M.E. (Applied Electronics)

2015 Regulations, Curriculum & Syllabi

BANNARI AMMAN INSTITUTE OF TECHNOLOGY

(An Autonomous Institution Affiliated to Anna University, Chennai
Approved by AICTE - Accredited by NBA New Delhi, NAAC with 'A' Grade and ISO 9001:2008 Certified)
SATHYAMANGALAM – 638 401 Erode District Tamil Nadu
Phone : 04295 226000 Fax : 04295 226666
Web:www.bitsathy.ac.in E-mail : bitsathy@bannari.com

CONTENTS

PROGRAM EDUCATIONAL OBJECTIVES (PEOs)

1. The Graduates will demonstrate their outstanding education skills that will enable them to integrate undergraduate fundamentals with advanced knowledge to solve complex electronics engineering problems.
2. The Graduates will develop their professional and ethical responsibility, effective communication skills, teamwork skills, multidisciplinary approach, and the life-long learning needed for a successful professional career.
3. The Graduates will pursue higher education and succeed research to create novel products and find solutions for real life problems

PROGRAMME OUTCOMES (POs)

(a) The Graduates will able to apply knowledge from undergraduate engineering and other disciplines to identify, formulate, solve novel advanced electronics engineering along with soft computing and networking problems that require advanced knowledge within the field.

(b) The Graduates will able to understand and integrate new knowledge within the field.

(c) The Graduates will able to apply advanced technical knowledge in multiple contexts.

(d) The Graduates will able to understand and design advanced electronics systems (Analog and Digital Systems) and conduct experiments, analyze and interpret data.

(e) The Graduates will able to demonstrate the skills to use modern engineering tools, software and equipment to analyze problems.

(f) The Graduates will able to plan, conduct an organized and systematic study on significant research topic within the field.

(g) The Graduates will able to convey technical material through formal written reports which satisfy accepted standards of writing style.

(h) The Graduates will able to communicate professionally.

(i) The Graduates will able to become knowledgeable about contemporary developments.

(j) The Graduates will able to develop confidence for self education and able to for lifelong learning.

MAPPING OF PEOs AND POs

PEO(s)	Programme Outcome (s)									
	(a)	(b)	(c)	(d)	(e)	(f)	(g)	(h)	(i)	(j)
I	x	x			x					
II			x			x			x	x
III				x			x	x		

M.E -Applied Electronics (Full Time)

Minimum credits to be earned: 76

First Semester							
Code No.	**Course**	**Objectives & Outcomes**		**L**	**T**	**P**	**C**
		PEOs	**POs**				
15AE11	Linear Algebra and Graph Theory	I,II,III	(a),(b),(c),(d)	3	2	0	4
15AE12	Digital System Design	I,III	(a), (b), (e), (f)	3	2	0	4
15AE13	Industrial Electronics	I,II	(b), (c), (i)	3	0	0	3
15AE14	Microprocessors & Embedded Systems	I,III	(a), (b), (c), (d)	3	2	0	4
15AE15	Computer Vision	I,II,III	(a), (b), (e), (f)	3	2	0	4
	Elective I			3	0	0	3
15AE17	Electronics System Design Laboratory I	II,III	(b), (c), (d), (e), (f)	0	0	2	1
15AE18	Microprocessor and Embedded Laboratory	II,III	(a), (b), (c), (d), (e)	0	0	2	1
15GE19	Business English - I[α]			1	0	2	2
			Total	**19**	**8**	**6**	**26**
Second Semester							
Code No.	**Course**	**Objectives & Outcomes**		**L**	**T**	**P**	**C**
		PEOs	**POs**				
15AE21	Research Methodology			3	0	0	3
15AE22	Automotive Electronics	I,II	(b), (c), (i)	3	0	0	3
15AE23	Neural Computing	I,II,III	(a), (b), (e), (f)	3	2	0	4
15AE24	Optoelectronics	I,II	(b), (c), (i)	3	2	0	4
	Elective II			3	0	0	3
	Elective III			3	0	0	3
15AE27	Advanced Electronics System Design Laboratory	II,III	(b), (c), (d), (e), (f)	0	0	2	1
15AE28	Technical Seminar	II,III	(f), (g), (h), (i), (j)	0	0	2	1
15GE29	Business English - II[α]			1	0	0	1
			Total	**19**	**4**	**4**	**23**
Third Semester							
Code No.	**Course**	**Objectives & Outcomes**		**L**	**T**	**P**	**C**
		PEOs	**POs**				
	Elective IV			3	0	0	3
	Elective V			3	0	0	3
	Elective VI			3	0	0	3
15AE34	Project Work - Phase I	III	(e), (f), (g)				6
			Total	**9**	**0**	**0**	**15**
Fourth Semester							
Code No.	**Course**	**Objectives & Outcomes**		**L**	**T**	**P**	**C**
		PEOs	**POs**				
15AE41	Project Work - Phase II	III	(e), (f), (g)				**12**
			Total				**12**

[α] Common to all M.E. / M.Tech. Programmes

M.E -Applied Electronics (Part Time)

First Semester							
Code No.	**Course**	**Objectives & Outcomes**		**L**	**T**	**P**	**C**
		PEOs	**POs**				
15AE11	Linear Algebra and Graph Theory	I,II,III	(a),(b),(c),(d)	3	2	0	4
15AE12	Digital System Design	I,III	(a), (b), (e), (f)	3	2	0	4
15AE13	Industrial Electronics	I,II	(b), (c), (i)	3	0	0	3
15AE17	Electronics System Design Laboratory I	II,III	(b), (c), (d), (e), (f)	0	0	2	1
15GE19	Business English - I[α]			1	0	2	2
			Total	**10**	**4**	**4**	**14**
Second Semester							
Code No.	**Course**	**Objectives & Outcomes**		**L**	**T**	**P**	**C**
		PEOs	**POs**				
15AE21	Research Methodology			3	0	0	3
15AE22	Automotive Electronics	I,II	(b), (c), (i)	3	0	0	3
15AE23	Neural Computing	I,II,III	(a), (b), (e), (f)	3	2	0	4
15AE27	Advanced Electronics System Design Laboratory	II,III	(b), (c), (d), (e), (f)	0	0	2	1
15GE29	Business English - II[α]			1	0	0	1
			Total	**10**	**2**	**2**	**12**
Third Semester							
Code No.	**Course**	**Objectives & Outcomes**		**L**	**T**	**P**	**C**
		PEOs	**POs**				
15AE14	Microprocessors & Embedded Systems	I,III	(a), (b), (c), (d)	3	2	0	4
15AE15	Computer Vision	I,II,III	(a), (b), (e), (f)	3	2	0	4
15AE24	Optoelectronics	I,II	(b), (c), (i)	3	2	0	4
15AE18	Microprocessor and Embedded Laboratory	II,III	(a), (b), (c), (d), (e)	0	0	2	1
			Total	**9**	**6**	**2**	**13**
Fourth Semester							
Code No.	**Course**	**Objectives & Outcomes**		**L**	**T**	**P**	**C**
		PEOs	**POs**				
	Elective I			3	0	0	3
	Elective II			3	0	0	3
	Elective III			3	0	0	3
15AE28	Technical Seminar	II,III	(f), (g), (h), (i), (j)	0	0	2	1
			Total	**9**	**0**	**2**	**10**
Fifth Semester							
Code No.	**Course**	**Objectives & Outcomes**		**L**	**T**	**P**	**C**
		PEOs	**POs**				
	Elective IV			3	0	0	3
	Elective V			3	0	0	3
	Elective VI			3	0	0	3
15AE34	Project Work - Phase I	III	(e), (f), (g)		-	-	6
			Total	**9**	**0**	**0**	**15**
Sixth Semester							
Code No.	**Course**	**Objectives & Outcomes**		**L**	**T**	**P**	**C**
		PEOs	**POs**				
15AE41	Project Work - Phase II	III	(e), (f), (g)				**12**

[α] Common to all M.E. / M.Tech. Programmes

List of Core Electives							
Code No.	**Course**	**Objectives & Outcomes**		**L**	**T**	**P**	**C**
		PEOs	**POs**				
15AE51	Advanced Wireless Networks	II,III	(a), (b), (c), (d) ,(e), (i), (j)	3	0	0	3
15AE52	Medical Image Processing	I,III	(a), (b), (c), (d), (e), (i), (j)	3	0	0	3
15AE53	Cognitive Radio Technologies	II,III	(f), (g), (h), (k)	3	0	0	3
15AE54	Wireless Security$^{\Omega}$	II,III	(a), (b), (c), (d), (e)	3	0	0	3
15AE55	Statistical signal processing$^{\$}$	I,III	(a), (b), (c), (d)	3	0	0	3
15AE56	Digital video processing	I,III	(e), (f), (g), (h)	3	0	0	3
15AE57	DSP Integrated Circuits$^{\#}$	I,III	(a), (b), (c), (d), (e), (f),(i), (j)	3	0	0	3
15AE58	Digital Control Systems	I,III	(a), (b), (c), (d), (e)	3	0	0	3
15AE59	Embedded Networking	II,III	(b), (c), (i)	3	0	0	3
15AE60	Nano Electronics	II,III	(b), (c), (i)	3	0	0	3
15AE61	RF IC and Microwave MEMS	I,III	(b), (c), (d)	3	0	0	3
15AE62	Network Security	II,III	(a), (b), (c), (d)	3	0	0	3
15AE63	Wireless Body Area Networks	II,III	(b), (c), (i)	3	0	0	3
15AE64	Micro Electro Mechanical Systems‡	I,III	(a), (c), (d), (e), (f)	3	0	0	3
15AE65	DSP Processor Architecture and Programming	I,III	(a), (b), (c), (d), (e)	3	0	0	3
15AE66	Medical Electronics	II,III	(a), (b), (e), (f)	3	0	0	3
15AE67	Communication Networks$^{\#}$	I,II	(a), (b), (c), (d)	3	0	0	3
15AE68	Robotics and Automation‡	I,II,III	(a), (b), (c), (d), (e)	3	0	0	3
15AE69	Pattern Recognition & Artificial Intelligent Techniques$^{\Upsilon}$	II,III	(a), (b), (c), (d), (e)	3	0	0	3
15AE70	Analog VLSI Design	I,III	(b) , (c), (d)	3	0	0	3
15AE71	Biometrics for Network Security	I,II,III	(f), (g), (h), (i)	3	0	0	3
15AE72	Cyber crime Investigations and Digital Forensics	II,III	(a), (b), (c)	3	0	0	3
15AE73	Evolutionary Computing	I,III	(a), (b), (c), (d), (e)	3	0	0	3

One Credit Courses							
Code No.	**Course**	**Objectives & Outcomes**		**L**	**T**	**P**	**C**
		PEOs	**POs**				
15AEXA	Programmable Logic Controllers	I,II	(b) , (c), (d)	1	0	0	1
15AEXB	Supervisory Control and Data Acquisition	I,II	(b) , (c), (d)	1	0	0	1

$^{\Omega}$ Common to Applied electronics and Communication Systems

$^{\#}$ Common to Applied electronics and VLSI Design

‡ Common to Applied electronics and Instrumentation Engineering

‡ Common to Applied electronics and Instrumentation Engineering

$^{\Upsilon}$ Common to Applied electronics and Embedded Systems

15AE11 LINEAR ALGEBRA AND GRAPH THEORY

3 2 0 4

Course Objectives

- To impart knowledge on the calculus of variations, with emphasis on its applications in several scientific fields.
- To understand the basic concepts of vector spaces and their applications.
- Ability to find the Eigen values and Eigen vectors of the matrix.
- Acquire the knowledge of interest in graph theory.

Course Outcomes (COs)

1. To provide the students with outstanding educational skills that will enable them to integrate under graduate fundamentals with advanced knowledge to solve complex problems.
2. Can get the idea of optimization and its applications.
3. Able to use a combination of theoretical knowledge and independent mathematical thinking using graph theory.

Unit I

Vector space

Definition and examples of linear space - Linear dependence and independence - Basis and Dimension - Inner product space - Orthogonalisation process - Gram - Schmidt process Least - square problems - Applications of inner product spaces.

9 Hours

Unit II

Eigen values and Eigen vectors

Generalized Eigen values and Eigen vectors - Characteristic equation - Diagonalization - Eigen vectors & linear transformations - Complex eigen values - Applications to differential equations - Iterative estimates for Eigen values.

9 Hours

Unit III

Advance Matrix Theory

Diagonalization of symmetric matrices - Quadratic forms - Singular values decomposition - Change of basis.

9Hours

Unit IV

Calculus of Variations

Introduction to variation problems - Euler's equation - Functional dependent on first and higher order derivatives - Functional dependent on functions of several independent variables - Applications -Direct method: Ritz method.

9 Hours

Unit V

Graph Theory

Introduction - Basic terminology - Representation of graphs - Connected graphs - Matrix representation of graphs (excluding graphs) - Applications - Critical path method - Shortest path problems - Trees - Definition - Binary tree.

9 Hours

Unit VI[$]

Matrix norms - Jordan canonical form - Pseudo inverse - Least square approximations – QR-algorithm.

Total: **45+30 Hours**

Reference(s):

1. Elsgolts.L, *Differential Equation and Calculus of variations*, MIR Publishers, 2013.
2. David C Lay, *Linear Algebra and its Applications*, Pearson Education Asia, New Delhi, 2011.
3. Howard Anton, Elementary *Linear Algebra*", John Wiley & Sons, 2015.
4. Jonathan Gross and Jay Yellen, *Graph Theory and its Applications*, CRCPress, 2006.
5. NarsinghDeo, *Graph Theory with Applications to Engineering and Computer Science*, Prentice Hall,2008.

15AE12 DIGITAL SYSTEM DESIGN

3 2 0 4

Course Objectives

- To understand the concepts of Asynchronous Sequential Circuit Design.
- To study the concepts of Fault Diagnosis and Testability Algorithms.
- To understand the concepts of System Design Using VHDL and Programmable Devices.

Course Outcomes (COs)

1. Design and analysis of asynchronous sequential circuit
2. Explore fault diagnosis and testability algorithm
3. Study of programmable logic devices
4. Design and analysis of clocked synchronous sequential networks

Unit I

Sequential Circuit Design

Analysis of Clocked Synchronous Sequential Networks (CSSN) Modeling of CSSN – State Stable Assignment and Reduction – Design of CSSN – Design of Iterative Circuits – ASM Chart –ASM Realization.

9 Hours

Unit II

Asynchronous Sequential Circuit Design

Analysis of Asynchronous Sequential Circuit (ASC) – Flow Table Reduction – Races in ASC – State Assignment – Problem and the Transition Table – Design of ASC – Static and Dynamic Hazards – Essential Hazards.

9 Hours

Unit III

Fault Diagnosis and Testability Algorithms

Fault Table Method – Path Sensitization Method – Boolean Difference Method – Kohavi Algorithm – Tolerance Techniques – The Compact Algorithm – Fault in PLA – Test Generation – Masking Cycle – Built- in Self Test.

9 Hours

[$] Includes Self Study topics of all 5 units and considered for Continuous Assessment only.

Unit IV

Synchronous Design Using Programmable Devices

EPROM to Realize a Sequential Circuit – Programmable Logic Devices – Designing a Synchronous Sequential Circuit using a GAL – EPROM – Realization State machine using PLD – FPGA – Xilinx FPGA– Xilinx 2000 -Xilinx 3000.

9 Hours

Unit V

System Design Using VHDL

VHDL Description of Combinational Circuits – Arrays – VHDL Operators – Compilation and Simulation of VHDL Code – Modeling using VHDL – Flip Flops – Registers – Counters – Sequential Machine –Combinational Logic Circuits - VHDL Code for – Serial Adder, Binary Multiplier – Binary Divider – complete Sequential Systems.

9 Hours

Unit VI[$]

Design of a Simple Microprocessor-SM chart and microprogramming- designing with FPGA-hardware testing

Total: 45+30 Hours

Reference(s)

1. G.DonaldGivone, *Digital principles and Design,* Tata McGraw Hill 2002.
2. M.John Yarbrough, *Digital Logic Applications and Design*, Thomson Learning, 1996.
3. N.Nripendra Biswas, Logic *Design Theory*, Prentice Hall of India, 2001.
4. H.Charles Roth, *Digital System Design using VHDL*, Thomson Learning, 2007.
5. H.Charles Roth, *Fundamentals of Logic design,* Thomson Learning, 2003.
6. Stephen Brown and Zvonk Vranesic, *Fundamentals of Digital Logic with VHDL Design*, Tata McGraw Hill, 2008.
7. D. Roychoudhury**,** *Digital System Design*, NPTEL Video Courseware,2009.

15AE13 INDUSTRIAL ELECTRONICS

3 0 0 3

Course Objectives

- To study the basics of industry based control electronics.
- To understand sensors and activators
- To study trends recent sensing systems in industry

Course Outcomes (COs)

1. To study different power control devices and its efficiency.
2. To learn different converters and choppers.
3. To study sensor types.

Unit I

Power Devices

Power diode – Power transistor – Power MOSFET – SCR – TRIAC – GTO – IGBT – MCT – Protection of power devices.

9 Hours

[$] Includes Self Study topics of all 5 units and considered for Continuous Assessment only.

Unit II

Converters

Introduction to half wave, full wave and bridge rectifiers – Single phase and three phase – Half controlled and fully controlled converters – Dual converters – Introduction to cyclo converters and ac controllers.

9 Hours

Unit III

Inverter and Chopper

Voltage, current and load commutation – Voltage Source Inverter (VSI) – Series and Parallel inverter – Bridge inverters – Single and three phase – Voltage control using PWM – Current Source Inverter (CSI) – Choppers – Step up and step down choppers – Chopper classification – Class A,B, C, D, E – AC choppers.

9 Hours

Unit IV

Transducers

Overview of conventional transducers and its characteristics,Overview of conventional sensors - Resistive, Capacitive, Inductive, Piezoelectric, Magneto strictive and Hall effect sensors - Static and Dynamic Characteristics and specifications.

9 Hours

Unit V

Sensors

Smart sensors, Integrated smart sensors – definition – Interface electronics: Design, sensing elements ,and their parasitic effects, ADC, Accuracy over a Dynamic range - Universal ,Sensor Interface – front end circuits – DAQ board design - Digital conversion techniques.

9 Hours

Unit VI[$]

Bio micro sensors – Introduction to Nano sensors -Smart temperature sensor – Case studies of smart sensor applications and micro sensors.

Total: 45 Hours

Reference(s)

1. G.K.Mithal,"IndustrialElectronics",KhannaPublishers,Delhi,2000.
2. M. H. Rashid, "Power Electronics Circuits, Devices and Application", PHI, 3rd edition, 2004.
3. Ernest O Doebelin and Dhanesh N Manik, Measurement Systems Application and Design, 5th Edition, Tata Mc-Graw Hill, 2011.
4. Ifan G. Hughes and Thomas P.A. Hase, Measurements and their Uncertainties: A Practical Guide to Modern Error Analysis, Oxford University Press, 2010.
5. Gerord C.M. Meijer, Smart Sensor Systems, John Wiley and Sons, 2008.
6. Tai-Ran Hsu, Mems and Micro Systems: Design and Manufacture, Tata McGrawHill, 2002.
7. D. Patranabis, Sensors and Transducers, Second Edition, PHI, 2004.

[$] Includes Self Study topics of all 5 units and considered for Continuous Assessment only.

15AE14 MICROPROCESSORS AND EMBEDDED SYSTEMS

3 2 0 4

Course Objectives

- To understand RISC and CISC architecture and evaluation.
- To acquire sound knowledge about ARM processors and CPU cores.
- To understand the concepts of 32 bit Free scale Cold Fire Processors and Programming skills.

Course Outcomes (COs)

1. Analysis the procedure for various microprocessor Architecture
2. Identification of types of interrupts and exceptions related to microprocessor Systems
3. Diagnose the design in methodologies in hardware and software design.
4. Identification of new developments in microprocessor systems.

Unit I

RISC and CISC Architecture

Instruction set – Data formats – Instruction formats – Addressing modes – Memory hierarchy – register file Cache – Virtual memory and paging – Segmentation – Pipelining – The instruction pipeline – pipeline Hazards The software model – functional description – CPU pin descriptions – RISC concepts – bus operations – Super scalar architecture – pipe lining – Branch prediction – The instruction and caches – Floating point unit –protected mode operation – Segmentation – paging – Protection – multitasking – Exception and interrupts – Input /Output – Virtual 8086 model – Interrupt processing -Instruction types – Addressing modes – Processor flags – Instruction set -programming the Pentium processor.

9 Hours

Unit II

ARM Processors

The ARM architecture – ARM assembly language program – ARM organization and implementation – The ARM instruction set - The thumb instruction set – ARM CPU cores.

9 Hours

Unit III

FreescaleColdFire 32 bit Processor

Introduction to ColdFire Core, User and Supervisor Programming Model, Addressing modes, Special instructions, Exceptions and Interrupt controller, cache, DMA controller, Flex CAN, Fast Ethernet Controller, USB, Timers, TPU, Code Warrior tools.

9 Hours

Unit IV

Embedded Architecture

Embedded systems Overview, Design Challenge – Optimizing design metrics, Processor Technology, Embedded system design process- Requirements, Specification, Architectural Design, Designing Hardware and Software Components, System Integration.

9 Hours

Unit V

Real-Time Characteristics

Introduction to RTOS- Special considerations in an RTOS, Clock driven Approach, weighted round robin Approach, Priority driven Approach, Dynamic Versus Static systems, effective release times and deadlines, Optimality of the Earliest deadline first (EDF) algorithm, challenges in validating timing constraints in priority driven systems, Off-lineVersus On-line scheduling

9 Hours

Unit VI[$]

Aurdino basics: PWM, reading analog sensors- controlling equipment: USB serial communication-Communication interface: I2C,SPI, Interfacing with LCD,Wireless communication with XBee radios.

Total: 45+30 Hours

Reference(s)

1. Daniel Tabak, Advanced *Microprocessors*, McGraw Hill, 2001.
2. L. James Antonakos, *The Pentium Microprocessor*, Pearson Education, 2000.
3. MunirBannaoura, Rudan Bettelheim and Richard Soja, *ColdFire Microprocessors and Microcontrollers*, AMT Publishing, 2007.
4. Steve Furber, *ARM System–On–Chip architecture*, Addison Wesley, 2000.
5. S.P. Das, *Microcontrollers and Applications*, NPTEL Courseware, 2004.
6. Wayne Wolf, *Computers as Components: Principles of Embedded Computing System Design*, Morgan Kaufman Publishers, 2008.
7. Jane.W.S Liu, *Real-Time systems*, Pearson Education Asia, 2000.
8. Jeremy Blum, ExploringArduino: Tools and Techniques for Engineering Wizardry, Wiley, 2013.

15AE15 COMPUTER VISION

3 2 0 4

Course Objectives

- To learn the image fundamentals and mathematical transforms necessary for image processing.
- To understand the image enhancement and restoration methods.
- To study the concepts of optics and lens systems.

Course Outcomes (COs)

1. Analysis image enhancement and edge detection methods
2. Diagnose the degree of complications in optical image processing methods
3. Identification of new developments in object recognition systems.
4. Analysis the procedure for various image processing principles in machine vision.

Unit I

Image Segmentation

Thresholding– Edge based segmentation – Region based segmentation – Matching – Evaluation issues in segmentation – Mean Shift segmentation – Active contour models –snakes – Geometric deformable models – level sets and geodesic active contours – Fuzzy Connectivity – Towards 3D graph-based image segmentation – Graph cut segmentation – Optimal single and multiple surface segmentation.

9 Hours

Unit II

Morphology and Shape Representation

Basic morphological concepts – Four morphological principles – Binary dilation and erosion –

[$] Includes Self Study topics of all 5 units and considered for Continuous Assessment only.

Gray scale dilation and erosion – Skeletons and object marking – Granulometry –Morphological segmentation and watersheds. Region identification – Contour based shape representation and description – Region based shape representation and description – Shape classes.

9 Hours

Unit III

Object Recognition

Knowledge representation – Statistical pattern recognition – Neural nets – Syntactic pattern recognition – Recognition as graph matching – Optimization techniques in recognition – Fuzzy systems – Boosting in pattern recognition.

9 Hours

Unit IV

3D vision

3D vision tasks – Basics of projective geometry – A single perspective camera – Scene reconstruction from multiple views – Two cameras, stereopsis – Three cameras and trifocal tensor – 3D information from radiometric measurements.

9 Hours

Unit V

Motion Analysis

Differential motion analysis methods – Optical flow – Analysis based on correspondence of interest points – Detection of specific motion patterns – Video tracking – Motion models to aid tracking.

9 Hours

Unit VI[$]

Image data properties– Discrete image transforms in image data compression – Predictive compression methods – Vector Quantization – Hierarchical and progressive compression methods – Comparison of compression methods and other techniques – Coding – JPEG and MPEG image compression.

Total: 45+30 Hours

Reference(s)

1. Sonka, Hlavac, Boyle, *Image Processing, Analysis and Machine Vision*, CENGAGE Learning, 4th Edition, 2015.
2. Ramesh Jain, RangacharKasturi and Brian G. Schunck, *Machine Vision*, McGraw Hill International Edition, 2012.
3. Rafael C. Gonzalez, Richard E. Woods, *Digital Image Processing*, Pearson India, 3rd Edition, 2013.
4. Gregory A Baxes, *Digital Image Processing*, John Wiley & Sons, 1994.
5. W.K. Pratt, *Digital Image Processing*, John Wiley and Sons, 2001.

[$] Includes Self Study topics of all 5 units and considered for Continuous Assessment only.

15AE17 ELECTRONICS SYSTEM DESIGN LABORATORY I

0 0 2 1

Course Objectives

- To design and simulate digital circuits.
- To write programs in VHDL and Verilog for modeling digital circuits
- To study and verify the combinational and sequential logic circuits with various levels of modeling and EDA Tools.
- To study this course the student will know basic electronics involved in the design of MOS circuits

Course Outcomes (COs)

1. Student will be able to make models of transistor circuits and simulate them for various operational requirements.
2. Design of different types of multiplier using EDA Tool.
3. Design of FIR Filter using EDA Tool.
4. Analysis and design of VLSI circuits.

List of Experiments

Simulation and Implementation of FPGA:

1. Design and simulation of Sequential circuits using HDL,
2. Design and Implementation of ALU, shift registers and carry save adder using HDL.
3. Design and Implementation of Multiplier using HDL
4. Design and Implementation of FSM using HDL
5. Design and Implementation of Traffic Light Controller using VHDL
6. Writing Test benches using VHDL/ Verilog.

TANNER EDA and MENTOR GRAPHICS Experiments:

1. Design and simulation of combinational circuits using EDA Tools.
2. Design and simulation of Sequential Circuit using EDA Tools.
3. IC layout design using EDA Tools
4. Design and simulation of Analog circuits using EDA Tools
5. Mini project

Total: 30 Hours

15AE18 MICROPROCESSORS AND EMBEDDED LABORATORY

0 0 2 1

Course Objectives

- To understand and Implement Microprocessor based system using ColdFire and ARM processor.
- To understand and Implement Microcontroller based system using following Devices
- S12X Microcontroller, PIC Microcontroller
- To Interface the peripherals using Microprocessor and Microcontroller.

Course Outcomes (COs)

1. Embedded Programming skills can be improved.
2. Real Time Application oriented design can be developed with advanced processor and controller.
3. Ability to interface the peripherals with the ARM and Coldfire processors.

List of Experiments

1. Design and Implementation of various peripherals interfacing in S12x Controllers.
2. Design and development of embedded application using S12x Microcontroller.
3. Implementation of serial communication using S12x Microcontroller.
4. Design and development of digital application using ColdFire.
5. Design and Implementation of Display interfacing using PIC microcontroller.
6. Design and development of Embedded system using ARM Processors.
7. Mini projects.

Total: 30 Hours

15GE19 BUSINESS ENGLISH I

1 0 2 2

Course Objectives

- To acquire skills for using English in workplace effectively.
- To communicate for essential business needs.
- To prepare students for taking BEC Vantage level examination which is an International Benchmark for English language proficiency of Cambridge English Language Assessment (CELA).

Course Outcomes (COs)

1. To enable students to get International recognition for work and study.
2. To use English confidently in the International business environments.
3. To be able to take part in business discussion, read company literature, write formal and informal business correspondences and listen and understand business conversations.

Unit I

GRAMMAR AND VOCABULARY

Comparison of adjectives – forming questions – asking complex questions – expressing purpose and function – tenses – conditionals – time statements – modal verbs – active and passive voice – articles – direct and indirect speech – cause and effect – relative pronouns – expressions followed by – *ing*forms – countable / uncountable – acronyms – marketing terms / vocabulary – financial terms – collocations – discourse markers.

10 Hours

Unit II

LISTENING

Purposes of listening – features of listening texts – potential barriers to listening – specific listening skills – strategies to use when listening– distinguishing relevant from irrelevant information – gap filling exercise – multiple-choice options – note completion – matching and multiple choice questions – listening for specific information, gist, topic, context and function.

7 Hours

Unit III

SPEAKING

Word and sentence stress – clear individual sounds – turn taking – initiating and responding - intonation patterns – pronunciation – mother tongue intrusion– conversation practice – turn-taking and sustaining the interaction by initiating and responding appropriately.

10 Hours

Unit IV

READING

Purposes of reading – potential barriers to reading – paraphrasing – identifying facts and ideas – skimming and scanning for information – matching statements with texts– spotting reference words – understanding text structure – understanding the ideas in a text – distinguishing between the correct answer and the distractor – understanding cohesion in a text – deciphering contextual meaning of words and phrases – cloze – proof reading - transcoding.

8 Hours

Unit V

WRITING

Paragraphing a text – using appropriate connectives – editing practice –Longer Documents: writing a proposal.

10 Hours

Total: 45 Hours

Reference(s):

1. Guy Brook-Hart, "BEC VANTAGE:BUSINESS BENCHMARK Upper-Intermediate – Student's Book", 1st Edition, Cambridge University Press, New Delhi, 2006.
2. Cambridge Examinations Publishing, "Cambridge BEC VANTAGE – Self-study Edition", Cambridge University Press, UK, 2005.

15AE21 RESEARCH METHODOLOGY

3 0 0 3

Course Objectives

- To understand some basic concepts of engineering research and its methodologies.
- To identify various sources of information for literature review and data collection.
- To familiar the various procedures to formulate appropriate research problem and design of image processing and wireless network experiments.

Course Outcomes (COs)

The students will be able to

1. Demonstrate the concepts of engineering research and its methodologies.
2. Understand the various methods used to collect the data to research.
3. Formulate appropriate research problem and conduct the experiments using systematics methods.

Unit I

Introduction

Definition, mathematical tools for analysis, Types of research, exploratory research, conclusive research, modeling research, algorithmic research, Research process- steps.

Data collection methods- Primary data – observation method, personal interview, telephonic interview, mail survey, questionnaire design. Secondary data- internal sources of data, external sources of data.

9 Hours

Unit II

Sampling Methods

Scales – measurement, Types of scale – Thurstone's Case V scale model, Osgood's Semantic Differential scale, Likert scale, Q- sort scale. Sampling methods- Probability sampling methods – simple random sampling with replacement, simple random sampling without replacement, stratified sampling, cluster sampling. Non-probability sampling method – convenience sampling, judgment sampling, quota sampling.

9 Hours

Unit III

Hypotheses Testing

Testing of hypotheses concerning means -one mean and difference between two means -one tailed and two tailed tests, concerning variance – one tailed Chi-square test.

9 Hours

Unit IV

Modeling Methodologies

Difference between modeling and simulation- Modeling and Optimization in Image Analysis - Hidden Markov Models for Image Recognition- Test bed for real-time image acquisition and processing systems. Wireless networks: mobility models,channel models.

9 Hours

Unit V

Simulation Methodologies

Wireless network system simulation example- PHY layer simulation tool: Labview,. Network simulation model: qualnet, NS-2. Performance metrics – Performance evaluation of designing network scenarios. image processing: simulink/matlab.

9 Hours

Unit VI[$]

Case Study: apply Research Methodology principles into design of the routing protocols for wireless adhoc networks

Total: 45 Hours

Reference(s)

1. Kothari, C.R., Research Methodology –Methods and techniques, New Age Publications, New Delhi, 2009.
2. Panneerselvam, R., Research Methodology, Prentice-Hall of India, New Delhi, 2004.
3. William T. Kasch, Jon R. Ward, and Julia Andrusenko, Wireless network modeling and simulation toosl for designer and developer,IEEE communication,2009.
4. Pahalavan Krishnamoorthy, "Wireless networks", pearson education, 2010
5. EPICSE. Barreraa,∗, M. Ruiza, D. Sanza, J. Vegab, R. Castrob, E. Juárezc, R. Salvador, Test bed for real-time image acquisition and processing systems based on FlexRIO, CameraLink, and EPICS, Fusion Engineering and Design 89 (2014) 633–637

15AE22 AUTOMOTIVE ELECTRONICS

3 0 0 3

Course Objectives

- To study the fundamentals of automotive electronics.
- To understand the starting, charging and ignition systems.
- To study sensors and actuators.

Course Outcomes(CO)

1. To study different the fundamentals of automotive systems.
2. To learn the concept of starting, charging and Ignition systems.
3. To study the batteries, lighting system, sensors and actuators.

Unit I

Fundamentals of Automotive Electronics

Automobile Systems –Engine – Engine control- Ignition system –Ignition timing- Drive train – Suspension – Brakes – Steering system. Control systems- Proportional controller-Proportional

[$] Includes Self Study topics of all 5 units and considered for Continuous Assessment only.

Integral controller - Proportional Integral differential controller - Closed-Loop Limit-Cycle Control, Electronic Dashboard instruments -On-board diagnostic systems.

9 Hours

Unit II

Starting and Charging Systems

Requirements of Starter Motor, Starter Motor types, Construction and characteristics, Starter drive mechanisms, Starter Switches and Solenoids, Charging system components, Generators and Alternators, Types, Construction and Characteristics. Voltage and Current Regulation, Cut –out relays and regulators, Charging circuits for D.C. Generator, A.C. Single Phase and Three – Phase Alternators.

9 Hours

Unit III

Ignition System

Battery Coil and Magneto–Ignition System, Circuit details and Components of Battery Coil and Magneto–Ignition System, Centrifugal and Vacuum Advance Mechanisms, Spark Plugs, Constructional details and Types. Electronically–Assisted and Full Electronic Ignition System, Non–Contact–type Ignition Triggering devices, Capacitive Discharge Ignition Distributor–less Ignition System, Digital Ignition System.

9 Hours

Unit IV

Batteries and Lighting Systems

Principle and construction of Lead Acid Battery, Characteristics of Battery, Battery Rating, Capacity and Efficiency, Various Tests on Battery, Battery–Charging Techniques-Maintenance of batteries.Lighting system: insulated and earth return system, details of head light and side light, LED lighting system, head light dazzling and preventive methods.

9 Hours

Unit V

Sensors and Actuators

Sensors – Oxygen (O2/EGO) Sensors, Throttle Position Sensor (TPS), Engine Crankshaft Angular Position (CKP) Sensor, Magnetic Reluctance Position Sensor, Engine Speed Sensor, Ignition Timing Sensor, Hall effect Position Sensor, Shielded Field Sensor, Optical Crankshaft Position Sensor, Manifold Absolute Pressure (MAP) Sensor - Strain gauge and Capacitor capsule, Engine Coolant Temperature (ECT) Sensor, Intake Air Temperature (IAT) Sensor, Knock Sensor, Airflow rat e sensor, Throttle angle sensor. **Actuators**– Fuel Metering Actuator, Fuel Injector, Ignition Actuator.

9 Hours

Unit VI[$]

Future Automotive Electronic Systems – Alternative Fuel Engines, Collision Avoidance Radar warning Systems, Low tire pressure warning system, Radio navigation, Advance Driver Information System.

Total: 45 Hours

Reference(s)

1. Bechhold, *Understanding Automotive Electronics*, SAE, 1998.

[$] Includes Self Study topics of all 5 units and considered for Continuous Assessment only.

2. W.H.Crouse, *Automobile Electrical Equipment*, McGraw-Hill, 1996.
3. A W Judge, *Modern Electrical Equipment of Automobiles*, Chapman & Hall, 1992.
4. P.L.Kholi, *Automotive Electrical Equipment*, Tata McGraw-Hill, 1995.
5. Robert Bosch *Automotive Hand Book,* SAE, 2000.
6. A.P.Young, L.Griffiths *Automotive Electrical Equipment*, ELBS & New Press, 1999.
7. William.B.Riddens, *Understanding Automotive Electronics*, Butter worth Heinemann Woburn, 1998

15AE23 NEURAL COMPUTING

3 2 0 4

Course Objectives

- To study the concepts of biological and artificial neurons
- To explore the fundamentals of various algorithms related to supervised neural networks and its applications
- To explore the Applications of various algorithms related Genetic algorithms and SVM

Course Outcome (COs)

1. Analysis the procedure for various neural network principles in real world problem.
2. Analysis feature enhancement and optimization methods
3. Analysis the windowing of better solution in rough surface searching algorithms both using association and non association rules.
4. Identification of new developments in object recognition systems

Unit I

Fundamental Concepts and Models of Artificial Neural Systems

Biological Neurons and their Artificial models, Models of Artificial Neural Networks, Learning and Adaptation, Neural Network Learning Rules, Single Layer Perceptron Classifiers.

9 Hours

Unit II

BPN and BAM

Back Propagation Network, Generalised Delta Rule, BPN Application, Associative Memory Definition, BAM,Hop field Memory, Simulated Annealing-Boltzmann Machine.

9 Hours

Unit III

Other Networks

Counter Propagation Network, Feature Mapping, Self Organizing Feature Maps, Adaptive Resonance Theory (ART) Network-Spatio-temporal neural networks Descriptions and applications.

9 Hours

Unit IV

Genetic Algorithms & Implementation Techniques

The Appeal of Evolution, Search Spaces and Fitness Landscapes, Elements of Genetic Algorithms, Data Structures, Adaptive Encoding. Selective Methods, Genetic Operators, Fitness Scaling

9 Hours

Unit V

Advances and Applications

Support Vector Machines, RBF Network, Neocognitron Evolving neural networksusing GA, Applications of ANN in signal analysis and Medical image analysis

9 Hours

Unit VI[$]

Multilayer Perceptron Model, Pattern Classification, Clustering, Simple Clustering algorithm- k-means & k-medoid based algorithm, ADALINE, MADALINE, Genetic Algorithm-Multiobjective& Multimodal optimization in GA.

9 Hours

Total: 45+30 Hours

Reference(s)

1. Sathish Kumar, *Neural networks-A Class Room approach*, third edition, Tata McGraw Hill New Delhi, 2012
2. James Freeman A. and David Skapura M., *Neural Networks - Algorithms, Applications &Programming Techniques,* Addison Wesley, 1992.
3. Yegnanarayana B., *Artificial Neural Networks,* Prentice Hall of India Private Ltd., New Delhi, 1999.
4. Laurence Fausett, *Fundamentals of Neural Networks: Architecture, Algorithms and Applications*, Prentice Hall, 1994.
5. Simon Haykin, *"Neural Networks: A Comprehensive Foundation"*, 2nd Edition,Prentice Hall India,2002..
6. David Goldberg, *Genetic Algorithms in Search, Optimization and Machine Learning,* Addison - Wesley USA,1997.
7. Melanie Mitchell, *An Introduction to Genetic Algorithms*: Prentice Hall of India, New Delhi 1998.

15AE24 OPTOELECTRONICS

3 2 0 4

Course Objectives

- To study the industry based optical fiber modes and structure.
- To understand sources and detectors
- To study trends recent applications of photonics in industry

Course Outcomes (COs)

1. To study various wave guide and fabrication of optical fiber.
2. To learn operation of LED and LASER.
3. To study advanced multiplexing strategies.

UNIT I

Introduction

Optical Fiber: Structures, Wave guiding and Fabrication –Nature of light, Basic optical laws and Definition, Optical fiber modes and Configuration, Mode theory for circular waveguides, Single mode fibers, Graded index fiber, Fiber materials, Fabrication and mechanical properties, Fiber

[$] Includes Self Study topics of all 5 units and considered for Continuous Assessment only.

optic cables, Basic Optical Communication System, Advantage of Optical Communication System.

10 Hours

UNIT II

Attenuation in Optical Fibers

Introduction, Absorption, Scattering, Very Low Loss Materials, All Plastic & Polymer Clad-Silica Fibers. Wave Propagation: Wave propagation in Step-Index & Graded Index Fiber, Overall Fiber Dispersion-Single Mode Fibers,MultimodeFibers, Dispersion-Shifted Fiber, Dispersion, Flattened Fiber, Polarization.

10 Hours

UNIT III

Optical Sources

Design& LED's for Optical Communication, Semiconductor Lasers for Optical Fiber Communication System and their types, Semiconductor Photodiode Detectors, Avalanche Photodiode Detector& Photo multiplier Tubes. Source to fiber power launching-Output patterns, Power coupling, Power launching, Equilibrium Numerical Aperture, Laser diode to fiber coupling.

9 Hours

UNIT IV

Optical detectors

Physical principles of PIN and APD, Detector response time, Temperature effect on Avalanche gain, Comparison of Photo detectors. Optical receiver operation-Fundamental receiver operation, Digital signal transmission, error sources, Receiver configuration, Digital receiver performance, Probability of error, Quantum limit, Analog receivers.

8 Hours

UNIT V

Optical Fiber Communication Systems

Data Communication Networks–Network Topologies, Mac Protocols, Analog System. Advanced Multiplexing Strategies–Optical TDM, Sub carrier Multiplexing, WDM Network. Architectures: SONET/SDH.

8 Hours

UNIT VI[$]

Optical Transport Network, Optical Access Network, Optical Premise Network. Applications-Military Applications, Civil, Consumer & Industrial Applications.

Total: 45+30 Hours

Reference(s)

1. J. Gowar, "Optical Communication System", IEEE Press,2nd Edition.
2. R.P.Khare, "Fiber Optics and Opto Electronics" Oxford Publication.
3. Optical Information Processing–F. T. S. Yu–Wiley, New York, 1983.
4. G. P. Agrawal, Fiber optic Communication Systems, John Wiley & sons, New York, 1992.
5. Ghatak, K. Thyagarajan, "An Introduction to FiberOptics", Cambridge University Press.

[$] Includes Self Study topics of all 5 units and considered for Continuous Assessment only.

6. J. H. Franz & V. K. Jain, "Optical Communication Components & Systems", Narosa Publish, 2013.
7. John M. Senior, "Optical Fiber Communications", Pearson, 3rd Edition, 2010

15AE27 ADVANCED ELECTRONICS SYSTEM DESIGN LABORATORY

0 0 2 1

Course Objectives

- To learn the student will be able to, Write programs in VHDL and verilog for modeling digital circuits
- To study this course the student will know basic electronics involved in the design of MOS circuits.
- To design a schematic and layout for Combinational and Sequential Circuits and to analyze the power and timing of Combinational and Sequential Circuits using EDA tools

Course Outcomes (COs)

1. By studying this subject the student will be able to make models of transistor circuits and simulate them for various operational requirements.
2. Design of different types of multiplier using TANNER EDA Tool.
3. Design of FIR Filter using TANNER EDA Tool.
4. Analysis and design of VLSI circuits.

List of Experiments

Simulation and Implementation OF FPGA

a. Design and simulation of Multiplier using HDL
b. Design and Implementation of Stepper Motor and Seven Segment Display using HDL
c. Design and Implementation 32x8 bit ROM and RAM model using VHDL
d. Design and Implementation of FIR filter using HDL
e. Design and Implementation of Lift controller using HDL.

TANNER EDA and MENTOR GRAPHICS Experiments

f. Design and simulation of Multiplier using EDA Tools.
g. Design and simulation of 4-tap FIR Filter using EDA Tools
h. Draw the layout diagram for combinational Circuits using EDA Tools.
i. Generation of synthesis report using Mentor Graphics using EDA Tools
j. Design, implementation, layout generation and verification of a digital building block using an EDA tool
   Mini project

Total: 30 Hours

15GE29 BUSINESS ENGLISH II

1 0 0 1

Course Objectives

- To acquire skills for using English in business environment .
- To communicate appropriately in business contexts.
- To prepare students for taking BEC Vantage level examination conducted by the Cambridge English Language Assessment (CELA).

Course Outcomes (COs)

1. To enable students to acquire business terms for communication.
2. To use English confidently in the business contexts.
3. To be able to take part in business discussion and write formal and informal business correspondences.

Unit I

SPEAKING

Non-verbal communication – agreeing / disagreeing, reaching decisions, giving and supporting opinions – making mini presentations – extending on conservations – collaborative task – tongue twisters.

6 Hours

Unit II

WRITING

Business letters – fax – Shorter Documents: e-mail - memo – message - note – report writing – formal / informal styles. **9 Hours**

Total: 15 Hours

Reference(s):

1. Guy Brook-Hart, "BEC VANTAGE:BUSINESS BENCHMARK Upper-Intermediate – Student's Book", 1st Edition, Cambridge University Press, New Delhi, 2006.
2. Cambridge Examinations Publishing, "Cambridge BEC VANTAGE – Self-study Edition", Cambridge University Press, UK, 2005.

15AE51 ADVANCED WIRELESS NETWORKS

3 0 0 3

Course Objectives

- To study fundamentals of 2G and 3G networks
- To explore issues and challenges in designing layers of 4G and adhoc networks
- To understand adaptation of the routing protocols in VANET
- To apply the sensor network in civilian and medical applications

Course Outcomes (COs)

1. Ability to identify the various challenges in 4G networks
2. Obtain awareness for adaptation in MAC, IP, protocols for advanced mobile networks.
3. Understand and recognize the architectures, designing TCP and security protocols
4. Analyze the solutions for covering the security principles of wireless networks.
5. Analyze and design security systems for wireless networks.
6. Apply in-depth knowledge of wireless communications principles, systems, and networks to the solution of wireless engineering problems.

Unit I

Wireless WANS and MANS

Cellular concept- GSM for mobile communication- EDGE-WLL- Long Term Evolution networks- UMTS-WCDMA : architecture, elements, Air interface-TDD and FDD.

9 Hours

Unit II

Ad hoc networks

Characteristics, Applications, issues in ad hoc networks- - MAC protocol : issues, MACAW, DPRMA, DPSMA, MAC protocol using directional antenna. Routing Protocols: issues, AODV,DSR, WRP, ZRP,energy efficient multicasting- Adhoc TCP

9 Hours

Unit III

VANET

Introduction-VANET architecture-communication domain- wireless access technology in VANET-characteristics, challenges, applications-mobility model-VANET simulation

9 Hours

Unit IV

Sensor Networks and Security

Introduction – Sensor Networks Architecture – Data dissemination-Data gathering-Location discovery-security issues-.

9 Hours

Unit V

Fundamentals of 4G Networks

Protocol Boosters-Hybrid 4G Wireless Network Protocols-Green Wireless Networks-Physical Layer and Multiple Access-ATDMA-CDMA-OFDM.

9 Hours

Unit VI[$]

Wirelessbody area networks- Internet of Things- Applications- cloud networks-challenges and applications.

Total: 45 Hours

Reference(s)

1. UpenaDalal, Wireless communication networks, Oxford press – 2015, 1st Edn.
2. C.Siva Ram Murthy and B.S.Manoj, *AdHoc Wireless Networks: Architectures and protocols*, Prentice Hall PTR, 2007
3. C.K.Toh. , *AdHoc Mobile Wireless Networks: Protocols and Systems*, Prentice Hall PTR, 2008
4. Young Kyun Kim and Ramjee Prasad,*4G Roadmap and Emerging Communication Technologies*, Universal Personal Communication Series, Artech House, Boston, 2006.
5. Hendrik Berndt, *Towards 4G Technologies*, Wiley Publishers, Lancaster, England, 2008.
6. Stefano Basagni, Marco Conti, Silvia Giordano and Ivan Stojmenovic, Mobile AdHoc Networking, Wiley – IEEE press, 2004
7. IEEE Transactions on Networking.
8. IEEE Transactions on Mobile Computing.

[$] Includes Self Study topics of all 5 units and considered for Continuous Assessment only.

15AE52 MEDICAL IMAGE PROCESSING

3 0 0 3

Course Objectives

- To study about various medical image acquisition methods.
- To understand 2D and 3D image reconstruction techniques.
- To gain sound knowledge about CT, MRI, nuclear and ultrasound imaging.
- To realize the factors those affect the quality of medical images.

Course Outcomes (COs)

1. Bring out the procedure for medical image acquisitions.
2. Describe and determine the performance of different Image reconstruction techniques.
3. Analysis the physiological events associated with the human system.
4. Describe the influences of artifacts in image quality
5. Identification of new developments in health care system

Unit I

Acquisition of Images

Introduction to Imaging Techniques- Single crystal scintillation camera – Principles of scintillation camera– multiple crystal scintillation camera –solid state camera –rectilinear scanner –Emission computed Tomography.

9 Hours

Unit II

Mathematical Preliminaries for Image Reconstruction

Image Reconstruction from Projections in Two dimensions –Mathematical Preliminaries for Two and Three dimensional Image Reconstructions –Radon Transform –Projection Theorem –central slice Theorem– Sinogram – Two Dimensional Projection Reconstruction –Three Dimensional Projection Reconstruction– Iterative Reconstruction Techniques.

9 Hours

Unit III

Fluoroscopy, CT, Image quality

Digital fluoroscopy – Automatic Brightness control- cinefluorography –Principles of computed Tomographic Imaging- Reconstruction algorithms- Scan motions – X –ray sources ***Influences of Images quality:*** Unsharpness–contrast- Image Noise.

9 Hours

Unit IV

Magnetic Resonance Imaging and Spectroscopy

Fundamentals of magnetic resonance – overview – Pulse techniques – spatial encoding of magnetic resonance imaging signal – motion suppression techniques – contrast agents- tissue contrast in MRI – MR angiography, spectrography.

9 Hours

Unit V

Ultra sound, Neuro magnetic Imaging: ***ultra Sound:*** Presentation modes–Time required to obtain Images – System components, signal processing –dynamic Range – Ultrasound Image Artifacts – Quality control, Origin of Doppler shift – Limitations of Doppler systems. ***Neuromagnetic Imaging:*** Background

9 Hours

Unit VI[$]

Image Visualization, Recent Trends and Applications-Image visualization – 2D display methods, 3D display methods, virtual reality based interactive- visualization - Medical Image Search and Retrieval - Current technology in medical image search- content- based image retrieval- Ontologies – Applications - Image Guided Surgery- Image Guided Therapy - Computer Aided Diagnosis/Diagnostic Support Systems

Total : 45 hours

Reference(s)

1. William R. Hendee, E. Russell Ritenour, *Medical Imaging Physics:* A John Wiley &sons, Inc., Publication, Fourth Edition 2002.
2. Z.H. Cho., J-oie, P. Jones and Manbir Singh, *Foundations of Medical Imaging:* John Wiley and sons Inc.
3. Avinash C. Kak, Malcolm Shaney, *Principles of Computerized Tomographic Imaging,* IEEE Press, Newyork-1998.

15AE53 COGNITIVE RADIO TECHNOLOGIES

3 0 0 3

Course Objectives

- To explore issues and challenges in SDR and CR networks
- To understand adaptation of SDR and CR architecture
- To develop procedure for radio encapsulation and spectrum sensing

Course Outcomes (COs)

1. Ability to identify the various challenges in SDR and CR networks
2. Obtain awareness for adaptation in SDR and CR protocols for advanced mobile networks.
3. Understand and recognize the architectures and design of CR.
4. Analyze spectrum management for wireless networks.

Unit I

INTRODUCTION TO SDR

Definitions and potential benefits, software radio architecture evolution–foundations, technology tradeoffs and architecture implications.

9 Hours

Unit II

SDR ARCHITECTURE

Essential functions of the software radio, architecture goals, quantifying degrees of programmability, top level component topology, computational properties of functional components, interface topologies among plug and play modules, architecture partitions.

9 Hours

[$] Includes Self Study topics of all 5 units and considered for Continuous Assessment only.

Unit III

INTRODUCTION TO COGNITIVE RADIOS

Marking radio self-aware, the cognition cycle, organization of cognition tasks, structuring knowledge for cognition tasks, Enabling location and environment awareness in cognitive radios– concepts, architecture, design considerations.

9 Hours

Unit IV

COGNITIVE RADIO ARCHITECTURE

Primary Cognitive Radio functions, Behaviors, Components, A–Priori Knowledge taxonomy, observe– phase data structures, Radio procedure knowledge encapsulation,componentsoforient,plan,decidephases,actphaseknowledgerepresentation,design rules.

9 Hours

Unit V

NEXT GENERATION WIRELESS NETWORKS

The NXG Network architecture, spectrum sensing, spectrum management, spectrum mobility, spectrum sharing, upper layer issues, cross–layer design.

9 Hours

Unit VI[$]

Trends and Application of CR -Cognitive scout node for communication in disaster scenarios-dynamic Spectrum access-cooperative cognitive radio.

Total: 45 hours

Reference(s)

1. J.Mitola,"The Software Radio Architecture", IEEE Communications Magazine, May1995.
2. Joseph MitolaIII and GeraldQ.Maquire, "Cognitive radio: makings of software Radios more personal",IEEE Personal Communications,August1999.
3. J.Mitola,"CognitiveRadio: AnIntegrated Agent Architecture for software defined radio",Doctor of Technology thesis, Royal Inst. Technology,Sweden2000.
4. Simon Haykin,"Cognitive Radio:Brain–empowered wireless communications", IEEE Journal on selected areas in communications,Feb2005.
5. HasariCelebi,HuseyinArslan,"Enablinglocationandenvironmentawarenessincognitiveradios",ElsevierComputerCommunications, Jan2008.
6. IanF.Akyildiz, Won–YeolLee, MehmetC.Vuran, ShantidevMohanty, "Nextgeneration/dynamicspectrumaccess/cognitiveradiowirelessnetworks: A Survey Elsevier Computer Networks,May2006.

[$] Includes Self Study topics of all 5 units and considered for Continuous Assessment only.

15AE54/ 15CO59 WIRELESS SECURITY
(Common to Communication Systems & Applied Electronics)

3 0 0 3

Course Objectives

- To explore variety of attacks and threats and its impact on MAC layer and Network layer
- To study characteristics, vulnerabilities and challenges of ad hoc networks
- To provide solution for covering the security principles and flaws of popular wireless technologies
- To evaluate the performance of secured routing protocols in MANETs.

Course Outcomes (COs)

1. Ability to identify the various attacks and threads of wireless Networks.
2. Understand and recognize the architectures, vulnerabilities and challenges of mobile protocols.
3. Analyze the solutions for covering the security principles of wireless networks.
4. Analyze and design security systems for wireless networks.
5. Apply in-depth knowledge of wireless communications principles, systems, and networks to the solution of wireless engineering problems.

Unit I

Attacks on Routing Protocols

Vulnerability of MANET to attack - review of AODV and DSR - type of attack - active and passive - internal and external - behavior of malicious node - black hole, DoS, Routing table overflow, Impersonation, Energy consumption, Information Disclosure - Misuse type – Misuse goals – Security flaw in AODV -attack on AODV - wormhole and rushing attack -Performance analysis of AODV in the presence of malicious node.

9 Hours

Unit II

Intrusion Detection in Wireless Ad Hoc Networks

Problem in current IDS techniques - requirements of IDS - classification of IDS – Network and host based - anamoly detection, misuse detection, specification based - intrusion detection in MANETs using distributed IDS and mobile agents - AODV protocol based IDS - Intrusion resistant routing algorithms - Comparison of IDS.

9 Hours

Unit III

Mitigating Techniques for Routing Misbehavior

Watchdog, Parthrater, Packet leashes and RAP.

9 Hours

Unit IV

Secure Routing Protocols:

Self organized network layer security in MANETs - mechanism to improve authentication and integrity in AODV using hash chain and digital signatures - on demand secure routing protocol resilent to Byzantine failures - ARIADNE, SEAD, SAR, and ARAN.

9 Hours

Unit V

Challenges in Routing Security

Security - Challenges and solutions - Providing Robust and Ubiquitous security support - Adaptive security for multilevel Ad Hoc Network - Denial of service Attack at the MAC layer -

Detection and handling of MAC layer Misbehavior.

9 Hours

Unit VI[$]

Opportunistic routing to mitigate attacks in MANET-The Security of Vehicular Adhoc Networks-Asymmetric and dynamic encryption for routing security in MANET.

Total: 45 Hours

Reference(s)

1. C.Siva Ram Murthy and B.S.Manoj, *AdHoc Wireless Networks: Architectures and Protocols*, Prentice Hall PTR, 2004.
2. Ivan Stojmenović, *Handbook of Wireless Networks and Mobile Computing*, Wiley, 2002.
3. Hongmei Deng, Wei Li and Dharma P. Agrawal, *Routing Security in Wireless Ad Hoc Networks*, IEEE Communication Magazine, Oct 2002.
4. Peng Ning, Kun Sun, *How To Misuse AODV: A Case Study of Insider Attacks Again Mobile AdHoc Routing Protocols* in proceeding of the 4th annaul IEEE information assurance workshop, page 60 – 67 west point, June 2003.
5. Amitabh Mishra, *Intrusion Detection in Wireless Ad Hoc Networks*, IEEE Wireless Communication, February 2004.
6. S.Marti, *Mitigating Routing Misbehaviour in Mobile Ad Hoc Networks*, ACM MOBICOM, 2000.

15CO13/15AE55/15ES52 STATISTICAL SIGNAL PROCESSING

(Common to Communication Systems, Applied Electronics & Embedded Systems)

3 0 0 3

Course Objectives

- To explore the concepts of multi rate signal processing and multi rate filters.
- To study the adaptive filters and its applications.
- To learn fundamental concepts on signal processing in power spectrum estimation.

Course Outcomes (COs)

1. Acquiring knowledge of how a multi rate system works.
2. Ability to design and implement decimator and interpolator and to design multi rate filter bank.
3. Understanding different spectral estimation techniques and linear prediction.
4. Ability to design LMS and RLS adaptive filters for signal enhancement, channel equalization.
5. Apply above knowledge and skills to engineering problems.

Unit I

Multirate signal Processing

Introduction-Sampling and Signal Reconstruction-Sampling rate conversion – Decimation by an integer factor – interpolation by an integer factor –Sampling rate conversion by a rational factor – poly-phase FIR structures – FIR structures with time varying coefficients - Sampling rate conversion by a rational factor-Multistage design of decimator and interpolator.

9 Hours

[$] Includes Self Study topics of all 5 units and considered for Continuous Assessment only.

Unit II

Multirate FIR Filter Design

Design of FIR filters for sampling rate conversion –Applications of Interpolation and decimation in signal processing –Filter bank implementation –Two channel filter banks-QMF filter banks – Perfect Reconstruction Filter banks – tree structured filter banks - DFT filter Banks – M-channel filter banks-octave filter banks

9 Hours

Unit III

Linear Estimation and Prediction

Linear prediction- Forward and backward predictions, Solutions of the Normal equations-Levinson-Durbin algorithms. Least mean squared error criterion -Wiener filter for filtering and prediction , FIR Wiener filter and Wiener IIR filters ,Discrete Kalman filter.

9 Hours

Unit IV

Adaptive Filters

FIR Adaptive filters - Newton's steepest descent method – Adaptive filters based on steepest descent method - LMS Adaptive algorithm – other LMS based adaptive filters- RLS Adaptive filters -Exponentially weighted RLS - Sliding window RLS - Simplified IIR LMS Adaptive filter-Applications: Adaptive channel equalization - Adaptive echo canceller - Adaptive noise cancellation.

9 Hours

Unit V

Power Spectral Estimation

Estimation of spectra from finite duration observations of a signal –The Period gram-Use of DFT in Power spectral Estimation –Non-Parametric methods for Power spectrum Estimation – Bartlett. Welch and Blackman–Tukey methods –Comparison of performance of Non – Parametric power spectrum Estimation methods –Parametric Methods - Relationship between auto correlation and model parameters, Yule-Walker equations, solutions using Durbin's algorithm,AR, MA, ARMA model based spectral estimation. Application: speech enhancement using power spectrum estimation

9 Hours

Unit VI[$]

Applications of adaptive filters: Adaptive channel equalization Adaptive echo canceller - Adaptive noise cancellation-, 1/M-octave-band filter banks, Adaptive filter-bank tree for power spectrum estimation-Speech enhancement using spectrum estimation

Total: 45 Hours

Reference(s)

1. H. Monson Hayes, *Statistical Digital Signal Processing and Modeling*, John Wiley and Sons,2008.
2. G.. John Proakis and G. DimitrisManolakis, *Digital Signal Processing*, Pearson Education, 2006.
3. P.P.Vaidyanathan ,*MultirateSyatems and Filter Banks*, Pearson Education, 2008.
4. N.J.Filege, *Multirate Digital Signal Processing*, John Wiley and Sons, 2000.

[$] Includes Self Study topics of all 5 units and considered for Continuous Assessment only.

5. G..JohnProakis, *Algorithms for Statistical Signal Processing*, Pearson Education, 2002.
6. G.Dimitris and G.Manolakis.,*Statistical and Adaptive Signal Processing*, McGraw Hill, 2002.
7. Sophoncles J. Orfanidis, *Optimum Signal Processing*, McGraw Hill, 2007.

15AE56 DIGITAL VIDEO PROCESSING

3 0 0 3

Course Objectives

- To explore the concepts of digital video acquisition and object tracking.
- To study the video filters and its applications.
- To learn fundamental concepts on video coding and retrival.

Course Outcomes (COs)

1. Acquiring knowledge of how a motion analysis works.
2. Ability to design and implement video object tracking and boundary detection.
3. Ability to design video filters for signal enhancement, restoration.

Unit I

Video Acquisition and Representation & Motion analysis

Spatio Temporal Sampling– Sampling Structure Conversion – Interpolation – Color spaces–Video formats 2D and 3D Motion Estimation and Compensation–Optical Flow methods–Block based– point correspondences–Gradient based– Intensity matching– Feature matching –Frequency domain motion estimation – Depth from motion - Structure from stereo– 3D Reconstruction– Motion analysis Applications: Video Summarization, Video Surveillance, Video Watermarking, Video Mosaicing.

12 Hours

Unit II

Video Object Tracking and segmentation

2D and3D motiontracking– blob tracking– kernel based– Contour tracking– Feature matching– Filtering–mosaicing–Video Segmentation –Mean Shift based–Active shape model– Video shot boundary detection.

9 Hours

Unit III

Video Filtering

Motion Compensation – Noise Filtering – Enhancement and Restoration – Video Stabilization and Super Resolution.

7 Hours

Unit IV

Videocoding, representation

Video Standards: MPEG 1,2, MPEG-4, MPEG-7, H.261, H.263, H.264. Video compression– Inter frame Compression–3D Waveform based–Motion Compensation.

7 Hours

Unit V

Content based Video retrieval and Video based Rendering

Object based coding–Content based representation–Featureextraction–MPEG7- Visual descriptors–Low to high level representation (CSS,Poly,B-Splinesetc.)–Video Indexing and retrieval–search engines.

10 Hours

Unit VI[$]

Generation of mosaics from video; Detection of Video object alpha-matte and Video cut & paste for Virtual Reality applications.

Total: 45 hours

Reference(s)

1. Video Processing and Communications by Yaowang, JoernOstermann andYa-QinZhang, Prentice Hall,2002,ISBN0-13-017547-1.
2. Handbook of Image and Video processing Bovik(AlanCBovik), Academic Press,SecondEdition,2005.
3. Digital Image Sequence Processing,CompressionandAnalysis–ToddR.Reed, CRCPress,2004.
4. H.264 andMPEG-4 Video Compression: Video Coding for Next GenerationMultimedia–IainE.G.Richardson,Wiley,2003.
5. DigitalVideoProcessing–A.MuratTekalp,PrenticeHall,1995.

15VL55 / 15AE57 DSP INTEGRATED CIRCUITS
(Common to VLSI Design & Applied Electronics)

3 0 0 3

Course Objectives

- To learn how DSP applications are implemented using VLSI Technology.
- To understand various VLSI fabrication techniques and trends in CMOS technology
- To impart knowledge about the DSP Processor Architecture using VLSI Technology.

Course Outcomes (COs)

1. Understanding of discrete-time transforms.
2. The ability to design FIR and IIR filters.
3. Knowledge of spectral estimation and linear prediction.
4. The ability to apply above knowledge and skills to engineering problems.

Unit I

DSP Integrated Circuits and VLSI circuit Technologies

Standard digital signal processors-Application specific IC's for DSP - DSP systems - DSP system design - Integrated circuit design - MOS transistors - MOS logic - VLSI process technologies - Trends in CMOS technologies.

9 Hours

Unit II

Digital Signal Processing

Digital signal processing - Sampling of analog signals - Selection of sample frequency – Signal - processing systems - Frequency response - Transfer functions - Signal flow graphs - Filter structures - Adaptive DSP algorithms - DFT - The Discrete Fourier Transform - FFT - The Fast Fourier Transform Algorithm - Image coding - Discrete cosine transforms.

9 Hours

[$] Includes Self Study topics of all 5 units and considered for Continuous Assessment only.

Unit III

Digital Filters and Finite Word Length Effects

FIR filters - FIR filter structures - FIR chips - IIR filters - Specifications of IIR filters - Mapping of analog transfer functions - Mapping of analog filter structures - Finite word length effects - Parasitic oscillations - Scaling of signal levels - Round-off noise - Measuring round-off noise - Coefficient sensitivity - Sensitivity and noise.

9 Hours

Unit IV

DSP Architectures and Synthesis of DSP Architectures

DSP system architectures - Standard DSP architecture - Ideal DSP architectures - Multiprocessors and multi computers - Systolic and Wave front arrays - Shared memory architectures - Mapping of DSP algorithms onto hardware - Implementation based on complex PEs - Shared memory architecture with Bit-serial PEs.

9 Hours

Unit V

Arithmetic Units and Integrated Circuit Design

Conventional number system - Redundant Number system - Residue Number System - Bit-parallel and Bit-Serial arithmetic - Basic shift accumulator - Reducing the memory size - Complex multipliers - Improved shift – accumulator - Layout of VLSI circuits - FFT processor - DCT processor and Interpolator as case studies.

9 Hours

Unit VI[$]

Multirate systems - Interpolation with an integer factor L - Sampling rate change with a ratio L/M - Multirate filters

Total: 45 Hours

Reference(s)

1. Lars Wan hammer, *DSP Integrated Circuits*, Academic Press, 1999.
2. A.V. Oppenheim, R.W.Schafer and J.R.Buck, *Discrete-time Signal Processing*, Prentice Hall, 2009.
3. Emmanuel C. I feachor and Barrie W.Jervis, *Digital Signal Processing–A Practical Approach*, Pearson Education, 2001.
4. Keshab K. Parhi, *VLSI Digital Signal Processing Systems Design and Implementation*, John Wiley & Sons, 2008.

[$] Includes Self Study topics of all 5 units and considered for Continuous Assessment only.

15AE58 DIGITAL CONTROL SYSTEMS

3 0 0 3

Course Objectives

- To learn the fundamental principles of feedback control and dynamic systems
- To acquire the concepts of Optimal Control Systems and Digital Control Systems
- To Model and control hybrid systems
- To learn how to perform the stability analysis of Feedback Control Systems

Course Outcomes (COs)

1. be familiar with The Design of Feedback Control Systems employing the previously learnt techniques such as the Bode Diagram, and the Root Locus method
2. Become familiar with issues faced in sampling, digital data and discrete time systems.
3. acquire the concepts of the Stability in the Frequency Domain employing The Nyquist Criterion, the Relative Stability, and Time Domain Performance Criteria in the Frequency Domain

Unit I

Review of Frequency and Time Response- Analysis and Specifications of Control Systems - Need for Controllers- Continues Time Compensations, Continues Time PI, PD, PID Controllers - Digital PID Controllers.

9 Hours

Unit II

Signal Processing In Digital Control

Sampling - Time and Frequency Domain Description – Aliasing-Hold Operation - Mathematical Model of Sample and Hold - Zero and First Order Hold - Factors Limiting the Choice of Sampling Rate - Reconstruction.

9 Hours

Unit III

Modelling and Analysis of Sampled Data Control System

Difference Equation Description - Z-Transform Method of Description - Pulse Transfer Function - Time and Frequency Response of Discrete Time Control Systems - Stability of Digital Control Systems - Jury's Stability Test - State Variable Concepts- First Companion- Second Companion- Jordan Canonical Models – Discrete State Variable Models – Elementary Principles.

9 Hours

Unit IV

Design of Digital Control Algorithms

Review of Principle of Compensator Design -Z-Plane Specifications - Digital Compensator Design using Frequency Response Plots - Discrete Integrator - Discrete Differentiator - Development of Digital PID Controller – Transfer Function – Design in the Z-Plane.

9 Hours

Unit V

Practical Aspects of Digital Control Algorithms

Algorithm Development of PID Control Algorithms- Software Implementation- Implementation using Microprocessors and Microcontrollers- Finite Word Length Effects- Choice of Data Acquisition Systems- Microcontroller based Temperature Control Systems- Microcontroller based Motor Speed Control Systems.

9 Hours

Unit VI[$]

Design of digital control systems with digital controllers through bilinear transformation. The Concept of Stability - The Routh—Hurwitz Stability Criterion. The Relative Stability of Feedback Control Systems - The Stability of State Variable Systems - The Root Locus Concept - The Root Locus Procedure - Sensitivity and the Root Locus - PID Controllers - Negative Gain Root Locus.

Total : 45 Hours

References

1. Gopal M., "Digital Control and Static Variable Methods", Tata McGraw Hill, New Delhi, 1997.
2. John D'Azzo J., "ConstantiveHoupios, Linear Control System Analysis and Design", Tata McGraw Hill, 1995.
3. Bishop and Dorf, Digital control systems Design, Prentice Hall; 12 Edition, 2010.
4. Mohammed S. Santina, Allen R. Stubberud, Gene H. Hostetter, Digital control system design, Oxford University Press, 2 edition, 1994.

15AE59 EMBEDDED NETWORKING

3 0 0 3

Course Objectives

- To study the concepts of embedded networking.
- To explore various bus architectures.
- To explore the fundamentals of embedded security.

Course Outcomes (COs)

1. To study properties of CAN components and Protocols
2. To understand USB transfer and embedded security tools.
3. To apply the TCP,IP,ISA client server protocols for embedded networks.

Unit I

The Automotive CAN Bus

Introduction-Concepts of Bus Access and arbitration–error processing and management–definition of the CAN protocol ISO 11898-1-error properties-detection and processing–framing, signal propagation-Bit synchronization-high speedCAN–low speed CAN-CAN components and development tools for CAN.

9 Hours

Unit II

USB

Introduction-types of USB transfers-bulk transfer–interrupt transfer-isochronous transfer-introduction to enumeration process–introduction to USB development tools.

9 Hours

[$] Includes Self Study topics of all 5 units and considered for Continuous Assessment only.

Unit III

Advanced Bus Architecture

RS422Bus,I2C Bus, IEEE1394 Firewire Bus, Domestic DigitalBus,Media Oriented System Transport Bus,AMBA,AHB.

9 Hours

Unit IV

Embedded Security

Introduction–access control and origins of security theory-introduction to cryptography, data integration and authentication-networked embedded systems and resource constraints-embedded security design.

9 Hours

Unit V

TCP/IP for Embedded Systems

Introduction – embedded SMTP client–embedded SMTP server-case studies :IP security camera–vending machine-internet radio–Ethernet gateway.

9 Hours

Unit VI[$]

ISA/PCI Bus protocols –Firewire - A simple application with CAN - Inside the Internet protocol - Email for Embedded Systems - Data Centric routing.

Total: 45 Hours

Reference(s)

1. Dominique Paret, Multiplexed Networks for Embedded Systems, Wiley 2007.
2. Timothy Stapko, Practical Embedded Security, Elsevier, 2008.
3. Jan Axelson, USB Complete, Lakeview Research, 2005.
4. Edward Insam, TCP/IP Embedded Internet Applications, Elsevier, 2003.
5. AjitPal, Computer Networks ,NPTEL Courseware 2005.

15AE60 NANO ELECTRONICS

3 0 0 3

Course Objectives

- To study the channel and gate effect of MOS system
- To understand nanotube FETs and MOSFET
- To study trends recent nano devices in industry

Course Outcomes(COs)

1. To study channel characteristics of novel MOSFET devices and its efficiency.
2. To understand CMOS Technology and nano wire MOSFETs.
3. To design digital circuit using multi gate devices.

Unit I

Introduction to Novel MOSFETS

MOSFET scaling, short channel effects– channel engineering- source/drain engineering- high k-

[$] Includes Self Study topics of all 5 units and considered for Continuous Assessment only.

dielectric – copper interconnects-strain engineering, SOIMOSFET, multigate transistors–single gate–double gate–triple gate–surround gate, quantum effects- volume inversion –mobility–threshold voltage–inter sub band scattering, multigate technology–mobility–gate stack.

9 Hours

Unit II

Physics of Multigate MOS System

MOS Electrostatics– 1D– 2D MOS Electrostatics, MOSFET Current-Voltage Characteristics–CMOS Technology–Ultimate limits, double gate MOS system–gate voltage effect–semiconductor thickness effect–asymmetry effect–oxide thickness effect–electron tunnel current–two dimensional confinement, scattering–mobility.

9 Hours

Unit III

Nanowire FETS and Transistors at the Molecular Scale

Silicon nanowire MOSFETs–Evaluation of I-V characteristics–The I-V characteristics for non-degenerate carrier statistics – The I-V characteristics for degenerate carrier statistics– Carbon nanotubes– Band structure of carbon nanotubes– Band structure of graphene–Physical structure of nanotubes –Band structure of nanotubes –Carbon nanotube FETs–Carbon nanotube MOSFETs–Schottky barrier carbon NanotubeFETs– Electronic conduction in molecules.

9 Hours

Unit IV

Radiation Effects

Radiation effects in SOIMOSFETs, total ion zing dose effects –single gate SOI –multigate devices, single event effect, scaling effects.

9 Hours

Unit V

Circuit Design Using Multigate Devices

Digital circuits–impact of device performance on digital circuits– leakage- performance trade off –multi V_T devices and circuits –SRAM design, analog circuit design–trans conductance – intrinsic gain–flicker noise–self heating – bandgap voltage reference–operational amplifier–comparator designs, mixed signal– successive approximation DAC, RFcircuits.

9 Hours

Unit VI[$]

General model for ballistic nano transistors– MOSFETs with 0D, 1D, and 2D channels – Molecular transistors – Single electron charging–Single electron transistors.

TOTAL:45 Hours

Reference(s)

1. J P Colinge, FINFETs and other multi-gate transistors, Springer – Series on Integrated circuits andsystems,2008
2. Mark Lundstrom JingGuo, Nanoscale Transistors: Device Physics, Modeling and Simulation, Springer,2006.
3. MSLundstorm, Fundamentals of Carrier Transport**,** Second Edition,Cambridge University Press, Cambridge UK,2000

[$] Includes Self Study topics of all 5 units and considered for Continuous Assessment only.

15AE61 RF IC AND MICROWAVE MEMS

3 0 0 3

Course Objectives

- To learn principle of passive and Active MMIC.
- To understand various MMIC components and switches
- To impart knowledge RF filters and types of MEMS packages.

Course Outcomes (COs)

1. Understanding of Circuit basics and Fabrication Technology of MEMS.
2. The ability to design MEMS switches.
3. The ability to apply above knowledge and skills to engineering problems.

Unit I

Introduction to MMIC, Processing & Layers, Passive MMIC Elements & Models, ActiveMMIC Elements & Models Biasing, Amplifiers. MMICs. Technologies: GaAs/Si/InP: MESFET HEMT BJT HBT. Applications, Circuit basics. Fabrication Technology. MMIC components, Active devices, Passive lumped elements, Microstrip elements.

9 Hours

Unit II

Introduction: RF MEMS for microwave applications, MEMS technology and fabrication, mechanical modelling of MEMS devices, MEMS materials and fabrication techniques. MEMS Switches: Introduction to MEMS switches; Capacitive shunt and series switches: Physical description, circuit model and electromagnetic modelling; Techniques of MEMS switch fabrication and packaging; Design of MEMS switches.

9 Hours

Unit III

MEMS Switches: Introduction to MEMS switches; Capacitive shunt and series switches: Physical description, circuit model and electromagnetic modelling; Techniques of MEMS switch fabrication and packaging; Design of MEMS switches.

9 Hours

Unit IV

RF Filters and Phase Shifters: Modeling of mechanical filters, micro machined filters, surface acoustic wave filters, micro machined filters for millimeter wave frequencies; Various types of MEMS phase shifters; Ferroelectric phase shifters.

9 Hours

Unit V

Transmission Lines and Antennas: Micro machined transmission lines, losses in transmission lines, coplanar transmission lines, micro machined waveguide components; Micro machined antennas: Micromachining techniques to improve antenna performance, reconfigurable antennas.

9 Hours

Unit VI[$]

Integration and Packaging: Role of MEMS packages, types of MEMS packages, module packaging, packaging materials and reliability issues.

Total: 45 Hours

[$] Includes Self Study topics of all 5 units and considered for Continuous Assessment only.

Reference(s)

1. Varadan, V.K., Vinoy, K.J. and Jose, K.J., "RF MEMS and their Applications", John Wiley & Sons. 2002.
2. Rebeiz, G.M., "MEMS: Theory Design and Technology", John Wiley & Sons. 1999.
3. De Los Santos, H.J, "RF MEMS Circuit Design for Wireless Communications", Artech House. 1999
4. Trimmer, W., "Micromechanics & MEMS", IEEE Press. 1996
5. Madou, M., "Fundamentals of Micro fabrication", CRC Press. 1997
6. Sze, S.M., "Semiconductor Sensors", John Wiley & Sons. 1994.

15AE62 NETWORK SECURITY

3 0 0 3

Course Objectives

- To explore network concept and threats in Network layer
- To study characteristics, vulnerabilities and challenges in authentication
- To provide solution for covering IP and Internet security
- To evaluate the performance of system security

Course Outcomes (COs)

1. Ability to identify the various attacks and threads in wired and wireless Networks.
2. Understand and recognize the architectures of IP and WEB security protocols
3. Analyze the solutions for Email security and privacy policies.
4. Analyze and design security systems for wireless networks.

Unit I

Introduction

Network concepts – Threats in networks – Network security controls – Importance of security – Threat models – Security concepts – Common mitigation methods.

9 Hours

Unit II

Authentication

Overview of authentication – Authentication of people – Security Handshake pitfalls – Strong password protocols – Kerberos – Public key infrastructure.

9 Hours

Unit III

IP & Web Security

IP security: Overview - Architecture – Authentication Header - Encapsulating Security Payload - Key management – Web security: Web security considerations – Secure Socket Layer and Transport Layer Security – Secure electronic transaction – Web issues

9 Hours

Unit IV

Electronic Mail Security

Store and forward – Security services for e-mail – Establishing keys – Privacy – Authentication of the Source – Message Integrity – Non-repudiation – Proof of submission and delivery - Pretty Good Privacy – Secure/Multipurpose Internet Mail Extension.

9 Hours

Unit V

System Security

Intruders – Intrusion detection – Password management – Malicious software: Viruses and related threats – virus countermeasures – Firewalls: Firewall design principles – Firewall configurations – Trusted systems

9 Hours

Unit VI[$]

Attacks and Network Integration in Wireless Mesh Networks- Network Security Situation Awareness System- web defense.

Total: 45 Hours

Reference(s)

1. Charles P. Fleeger, *Security in Computing*, Prentice Hall, New Delhi, 2009
2. BehrouzA. Forouzan, *Cryptography & Network Security*, Tata McGraw Hill, India, New Delhi, 2009.
3. William Stallings, *Cryptography and Network Security*, Prentice Hall, New Delhi, 2006.
4. Chalie Kaufman, Radia Perlman, Mike Speciner, *Network Security: Private Communication in a Public Network*, Pearson Education, New Delhi, 2004.
5. Neal Krawetz, *Introduction to Network Security*, Thomson Learning, Boston, 2007.
6. Bruce Schneier, *Applied Cryptography*, John Wiley & Sons, New York, 2004.

15AE63 WIRELESS BODY AREA NETWORKS

3 0 0 3

Course Objectives

- To study the overview of wireless sensor networks and their applications in Healthcare system.
- To study the fundamentals and principles of wireless Body Area Networks.
- To study the standards related to Wireless Body Area Networks.

Course Outcomes (COs)

1. Ability to identify the various challenges in WBAN
2. Obtain awareness for adaptation in WSN solutions for healthcare
3. Understand and recognize the effect of RF effects on human tissues
4. Analyze performance of networking sensors in e-health applications.

Unit I

Overview of Wireless Sensor Networks

Challenges for Wireless Sensor Networks-Characteristics requirements-required mechanisms, Difference between mobile ad-hoc and sensor networks, Enabling Technologies for Wireless Sensor Networks –Operating Systems –Hardware– Berkeley Motes, Programming Challenges, Node-levels of tare platforms, Node- level Simulators, State-centric programming.

9 Hours

[$] Includes Self Study topics of all 5 units and considered for Continuous Assessment only.

Unit II

Wireless Sensor Networks For Health care Applications

General approach to WSN in Healthcare – Key Principles, Methodology – Architecting WSN solutions for Healthcare –Hardware, Firmware and Software Choices.

9 Hours

Unit III

Frequency Regulations

Frequency regulations on candidate frequency bands indifferent countries and regions, Ultra wide band(UWB),industrial, scientific, and medical(ISM),medical implant communication service(MICS), and wireless medical telemetry system (WMTS).

9 Hours

Unit IV

Antenna, Propagation and Channel Modeling

Antenna propagation, and channel model interrelated to WBAN–Effects of radio frequency on tissues and organs and effects of human tissues on RF propagations.

9 Hours

Unit V

Networking of Sensors

Physical (PHY)layer technologies –Narrow band and UWB–Medium access control (MAC) technologies for WBAN – Unified MAC design independent of underlying PHY technologies; Standardization withIEEE802.15.6, IEEE 11073, and ETSI eHealth Project.

9 Hours

Unit VI[$]

Tiny OS – ETSI eHealth Project – Ubiquitous e-Health care – Smart wearable systems : current status and future challenges – Implant Wireless Body Area Network.

TOTAL:45 Hours

Reference(s)

1. BhaskarKrishnamachari, "Networking Wireless Sensors", Cambridge Press,2005.
2. Mohammedll yas AndImad Mahgaob, "Handbook Of Sensor Networks: CompactWirelessAndWiredSensingSystems",CRCPress,2005.
3. WayneTomasi, "Introduction To Data Communication And Networking", PearsonEducation,2007.
4. Guang-ZhongYang (Editor), and M. Yacoub (Foreword), "Body Sensor Networks", Springer; First Edition, March 28, 2006, ISBN-13: 978-1846282720.
5. Burkhardt,"PervasiveComputing",FirstEdition,PearsonEducation,2003.
6. Terrance J. Dishongh and Michael Mcgrath, "Wireless Sensor Networks for Healthcare Applications", Artech House; Firstedition, October30, 2009, ISBN–978-1596933057.
7. Huan-Bang Li, KamyaYekeh Yazdandoost, and Bin Zhen, "Wireless Body Area Network", River Publishers' Seriesin Information Science and Technology, Oct29,2010,ISBN:978-87-92329-46-2.

[$] Includes Self Study topics of all 5 units and considered for Continuous Assessment only.

15AE64/ 15IE55 MICRO ELECTRO MECHANICAL SYSTEMS
(Common to Applied Electronics &Instrumentation Engineering)

3 0 0 3

Course Objective

- To acquire knowledge about various fabrication process, electrical and mechanical concepts in MEMS
- To impart a good knowledge about various MEMS sensors and actuators
- To understand applications of polymer and optical MEMS

Course Outcomes (COs)

1. To understand the concepts of fabrication methods and materials used in MEMS
2. To identify the application of MEMS in sensing and actuating process
3. To apply the polymer and optical MEMS in various measurements

Unit I

Introduction

Intrinsic Characteristics of MEMS - Energy Domains and Transducers - Sensors and Actuators - Introduction to Micro fabrication - Silicon based MEMS processes - New Materials - Review of Electrical and Mechanical concepts in MEMS - Stress and strain analysis - Flexural beam bending - Torsional deflection

9 Hours

Unit II

Sensors and Actuators-I

Electrostatic sensors - Parallel plate capacitors - Applications – Inter digitized Finger capacitor - Comb drive devices - Thermal Sensing and Actuation - Thermal expansion - Thermal couples - Thermal resistors - Applications - Magnetic Actuators – Micro magnetic components

9 Hours

Unit III

Sensors and Actuators-II

Piezo resistive sensors – Piezo resistive sensor materials - Stress analysis of mechanical elements – Applications to Inertia, Pressure, Tactile and Flow sensors. Piezoelectric sensors and actuators - piezoelectric effects - piezoelectric materials - Applications to Inertia, Acoustic, Tactile and Flow sensors

9 Hours

Unit IV

Micro machining

Silicon anisotropic etching - Anisotrophic wet etching - Dry etching of silicon - Plasma etching – Deep Reaction Ion Etching (DRIE) - Isotropic wet etching - Gas phase etchants - Case studies: Basic surface micromachining processes - Structural and sacrificial materials - Acceleration of sacrificial etch - Striction and antistriction methods

9 Hours

Unit V

Polymer and Optical MEMS

Polymers in MEMS - Polyimide - SU-8 - Liquid Crystal Polymer (LCP) - PDMS - PMMA - Parylene - Fluorocarbon - Application to Acceleration, Pressure, Flow and Tactile sensors - Optical MEMS - Lenses and Mirrors - Actuators for Active Optical MEMS

9 Hours

Unit VI[$]

Case studies of MEMS actuators – micropumps - Assembly of 3D MEMS - Foundry process

Total: 45 Hours

References

1. Chang Liu, *Foundations of MEMS*, Pearson Education Inc., 2014
2. James J.Allen, *Micro Electro Mechanical System Design*, CRC Press published in 2005
3. NadimMaluf, *An Introduction to Micro Electro Mechanical System Design*, Artech House, 2004
4. Mohamed Gad-el-Hak, *The MEMS Handbook*, CRC press Baco Raton, 2005
5. Tai Ran Hsu, *MEMS & Micro systems Design and Manufacture*, Tata McGraw Hill, New Delhi, 2008
6. Julian W. Gardner, Vijay K. Varadan and Osama O.Awadelkarim, *Micro Sensors MEMS and Smart Devices*, John Wiley & son Ltd, 2002

15AE65 DSP PROCESSOR ARCHITECTURE AND PROGRAMMING

3 0 0 3

Course Objectives

- To study the fundamentals of Programmable DSPs.
- To impart knowledge on the operation of ADSP and Analog Processors.

Course Outcomes (COs)

1. Analyse the procedure for various DSP System Architecture
2. Diagnose the design methodologies in hardware and software.
3. Identification of new developments in DSP systems.
4. Design and implement various signal processing techniques using DSP processors.

Unit I

Fundamentals of Programmable DSPs

Multiplier and Multiplier accumulator – Modified Bus Structures and Memory access in P-DSPs – Multiple access memory – Multi-port memory – VLIW architecture- Pipelining – Special Addressing modes in PDSPs– On chip Peripherals.

9 Hours

Unit II

TMS320C5X Processor

Architecture – Assembly language syntax - Addressing modes – Assembly language Instructions - Pipeline structure– Operation – Programs for FIR and IIR filters.

9 Hours

Unit III

TMS320C3X Processor

Architecture – Data formats - Addressing modes – Groups of addressing modes- Instruction sets - Operation–Generating and finding the sum of series- Convolution of two sequences- Programs for FIR and IIR filters.

9 Hours

[$] Includes Self Study topics of all 5 units and considered for Continuous Assessment only.

Unit IV

ADSP Processors

Architecture of ADSP-21XX and ADSP-210XX series of DSP processors- Addressing modes and assembly language instructions – Application programs – Programs on ADSP21xx for FIR and IIR filters.

9 Hours

Unit V

Advanced Processors

Architecture of TMS320C54X - Pipe line operation, Code Composer studio - Architecture of TMS320C6X -Architecture of Motorola DSP563XX – Comparison of the features of DSP family processors.

9 Hours

Unit VI[$]

Real time DSP: TMS320C6X architechture- pipelined CPU- C64X DSP-Code composer studio simulator-real time filtering-adaptive filtering

Total: 45 Hours

Reference(s)

1. B.Venkataramani. and M.Bhaskar, *Digital Signal Processors–Architecture, Programming and Applications*, Tata McGraw–Hill Publishing Company Limited, 2003.
2. *User guides of Texas Instruments*, Analog Devices, Motorola Incorporation, 2005.

15AE66 MEDICAL ELECTRONICS

3 0 0 3

Course Objectives

- To study the functions of sensors and physiological system.
- To understand operation of the Medical Electronics Equipment
- To study recent trends and electronics system in bio medical applications

Course Outcomes (COs)

1. To classify the various medical electronics equipment**.**
2. To understand the characteristics of Bioelectric signals and transducer
3. To explore Patient Monitoring Systems and Safety Aspects of Medical Instruments.

Unit I

Introduction to Physiology - Electrodes

Types of Electrodes, Electrodes used for ECG, EEG.**Transducers:** Typical signals from physiological parameters, pressure transducer, flow transducer, temperature transducer, pulse sensor, respiration sensor.

10 Hours

[$] Includes Self Study topics of all 5 units and considered for Continuous Assessment only.

Unit II

Bio Medical Recorders

Block diagram description and application of following instruments: ECG Machine, EEG Machine and EMG Machine.

8 Hours

Unit III

Assisting and Therapeutic Equipments

Pacemakers – Defibrillators – Ventilators – Nerve and muscle stimulators – Diathermy – Heart – Lung machine – Audio meters – Dialysers – Lithotripsy.

8 Hours

Unit IV

MEDICAL IMAGING

Radio graphic and fluoroscopic techniques – Computer tomography – MRI – Ultrasonography – Endoscopy – Thermography – Different types of biotelemetry systems and patient monitoring – Introduction to Biometric systems.

10 Hours

Unit V

Patient Monitoring Systems: Heart rate measurement, Pulse rate measurement, Respiration rate measurement, Blood pressure measurement, Principle of defibrillator and pace mark, Use of Microprocessor in patent monitoring.

9 Hours

Unit VI[$]

Safety Aspects of Medical Instruments: Gross current shock, Micro current shock, Special design from safety consideration, Safety standards

Total: 45 Hours

Reference(s)

1. RS Khandpur, Handbook of biomedical Instrumentation, Tata McGraw Hill Publishing Co Ltd.,2003.
2. Cromwell , Leslie Cromwell, Fred J.Weibell, Erich A.Pfeiffer, 'Bio-Medical Instrumentation and Measurements', II edition, Pearson Education, 2002 / PHI.
3. RS Khandpur , Modern Electronics Equipment by, TMMH, New Delhi
4. Edward J. Perkstein; Howard Bj , Introduction to BioMedical Electronics, USA
5. L.A.Geddes and L.E.Baker, 'Principles of Applied Bio-Medical Instrumentation', John Wiley &Sons, 1975.
6. J.Webster, 'Medical Instrumentation', John Wiley & Sons, 1995.
7. C.Rajarao and S.K. Guha, 'Principles of Medical Electronics and Bio-medical
8. Instrumentation', Universities press (India) Ltd, Orient Longman ltd, 2000.

[$] Includes Self Study topics of all 5 units and considered for Continuous Assessment only.

15AE67 / 15VL63 COMMUNICATION NETWORKS
(Common to Applied Electronics & VLSI Design)

3 0 0 3

Course Objectives

- To study about the wired and wireless LANs and backbone networks.
- To gain depth knowledge about the routing protocol and congestion controls.
- To focus on simulation and modeling of Qualnet and NS2 simulators.

Course Outcomes (COs)

1. To identify the type of networks and protocols for a given network scenario.
2. To estimate the performance and throughput of a given network.
3. Design a network aimed at optimum performance.
4. Traffic modeling and congestion control in networks.

Unit I

Wired LANs

Standard Ethernet- Mac sub layer-physical layer, Bridged Ethernet, switched Ethernet, Fast Ethernet, Gigabit Ethernet. **Backbone Networks:** Connecting devices, Hubs, Bridges, Routers, Gateway, three layer switches, Virtual LAN-SONET**.**

9 Hours

Unit II

Flow/Congestion Control

Implementation, modeling, fairness, stability, open-loop, closed-loop and hybrid, traffic specification (LBAP, leaky-bucket), window, rate, hop-by-hop , end-to-end flow control, implicit and explicit feedback,aggregate flow control, reliable multicast. TCP variants (Tahoe, Reno, Vegas, New-Reno, SACK), DECbit, Packet Pair, NETBLT, ATM Forum EERC, T/TCP.

Scheduling and Buffer Management

Implementation, faimess, performance bounds, admission control, priorities, work conservation, scheduling best-effort (BE) flows, scheduling guaranteed-service (GS) flows (GPS, WRR, DRR, WFQ, EDD, RCSP), aggregation, drop strategies (tail-drop, RED, WRED).

9 Hours

Unit III

Routing

Implementation, stability/convergence, link-state vs distance-vector vs link-vector, conventional routing, Routing Information Protocol (RIP), Open Shortest Path First (OSPF), Multicast OSPF (MOSPF), Distance Vector Multicast Routing Protocol (DVMRP), BGP instability, Fair queuing, TCP congestion control, TCP variants, Random Early Detect, TCP RTT estimation, Fast retransmit, Fast recovery.

9 Hours

Unit IV Congestion control

Congestion Control-open loop-closed loop, congestion control in TCP, congestion control in Frame relay-Quality of service- Integrated Services, Resource Reservation Protocol (RSVP), Differentiated Services, Overlay Networks, Peer-to-Peer Networks, Chord.

9 Hours

Unit V

Simulation and Modeling

Wide-Area Traffic Modeling, End-to-end Internet Packet Dynamics, Traffic engineering, Multi-

Protocol Label Switching (MPLS), Network Simulators- NS2, OPNET, QualNet.

9 Hours

Unit VI[$]

IP Next Generation

IP Next Layer (IPNL), IPV6 features, including transition, Mobile IPV6 operation, Models to support (WLAN) network roaming, IPV6 transition methods, Advanced IP routing and multihoming, IP Multicast.

Total: 45 Hours

Reference(s)

1. Larry Peterson and Bruce Davie, *Computer Networks: A Systems Approach*, Morgan Kaufmann, 2007.
2. Michael A Gallo and William M Hancock, *Computer Communications and NetworkingTechnologies*, Thomson Learning, 2002.
3. Jim Kurose and Keith Ross, *Computer Networking: A Top-Down Approach Featuring theInternet*, Addison- Wesley, 2004.
4. William Stallings, *Data and Computer Communications*, Prentice Hall, 2006.
5. Andrew S Tanenbaum, *Computer Networks*, Prentice Hall, 2002.
6. Behrouz Forouzan, *Data communications and Networking*, TMH, 2007
7. Behrouz Forouzan, *TCPIP Overview*,TMH,2008

15IE58/15AE68 ROBOTICS AND AUTOMATION
(Common to Applied Electronics & Instrumentation Engineering)

3 0 0 3

Course Objectives

- To compute the transformations and robot kinematics
- To investigate planning and control design of robot manipulators
- To analyze the sensors and applications of robots

Course Outcomes (COs)

1. To understand the basic principles of robotics
2. To acquire knowledge about navigation and movement of the robots and robotic arm.
3. To obtain awareness the function of various sensors used in robotics.
4. To become capable of design and implementation of robotics in specific applications.

Unit I

Transformations

Evolution of robots and robotics – laws of robotics – robotic joints – classification – specifications – Application – robot architecture – pose of a rigid body – coordinate transformation – homogeneous transformation matrix – Denavit and Hartenberg Parameters – a variant of DH parameters – DH Parametrization of Euler angles.

9 Hours

[$] Includes Self Study topics of all 5 units and considered for Continuous Assessment only.

Unit II

Robot Kinematics

Forward position analysis– inverse position analysis – forward and inverse velocity analysis – acceleration analysis – end effectors – design – selection.

9 Hours

Unit III

Planning and Control of Robotic Manipulators

Considerations on trajectory planning – joint interrelated trajectories – cartesian path trajectories – control of robot – PID control – computed torque technique – near minimum time control – variable structure control – nonlinear decoupled feedback control – motion control – adaptive control.

9 Hours

Unit IV

Robotic Sensors and Vision

Sensors in robotics – classification – tactile, proximity and range sensors – sensors based systems – Introduction to machine vision – the sensing and digitizing function in machine vision – image processing and analysis – training the vision system – robotic applications – robot programming – robot languages – artificial intelligence.

9 Hours

Unit V

Robot Applications

Multiple robots – Machine interface – Robots in manufacturing and non-manufacturing application – Robot cell design – Selection of a robot.

9 Hours

Unit VI[$]

Mobile Robots and Control Issues

Industrial automation - General layout - General configuration of an automated flow line - Conveyor systems - Inspection station with feedback loops to up steam workstations - Shop floor control - 3 Phases - Order scheduling.

Total: 45 Hours

Reference(s)

1. Thomas R. Kurfess, *Robotics and Automation Handbook*, CRC Press, 2004
2. Mittal &Nagrath, *Robotics and Control*, Tata McGraw-Hill Education, 2007
3. K S Fu,Ralph Gonzalez,C S G Lee, *Robotics: Control, Sensing, Vision, and Intelligence*, Tata McGraw-Hill Education, 2008
4. MikellP.Groover, Mitchell Weiss, Roger N.Nagel, Nicholas G. Odrey, *Industrial Robotics*, Tata McGraw-Hill Education, 2012
5. David W. Pessen, *Industrial Automation: Circuit Design and Components*, A Wiley-Interscience publication, 1989
6. S K Saha, *Introduction to Robotics*, Tata McGraw-Hill Education, 2013

[$] Includes Self Study topics of all 5 units and considered for Continuous Assessment only.

15AE69 / 15ES62 PATTERN RECOGNITION & ARTIFICAL INTELLIGENTTECHNIQUES
(Common to Applied Electronics & Embedded Systems)

3 0 0 3

Course Objectives

- To understand different supervised and unsupervised learning techniques
- To obtain sound knowledge on recent advancement on pattern recognition techniques.

Course Outcomes (COs)

1. Analysis the procedure for various pattern recognition principles in real world problem.
2. Analysis feature enhancement and optimization methods
3. Analysis the windowing of better solution in rough surface searching algorithms both using association and non association rules.
4. Identification of new developments in object recognition systems.

Unit I

Pattern Classifier

Overview of pattern recognition - Discriminant functions - Supervised learning - Parametric estimation - Maximum likelihood estimation - Bayesian parameter estimation - Perceptron algorithm - LMSE algorithm -Problems with Bayes approach - Pattern classification by distance functions - Minimum distance pattern classifier.

9 Hours

Unit II

Unsupervised Classification

Clustering for unsupervised learning and classification - Clustering concept - C-means algorithm – Hierarchical clustering procedures - Graph theoretic approach to pattern clustering - Validity of clustering solutions. **9 Hours**

Unit III

Structural Pattern Recognition

Elements of formal grammars - String generation as pattern description - Recognition of syntactic description -Parsing - Stochastic grammars and applications - Graph based structural representation.

9 Hours

Unit IV

Feature Extraction and Selection

Entropy minimization - Karhunen - Loeve transformation - Feature selection through functions approximation -Binary feature selection.

9 Hours

Unit V

Recent Advances

Neural network structures for Pattern Recognition - Neural network based Pattern associators – Unsupervised learning in neural Pattern Recognition - Self organizing networks - Fuzzy logic - Fuzzy pattern classifiers -Pattern classification using Genetic Algorithms.

9 Hours

Unit VI[$]

NON PAREMETRIC TECHNIQUES: Density Estimation – Parzen Windows – KNN Estimation – The Nearest neighbor rule– Metrics & Nearest neighbor classification.

Total: 45 Hours

Reference(s)

1. Robert J.Schalkoff, *Pattern Recognition: Statistical, Structural and Neural Approaches*, John Wiley &Sons Inc., New York, 2007.
2. Tou and Gonzales, *Pattern Recognition Principles*, Wesley Publication Company, London, 1974.
3. Duda R.O., Hart.P.E., and Strok, *Pattern Classification*, second Edition Wiley, New York, 2008.
4. Morton Nadier and Eric Smith P., *Pattern Recognition Engineering*, John Wiley & Sons, New York, 1993.
5. IEEE Transaction on Pattern Recognition Techniques 2006.
6. IEEE Engineering Medicine and Biology Magazine 2006.

15AE70 ANALOG VLSI DESIGN

3 0 0 3

Course Objectives

- To understand the operation of BJTs and MOS devices.
- To analyze various devices in small and large signal conditions.
- To impart in-depth knowledge about switched capacitors, ADCs and DACs.

Course Outcomes (COs)

1. To acquire knowledge of how a circuit works.
2. To learn to analyze the circuit.
3. To view analog integrated circuit design from a hierarchical viewpoint.
4. To realize schematic of the circuit, dc currents, and W/L ratio.

Unit I

CMOS Technology and Device Modeling

Basic MOS semiconductor fabrication processes-other considerations of CMOS technology-MOS large signal model and parameters-Small signal model for the MOS transistor-Computer simulation models-Sub threshold MOS model.

9 Hours

Unit II

Analog CMOS Sub circuits, CMOS Amplifiers

MOS switch-MOS diode and active resistor-Current sinks and sources-Current mirrors-Current and voltage References:-Band gap References:-Invertors-Differential amplifiers - Cascode amplifiers – Current amplifiers - Output amplifiers- High gain amplifiers architectures.

9 Hours

Unit III

High-Performance CMOS Operational Amplifiers

Buffered operational amplifiers-High speed and frequency operational amplifiers-Differential

[$] Includes Self Study topics of all 5 units and considered for Continuous Assessment only.

output operational amplifiers-Microwave operational amplifiers - Low noise operational amplifiers - Low voltage operational amplifiers.

9 Hours

Unit IV

Switched Capacitor Circuits

Switched Capacitor Circuits-Switched Capacitor amplifiers-Switched Capacitor integrators-z domain models of two phase switched capacitor circuits-First order switched capacitor circuits-Second order switched capacitor circuits-Switched Capacitor Filters.

9 Hours

Unit V

Digital-Analog and Analog-Digital Converters

Introduction and characterization of DAC-Parallel DAC-Extending the resolution of parallel DAC-Serial DAC-Introduction and characterization of ADC-Serial ADC-Medium ADC-High speed ADC.

9 Hours

Unit VI[$]

Integrated Circuit Layout-Sub threshold MOS model - High gain amplifiers architectures - Low voltage operational amplifiers –Characterization of Comparators - Oversampling Converters

Total: 45 Hours

Reference(s)

1. Phillip E.Allen and Douglas R.Holberg, *CMOS Analog Circuit Design*, Oxford University Press, 2002.
2. Malcom R.Haskard and LanC.May, *Analog VLSI Design - NMOS and CMOS*, Prentice Hall, 1998.
3. Jose E.France and Yannis Tsividis, *Design of Analog-Digital VLSI Circuits for Telecommunication and Signal Processing*, Prentice Hall, 1994.
4. Randall L Geiger, Phillip E. Allen and Noel K.Strader, *VLSI Design Techniques for Analog and Digital Circuits*, McGraw Hill International Company, 1990.
5. K.Radhakrishna Rao, *Electronics for Analog Signal Processing-I*, NPTEL, Courseware, 2005

15AE71 BIOMETRICS FOR NETWORK SECURITY

3 0 0 3

Course Objectives

- To explore variety of biometric systems for authentication
- To study characteristics of finger print sensors and RF imaging techniques
- To evaluate the performance of multimodal biometric system

Course Outcomes (COs)

1. Ability to identify the various biometric systems.
2. Understand and recognize the finger print pattern, face recognition and Hand geometry.
3. Analyze the solutions for securing and trusting a biometric transaction

[$] Includes Self Study topics of all 5 units and considered for Continuous Assessment only.

Unit I

Introduction to Biometrics

Introduction and background–biometric technologies– passive biometrics–active biometrics– Biometric systems–Enrollment –templates–algorithm –verification – Biometric applications– biometric characteristics–Authentication technologies–Need for strong authentication– Protecting privacy and biometrics and policy– Biometric applications–biometric characteristics.

9 Hours

Unit II

Fingerprint Technology

History of fingerprint pattern recognition –General description of fingerprints–Finger print feature processing techniques–fingerprint sensors and RF imaging techniques– fingerprint quality assessment –computer enhancement and modeling of fingerprint images –fingerprint enhancement –Feature extraction –fingerprint classification – fingerprint matching.

9 Hours

Unit III

Face Recognition and Hand Geometry

Introduction to face recognition, Neural networks for face recognition–face recognition from correspondence maps–Hand geometry–scanning–Feature Extraction–Adaptive Classifiers – Visual-Based Feature Extraction and Pattern Classification – feature extraction–types of algorithm– Biometric fusion.

9 Hours

Unit IV

Multimodal Biometrics

Introduction to multimodal biometric system–Integration strategies–Architecture–level of fusion– combination strategy– training and adaptability–examples of multimodal biometric systems

9 Hours

Unit V

Biometric Authentication

Introduction–Biometric Authentication Methods– Biometric Authentication Systems– Biometric authentication by fingerprint–Biometric Authentication by Face Recognition– Expectation– Maximization theory–Support Vector Machines. Biometric authentication by fingerprint– biometric authentication by hand geometry–Securing and trusting a biometric transaction– matching location– local host– authentication server– match on card(MOC)–Multi biometrics and Two-Factor Authentication.

9 Hours

Unit VI[$]

Multimodal biometric system : Performance Evaluation –Statistical Measures of Biometrics–FAR –FRR–FTE–EER –Memory requirement and allocation.

Total: 45 Hours

Reference(s)

1. PaulReid, "Biometrics for Network Security", Pearson Education, 2004.
2. NaliniK.Ratha, RundBolle, "Automatic finger printer cognition system Springer",2003.

[$] Includes Self Study topics of all 5 units and considered for Continuous Assessment only.

3. LCJain, IHayashi,S B Lee, UHaleci, "Intelligent Biometric Techniques in Fingerprint and Face Recognition".
4. S.Y.Kung, S.H.Lin, M.W., "Mak Biometric Authentication :A Machine learning Approach". John Chirillo, ScottBlaul, "Implementing Biometric Security", JohnWile, 2003.
5. IEEE–T-PAMI(IEEE transaction on Pattern Analysis and Machine Intelligence) International journal of computer vision, Springer.

15AE72 CYBER CRIME INVESTIGATIONS AND DIGITAL FORENSICS

3 0 0 3

Course Objectives

- To explore cyber crime issues in social networks
- To study characteristics, vulnerabilities and challenges in authentication
- To provide solution for covering IP and Internet security
- To evaluate the performance of system security

Course Outcomes (COs)

1. Ability to identify the cyber attacks and threads in Internet.
2. Understand and recognize cyber laws and issues
3. Ability to identify investigation, solutions handling the cyber attacks..
4. Ability to apply digital forensics methods

Unit I

Introduction

Introduction and Overview of Cyber Crime, Nature and Scope of Cyber Crime, Types of Cyber Crime: Social Engineering, Categories of Cyber Crime, Property

9 Hours

Unit II

Cyber Crime Issues

Unauthorized Access to Computers, Computer Intrusions, White collar Crimes, Viruses and Malicious Code, Internet Hacking and Cracking, Virus Attacks, Pornography, Software Piracy, Intellectual Property, Mail Bombs, Exploitation ,Stalking and Obscenity in Internet, Digital laws and legislation, Law Enforcement Roles and Responses.

9 Hours

Unit III

Investigation

Introduction to Cyber Crime Investigation, Investigation Tools, eDiscovery, Digital Evidence Collection, Evidence Preservation, E-Mail Investigation, E-Mail Tracking, IP Tracking, E-Mail Recovery, Hands on Case Studies. Encryption and Decryption Methods, Search and Seizure of Computers, Recovering Deleted Evidences, Password Cracking.

9 Hours

Unit IV

Digital Forensics

Introduction to Digital Forensics, Forensic Software and Hardware, Analysis and Advanced Tools, Forensic Technology and Practices, Forensic Ballistics and Photography, Face, Iris and Fingerprint Recognition,

9 Hours

Unit V

Cyber crime. Laws and acts

Laws and Ethics, Digital Evidence Controls, Evidence Handling Procedures, Basics of Indian Evidence ACT IPC and CrPC , Electronic Communication Privacy ACT, Legal Policies.

9 Hours

Unit VI[$]

Network Forensics ,Audio Video Analysis, Windows System Forensics, Linux System Forensics,. **Total: 45 Hours**

Reference(s)

1. Nelson Phillips and Enfinger Steuart, "*Computer Forensics and Investigations",* Cengage Learning, New Delhi, 2009.
2. Kevin Mandia, Chris Prosise, Matt Pepe, "*Incident Response and Computer Forensics* ", Tata McGraw -Hill, New Delhi, 2006.
3. Robert M Slade," *Software Forensics*", Tata McGraw - Hill, New Delhi, 2005.
4. Bernadette H Schell, Clemens Martin, "*Cybercrime*", ABC – CLIO Inc, California, 2004.

15AE73 EVOLUTIONARY COMPUTING

3 0 0 3

Course Objectives

- To study different types of optimization techniques.
- To understand the concepts of genetic algorithms.
- To attain sound knowledge applications of soft computing.

Course Outcomes (COs)

1. Analysis the procedure for various principles of Evolutionary computing in real world problem.
2. Analysis feature enhancement and optimization methods using soft computing techniques.
3. Analysis the windowing of better solution in rough surface searching algorithms both using association and non association rules.
4. Identification of new developments in object recognition systems.

Unit I

Fuzzy Systems

Fuzzy set theory-fuzzy rules and fuzzy reasoning-fuzzy inference systems-decomposition-fuzzy automata and languages-fuzzy control methods.

9 Hours

Unit II

Neural Networks

Basic concepts-knowledge based processing-single layer perceptron-multilayer perceptron-supervised and unsupervised learning-feed forward and back propagation and counter propagation networks-kohens self organizing networks-Hopfield networks.

9 Hours

[$] Includes Self Study topics of all 5 units and considered for Continuous Assessment only.

Unit III

Neuro Fuzzy Modeling

Adaptive neuro fuzzy inference systems-classification and regression trees- data clustering-rule base structure identification-neuro fuzzy controls.

9 Hours

Unit IV

Genetic Algorithms

Basics of GA- choice of encoding-selection probability-mutation and crossover-fitness evaluation improving convergence rate-a simplex GA- Hybrid approach.

9 Hours

Unit V

Applications of Soft Computing

Fuzzy techniques for inverted pendulum case-SIRM fuzzy systems-MCDM for weather forecasting and financial marketing-Neural networks for pattern recognition-TS problems-Routers - GA application to metabolic modeling.

9 Hours

Unit VI[$]

Fuzzy multi criteria algorithm and Multi-objective fuzzy clustering for Wireless Networks-Routing in Wireless Sensor Network using Fuzzy rules.

Total : 45 Hours

Reference(s)

1. Jang J.S.R.,Sun C.T and MizutaniE**, "***Neuro Fuzzy and Soft computing",* Pearson Education (Singapore), 2006
2. David E.Goldberg, **"***Genetic Algorithms in Search, Optimization, and Machine Learning",*Pearson Education, Asia, 2001**.**
3. Timothy J.Ross**, "***Fuzzy Logic Engineering Applications",* McGrawHill, NewYork, 2002.
4. S.Rajasekaran and G.A.VijayalakshmiPai, **"***Neural networks, Fuzzy logics and Genetic algorithms"***,** Prentice Hall of India, 2003.
5. George J.Klir and Bo Yuan,"*Fuzzy Sets and Fuzzy Logic***",** Prentice Hall Inc., New Jersey, 2002.

[$] Includes Self Study topics of all 5 units and considered for Continuous Assessment only.

15AEXA PROGRAMMABLE LOGIC CONTROLLERS

1 0 0 1

Course Objectives

- To understand the basic architecture of PLC
- To learn the advanced sensors and monitoring process using PLC
- To acquire the knowledge in PLC programming

Course Outcomes (COs)

1. Understand the fundamental monitoring and control in PLC
2. Know the PLC for data file handling and fault correction

Architecture of PLC- different modules, power supply unit etc-Need of PLC in designing. Different types of sensors- sinking, sourcing, NPN, PNP.Monitoring the process through sensors- connection details. Analog addressing, continuous process monitoring and control. Different types of controllers- ON/OFF, Proportional, Derivative, Integral and PID control. PLC Programming of branded PLCs. NO/ NC concept. Data file handling- forcing I/O Wiring and fault correction- Programming practice

Total: 20 hours

15AEXB SUPERVISORY CONTROL AND DATA ACQUISITION

1 0 0 1

Course Objectives

- To understand the basics of industrial automation using SCADA
- To learn the configuration and communication protocols od SCADA system
- To acquire the knowledge in script programming

Course Outcomes (COs)

1. Understand the fundamental of industrial monitoring and control using SCADA
2. Develop the real time interfacing with PLC

SCADA Packages-Role of SCADA in industrial automation -SCADA system configuration, RTU, communication protocols-Script programming- Real time and historical trend. Configuring Alarms-Real time project development with PLC interfacing. Communication with other software. Recipe management Accessing different security levels

Total: 20 hours