcomes:

1. Able to understand the propagation of signal through Fiber cable.
2. Able to understand the various modes of propagation and its importance.
3. Able to implement Fiber optics systems.

Text Books:

1. G. Keiser, Optical Fiber Communications (4/e), TMH, 2008.
2. Optical Fibre Communication: Principals and Techniques", John M. Senior, PHI New Delhi 3/e,2008

Reference Books:

1. MMK. Liu, Principles and Applications of Optical Communications, TMH, 2010.
2. G.P. Agrawal, Fiber Optic Communication Systems, (3/e), Wiley, 2002.
3. J. Gowar, Optical Communication Systems, (2/e), PHI, 2001.

EC1014 MICROPROCESSORS AND ITS APPLICATIONS (3-0-0) 3

Objectives

- To introduce the architecture and programming of 8085 microprocessor.
- To introduce the interfacing of peripheral devices with 8085 microprocessor.
- To introduce the architecture and programming of 8086 microprocessor.
- To introduce the architecture, programming and interfacing of 8086 microprocessor.

Topics Covered

Unit -1: 8085 CPU

8085 Architecture – Instruction set – Addressing modes – Timing diagrams – Assembly language programming – Counters – Time Delays – Interrupts – Memory interfacing – Interfacing, I/O devices.

Unit -2: 8086 CPU

Intel 8086 Internal Architecture – 8086 Addressing modes- Modes of operation -Instruction set- 8086 Assembly language Programming–Interrupts.

Unit - 3: 80186, 80286, 80386 And 80486 Microprocessors

80186 Architecture- Enhancements of 80186 - 80286 Architecture real and Virtual Addressing - 80386 Architecture - Special Registers, Memory Management Memory Paging Mechanism – 80486 Architecture – Enhancements – Cache Memory Techniques Exception Handling – Comparison of microprocessors (8086, 80186, 80286, 80386, 80486).

Unit - 4: Pentium Microprocessors

Pentium Microprocessor Architecture - Special Pentium Registers - Pentium Memory Management - New Pentium Instructions - Pentium Pro Microprocessor Architecture - Special Features - Pentium II Microprocessor Architecture - Pentium III Microprocessor Architecture - Pentium IV Microprocessor Architecture - Comparison of Pentium Processors.

Unit - 5: Peripherals Interfacing

Interfacing Serial I/O (8251)- parallel I/O (8255) –Keyboard and Display controller (8279) – ADC/DAC interfacing – Inter Integrated Circuits interfacing (I^2C Standard)- Bus: RS232C-RS485-GPIB

Course Outcomes:

Students will be able to

1. Apply the concept of buses, microprocessor architecture and interrupts.
2. Interface memory and I/O devices with microprocessors
3. Program assembly language programming/ C programming of 8086
4. Design microprocessor based small systems.

Text Books:

1. Ramesh S Gaonkar, "Microprocessor Architecture- Programming & Applications with 8085/8080A", 5th Ed., Penram International Publishing (India) Pvt. Ltd.
2. Rodnay Zaks and Austin Lesea, "Microprocessor Interfacing Technique", 1st Indian Edition, BPB Publication (1988)
3. John Uffenbeck, "The 80x86 Family, Design, Programming and Interfacing", Third Edition. Pearson Education, 2002.

Reference Books

1. Ram B, "Introduction of Microprocessors & Microcomputers", 4th Ed., Dhanpat Rai Publisher (P) Ltd

2. James L Antonakes, “An introduction to Intel family of Microprocessors”, 3rd Ed., Pearson Education.
3. Charles M Gilmore, “Microprocessor; Principles and Applications”, 2nd Ed., McGraw Hill
4. A.K. Ray and K.M.Burchandi, “Intel Microprocessors Architecture Programming and Interfacing”, McGraw Hill International Edition, 2000
M. Rafi Quazzaman, “Microprocessors Theory and Applications: Intel and Motorola”, Prentice Hall of India, Pvt. Ltd., New Delhi, 2003.

EC1015 INFORMATION THEORY AND CODING (3- 0- 0) 3

Objectives

To provide basic concepts of Information
To enable the students to propose, design and analyse suitable coding/decoding scheme for a particular digital communication application

Topics Covered

Unit 1
Information theory- information and entropy-properties of entropy of a binary memory less source- source coding theorem-Shannon fano coding-Huffman coding –Lempel ziv coding-discrete memory less source-binary symmetric channel –mutual information-properties-channel capacity –channel coding theorem
Unit 2
Introduction to algebra-groups-fields-binary field arithmetic-construction of Galois field-basic Properties-computations-vector spaces-matrices-BCH codes-description-coding & decoding –Reed Solomon codes-coding & decoding
Unit 3
Coding –linear block codes-generator matrices-parity check matrices-encoder-syndrome and error correction-minimum distance-error correction and error detection capabilities-cyclic codes-coding and decoding
Unit 4
Coding –convolutional codes-encoder –generator matrix-transform domain Representation-state Diagram-distance properties-maximum likelihood decoding-Viterbi decoding-sequential decoding
Unit 5
Burst errors -Interleaved codes-Turbo coding- coding & decoding -Trellis codes- coding & decoding

Text Books

1. Simon Haykins,Communication Systems,John Wiley
2. Shi Lin,Costello D.J ., Errpr Control Coding-Fundamentals amd Applications,Prentice Hall Inc. Eaglewood Cliffs

Reference Books

1. Das J.Malik A.K., Chatterjee P. K. .,Principles of Digital Communications,New Age International
2. Simon Haykin,Digital Communications,John Wiley
3. Taub& Schilling, Principles of Communication System,TATA MC Graw Hill
4. Tomasi,Electronic Communications,Fundamentals Through Advanced,Pearson education
5. Sklon, Digital Communications Pearson education
6. Couch,Digital and Analog Communication System, Pearson education