Bansilal Ramnath Agarwal Charitable Trust’s
Vishwakarma Institute of Technology
(An Autonomous Institute affiliated to University of Pune)

Structure & Syllabus of
Final Year B.Tech. (Electronics)

Pattern ‘E-11’
Academic Year 2015-16

Prepared by: - Board of Studies in Electronics Engineering

Approved by: - Academic Board, Vishwakarma Institute of Technology, Pune

Signed by

Chairman – BOS → Chairman – Academic Board
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| TOTAL       |                                                 | 14 | 12 | 2 |   |   |   | 24 |

**Based on Digital Electronics and Data Structure & Algorithms
**S.Y. B.Tech Electronics Engineering Structure with effect from Academic Year 2014-15**

**Semester I – Irrespective of Module**

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<td>Matlab fundamentals and programming techniques</td>
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* ONLY FOR SECOND YEAR DIRECT ADMITTED STUDENTS
### T.Y. B.Tech Electronics Engineering Structure with effect from Academic Year 2014-15

#### Module 5

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### T.Y. B.Tech Electronics Engineering Structure with effect from Academic Year 2014-15

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$ Elective with tutorial
$$ Elective with Lab
### Final Year B.Tech Electronics Engineering Structure with effect from Academic Year 2014-15

**Module 8**

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\(\^\) Elective with tutorial
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<td>Artificial Neural Networks and Fuzzy Logic</td>
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Final Year B.Tech Electronics Engineering Structure with effect from Academic Year 2014-15

Semester I – Irrespective of Module

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EC 40101: ELECTRONICS CIRCUIT DESIGN

Credits: 03
Teaching Scheme: - Theory 3 Hrs/Week

Unit I
Design of Power Supplies (8 Hrs)
A. Linear regulated power supply design, design of crowbar and foldback protection circuits, line filter, fuse selection, Positive, negative and dual power supply, floating power supply.
Switched mode power supplies, forward, flyback, buck & boost converters, design of transformers and control circuits for SMPS.
B. Design of programmable power supply.

Unit II
Design of Audio Amplifier (8 Hrs)
A. Selection of microphone, Signal conditioning; grounding, shielding and guarding techniques; design of multistage amplifier, power amplifier; impedance matching, biasing and stability issues, interfacing with loudspeaker; Volume control, Bass boost design, graphic equalizer.
B. Design of Class D audio amplifier

Unit III
Discrete Circuit Design (8 Hrs)
A. Switched capacitors- design issues and applications like DC to DC converters, filters, ADC etc. Phase Locked Loop, Voltage Controlled Oscillator, applications like FM detector, FSK demodulator, frequency multiplier. PLL IC 565
B. AM Detector

Unit IV
Introduction to RF Design (8 Hrs)
A. RF behaviour of passive components, Chip components and circuit board considerations, scattering parameters, Analysis of amplifier using scattering parameter.
RF filter – Basic resonator and filter configurations – Butterworth. Implementation of microstrip filter design. Band pass filter and cascading of band pass filter elements, stability issues. RF amplifier design- Broad band, high power amplifiers, RF oscillator design- stability and phase noise, LNA design, Mixers and receiver design, Use of Smith Chart.
B. ABCD parameters, Basic resonator and filter configurations – Chebyshev filters.
Receiver and transmitter design

Unit V

Reliability & Noise considerations in design of electronics circuits. (8 Hrs)

A. Introduction to reliability and quality, bath tub curve, MTBF, MTTR, failure rate, causes of failure, maintainability, availability, techniques to enhance system reliability, fault tree technique.
Noise: definition, noise reduction and interference eliminating methods, grounding, shielding. Noise considerations in transistors and opamp.

B. EMI, EMC, ESD constraints in circuit design.

<table>
<thead>
<tr>
<th>Text Books</th>
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<tbody>
<tr>
<td>2. “Noise Reduction Techniques in Electronics Circuits”, Henry Ott, John Wiley &amp; Sons</td>
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<tr>
<td>3. “SMPS Design”, Abraham Pressman,</td>
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<td>4. “Audio amplifier design handbook” Philips</td>
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<td>7. “RF Circuit Design- Theory and Applications”, Reinhold Ludwig, Pavel Bretchko</td>
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<tr>
<td>1. “High Frequency Switching Power Supplies: Theory &amp; Design”, George Chryssis,</td>
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<td>3. Datasheets of regulated power supply IC, signal conditioning IC, graphic equalizer IC, Tone control IC, RF transistor, PLL IC 565, etc</td>
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Course Outcomes:
The student will be able to-
1. Design reliable power supplies.
2. Design an audio system on paper.
3. Explain switched capacitor circuits and Phase Locked loops.
4. Describe RF circuit behavior.
5. Apply noise reduction techniques in electronic circuit design.
Tutorial Course Syllabus

ELECTRONICS CIRCUIT DESIGN

Credits: 01  Teaching Scheme: - Tutorial 1 Hrs/Week

List of Tutorial

1. To design a Linear regulated power supply.
2. To design a Linear regulated power supply.
3. To design a SMPS.
4. To design a SMPS.
5. To design a multi-stage amplifier.
6. To design an Audio amplifier.
7. To design an Audio amplifier.
8. To design a circuit using switched capacitor.
9. To design a circuit using PLL.
10. To study Smith Chart.
11. To design an RF amplifier.
12. To design an RF amplifier.
**EC 40103 : CODING AND DATA COMPRESSION**

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### Unit I
**Information Theory & Source Coding** (8 Hrs.)

A. Introduction, Information & Entropy, Probability & Markov models; Uniquely decodable codes, Prefix codes, Source Coding Theorem, Shannon Fanon, Huffman codes  
B. Discrete Memory less Channel & Mutual Information

### Unit II
**Huffman Coding** (8 Hrs.)

A. Optimality of Huffman Codes, Extended Huffman codes, Adaptive Huffman codes, Golomb & Rice codes, Applications of Huffman coding  
B. Linear Block Codes, Trellis Codes, Cyclic codes, Convolution Codes, Viterbi decoding, Channel capacity and coding allocations

### Unit III
**Lossless Coding** (10 Hrs.)

B. Applications– Lossless image compression, text compression, Audio Compression

### Unit IV
**Scalar & Vector Quantization** (7 Hrs.)

A. Uniform Quantizer, Adaptive Quantizer – Forward & Backward adaptive quantizer, Jayant quantizer, non-uniform quantizer, vector quantization, Trellis coded quantization  
B. Advantages of vector quantization over scalar quantization, Linde-Buzo-Gray (LBG) algorithm, application of LBG algorithm to image compression

### Unit V
**Transform coding** (7 Hrs.)

A. Necessity of transforms, Discrete Cosine, Sine, Walsh, Hadamard transform, KL transform, Quantization and coding of transform coefficients, JPEG image compression.  
B. Applications– Lossy image compression, Audio & Video Compression, Modified Discrete Cosine Transform (MDCT)
### Text Books
2. Khalid Sayood, ‘Introduction to Data Compression’, Elsvier publication, 3rd edition,

### Reference Books

### Course Outcomes:
The student will able to-
1. Explain various lossless and lossy compression methods.
2. Calculate the effect and efficiency of data compression algorithms.
3. Apply compression algorithms to text, signal and image.
Laboratory Course Syllabus

EC 40301 : CODING AND DATA COMPRESSION

| Credits: 01 | Teaching Scheme: - Laboratory 2 Hrs/Week |

List of Practicals

1. Linear Block Coding/ Convolution Coding
2. Unique Decodability Test
3. Huffman Coding.
4. Golomb Coding
5. Arithmetic Coding
6. Lempel Ziv-77
7. Uniform Quantizer
8. Jayant Quantizer
9. Discrete Cosine Transform
10. Miniproject

Course Outcomes:
The student will be able to-

1. Implement various lossless and lossy compression methods.
2. Apply text, signal and image compression techniques to specific application.
EC 40104 : COMPUTER NETWORK

Credits: 03  
Teaching Scheme: - Theory 3 Hrs/Week

Unit I  
Network Architecture and OSI reference model  

B. Transmission Media: Guided media and Unguided media

Unit II  
TCP/IP Protocol Suite  

B. Overview of IPv6

Unit III  
Local Area Networks  
A. Introduction to Local Area Networks, IEEE Standards for LANs, Wired LANs, Wireless LANs: IEEE 802.11, Channel Access Methods, Fast Ethernet, Gigabit Ethernet.

B. LAN Components: NIC, HUB, Switch, Bridge, Router, Gateway.

Unit IV  
Wide Area Networks  
A. Introduction to Wide Area Networks, SONET/SDH, Frame Relay, ATM, Wireless WANs. Congestion Control

B. Routing Algorithms.

Unit V  
Network Management & Security  

B. Encryption, Decryption Algorithms
Text Books

1. Computer Networks (3rd edition), Tanenbaum Andrew S., International edition,

Reference Books

1. Data and computer communication by William Stallings.

Course Outcomes:

The student will be able to-

1. Describe OSI reference Model.
3. Design Local Area Networks.
4. Describe the Wide Area Networks.
5. Apply algorithms for Data security in Networks.
**Tutorial Course Syllabus**

**COMPUTER NETWORK**

| Credits: 01 | Teaching Scheme: - - Tutorial 1 Hr/Week |

List of Tutorials

1. Basic media/ channel used in Computer networks.
2. Cable and connectors preparation
3. LAN card
4. Network components
5. LAN MAN architecture
6. Design of Network
7. Sliding window protocol
8. Dial up modems
9. Web Server FTP server
10. Mini projects based on course

**Text Books**

1. Computer Networks (3rd edition), Tanenbaum Andrew S., International edition,

**Reference Books**

1. Data and computer communication by William Stallings.
Theory Course Syllabus

EC41101 : EMBEDDED SYSTEMS

Credits: 03

Teaching Scheme: - Theory 3 Hrs/Week

Unit I
Embedded System Architecture

(8 Hrs)

A. Introduction, History, Application of embedded systems, Hardware and software architecture, Processor selection for Embedded System, Memory Architecture and IO devices, Interrupt Service Mechanism, Context switching, Device Drivers

B. Recent trends in embedded systems.

Unit II
Embedded processors

(8 Hrs)

A. ARM Processor: Architecture and Programming: RISC and CISC, ARM organization, ARM Programmers model, operating modes, Exception Handling, Nomenclature. Introduction to ARM instruction set

B. ARM Core Extensions

Unit III
Protocols

(8 Hrs)

A. Bluetooth, Wireless Ethernet, MODBUS, CAN and USB

B. Applications of protocols

Unit IV
Real Time Operating System

(8 Hrs)

A. Architecture of the kernel, Task scheduler, ISR, Semaphores, Mailbox, Message queues, Pipes, Events, Timers, Memory Management.

B. RTLinux architecture and specifications

Unit V
System Design Techniques

(8 Hrs)

A. Design goals, Development strategies, software development, cross compilation and code generation, porting to the final target system, generation of test modules, Target hardware testing, future techniques, relevance to more complex design, the need for emulation. Examples: Burglar alarm system, Set Top box, Smart card
B. Automobile electronic

<table>
<thead>
<tr>
<th>Text Books</th>
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<tbody>
<tr>
<td>1. Raj Kamal,”Embedded Systems “ TMH</td>
</tr>
<tr>
<td>2. Sloss etal ,”ARM Developers Guide”.</td>
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</tbody>
</table>

<table>
<thead>
<tr>
<th>Reference Books</th>
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</thead>
<tbody>
<tr>
<td>1 Dr. K.V.K.K. Prasad “Embedded / Real Time Systems” Dreamtech</td>
</tr>
<tr>
<td>2 Iyer , Gupta “ Embedded Real systems programming “ TMH.</td>
</tr>
</tbody>
</table>

Course Outcomes:
The student will be able to-
1. Explain components of embedded system.
2. Compare communication protocols used in embedded applications.
3. Explain architecture of ARM processor.
4. Relate RTOS kernel functions with general purpose OS functions.
5. Design embedded system such as burglar alarm, Set top box and smart card.
Laboratory Course Syllabus

<table>
<thead>
<tr>
<th>EC41301 : EMBEDDED SYSTEMS</th>
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<tr>
<td>Credits: 02</td>
</tr>
<tr>
<td>Teaching Scheme: - Practical 2 Hrs/Week</td>
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</table>

List of Practicals

1. Interfacing LED to LPC2294
2. Interfacing Seven Segment to LPC2294
3. Interfacing 4X4 Matrix Keyboard to LPC2294
4. Interfacing 2X16 LCD in 4bit Mode to 2294
5. LPC 2294 Serial Communication
6. LPC 2294 ADC
7. Power Down Mode of LPC2294
8. Interfacing LCD and Keyboard to LPC2294 with RTOS
9. Task scheduling with priority using RTOS functions
10. Implementation of semaphore for given task switching using RTOS

Course Outcomes:

The student will be able to

1. Interface peripheral devices with ARM 7 processor.
2. Program peripheral devices interfaced with ARM7 processor.
3. Analyze RTOS kernel functions.
EC42102 : ARTIFICIAL INTELLIGENCE

Credits: 03          Teaching Scheme: - Theory 3 Hrs/Week

Unit 1:
Introduction To Artificial Intelligence  (6+1Hrs)
A) AI task domain, problem representation in AI, Problem characteristics.
B) Game playing using AI.

Unit 2:
Searching Techniques  (9+1Hrs)
A) A.I. search process, non-heuristic and heuristic search techniques, constrain satisfaction and their applications.
B) Min-max search procedure.

Unit 3:
Knowledge Representation  (8+1Hrs)
A) Hierarchy of knowledge, types of knowledge, knowledge representation, methods for knowledge representation, predicate logic, Problems on predicate logic.
B) Introduction to PROLOG.

Unit 4:
Planning  (8+1Hrs)
A) Components of planning system, goal stack planning technique.
B) Nonlinear Planning using Constraint Posting.

Unit 5:
AI Tools  (9+1Hrs)
A) Expert System Shells, Explanation, and Knowledge Acquisition. Human expert behaviors, Expert system components, structure of expert system, the production system, how expert system work and Expert system development for particular application.
Natural language processing: Introduction, Syntactic Processing, Semantic Analysis, Discourse and Pragmatic Processing.
Architectures and functions in ANN, various learning rules. Building an ANN.
B) Building an Expert System

Text Books:-
1. Elain Rich and Kerin Knight, “Artificial Intelligence”
2. Elements of Artificial Neural Networks - by Kishan Mehrotra, Chilukurik. Mohan, Sanjay Ranka Penram International Publishing (India) Pvt. Ltd. Second edition,

Reference Books:-
4. Relevant IEEE papers.

Course Outcomes:
The student will be able to-
1. Identify real world problems of AI domain.
2. Write algorithms for searching techniques.
3. Describe real world problem in symbolic form.
4. Develop an expert system.
Tutorial Course Syllabus

ARTIFICIAL INTELLIGENCE

Credits: 01  Teaching Scheme: - Tutorial 1 Hrs/Week

List
1. To study of any game playing using non heuristic search technique.
2. To study of Eight tile puzzle.
3. To study of heuristic search technique like A*.
4. To study of heuristic search technique like AO*.
5. To study of heuristic search technique like Hill Climbing.
6. Neural network architecture for character recognition..
7. Neural network architecture for pattern classification or clustering application.
9. Mini-project (Individual task).

Text Books
1. Elain Rich and Kerin Knight, “Artificial Intelligence”
2. Roberts, “Artificial Intelligence”
Unit 1: Probability and Statistics for Pattern Recognition: (6 Hrs.)

Part A: Pattern recognition systems, design cycle, learning and adaptation. Case studies of Pattern recognition
Part B: Statistical and syntactic pattern recognition

Unit 2: Bayesian decision theory & Optimal classifiers: (8 Hrs.)

Part A: Classification problem, classification error, Bayes minimum error classifier, Bayes minimum risk classifier, discriminant functions and decision surfaces
Part B: discriminant functions and decision surfaces – multidimensional case for distributions

Unit 3: Parametric and Non-parametric estimation : (9 Hrs.)

Part A: Parametric estimation of probability density functions, non parametric estimation of probability density functions, Parzen windows, k-nearest neighbor classifier
Part B: implementation of Parzen windows for estimation

Unit 4: Linear Discriminent functions & classifiers: (9 Hrs.)

Part A: Properties of linear classifiers, linearly separable training samples, perceptron criterion and algorithm, minimum squared error criterion, Support vector machines
Part B: Fisher’s linear discriminant

Unit 5: Unsupervised learning & Clustering: (8 Hrs.)

Part A: Unsupervised learning & Clustering, Stages in clustering , hierarchical clustering, partitional clustering
Part B: Expectation-maximization(EM) algorithm

Text Books:
Course Outcomes:
The student will be able to-

1. Explain the process of Pattern Recognition.
2. Apply probability theory to estimate classifier performance.
3. Describe the principles of parametric and non parametric classification methods.
4. Compare pattern classifications and pattern recognition techniques.
5. Apply Pattern Recognition techniques to real world problems such as image analysis, character recognition, etc.
**Tutorial Course Syllabus**

**PATTERN RECOGNITION**

| Credits: 01 | **Teaching Scheme:** - Tutorial 1 Hrs/Week |

**List of Contents**

2. Analysis of Bayesian Decision theory continuous features
3. Analysis of Bayesian Decision theory discrete features
4. Analysis of Maximum-Likelihood estimation
5. Study of different Classification methods.
6. Analysis of Neighbour method-1
7. Analysis of Neighbour method-2
8. Analysis of Linear discriminant function
9. Analysis of Support vector machines
10. Analysis of Algorithms for clustering-1
12. Analysis of cluster validation

**Text Books**


**Reference Books**

1. Pattern Recognition and Machine Learning, C.M.Bishop, Springer, 2006
FF No. : 654 A

Theory Course Syllabus

EC42127 : HIGH POWER SEMICONDUCTOR DEVICES

| Credits: 03 | Teaching Scheme: - Theory 3 Hrs/Week |

Unit I  
Transport Physics  
(8 Hrs)

A. Intrinsic silicon mobility - Temperature dependence and Electric field dependence Intrinsic silicon resistivity, SRH recombination, Auger recombination, Lifetime control

B. Band-gap narrowing

Unit II  
Breakdown Voltage  
(8 Hrs)

A. Drift Region, Avalanche breakdown, Punch Through & Non Punch Through, Edge terminations

B. Bevel edge termination

Unit III  
Bipolar Semiconductor Devices  
(8 Hrs)

A. PiN rectifier, Introduction to Junction Barrier Controlled Schottky (JBS) rectifier and Merged PiN Schottky (MPS) rectifier, Power bipolar junction transistor

B. Darlington power transistor

Unit IV  
Power MOSFET  
(8 Hrs)

A. Detail conduction characteristic, Switching performance, Planar structure of power MOSFET, Introduction to Diffusion Metal Oxide Semiconductor (DMOS), Lateral Diffused Metal Oxide Semiconductor (LDMOS), UMOS(U shape MOS), Vertical MOS (VMOS)

B. Silicon carbide MOSFET
Unit V  

Novel Devices  

A. IGBT - Planar IGBT and Trench IGBT, Introduction to Power devices - MOS-Controlled Gate Turn-Off Thyristor (MOS-GTO), MOS-Controlled Thyristor (MCT), Emitter Switched Thyristor (EST), Base Resistance controlled Thyristor (BRT), Use of wide band-gap semiconductor in power devices.

B. Performance comparison of Insulated Gate Bipolar Transistor (IGBT), Base Resistance controlled Thyristor (BRT), Emitter Switched Thyristor (EST)

Text Books


Reference Books


Course Outcomes:

The student will be able to-

1. Analyse Shockley-Read-Hall (SRH) Generation and Recombination processes in a semiconductor.
2. Differentiate between Zener and Avalanche Breakdown.
3. Identify the type of termination technique used in a power device.
4. Draw energy band diagram for Metal-Oxide-Semiconductor (MOS) structure.
5. Compute threshold voltage of a MOSFET.
6. Relate the output resistance of IGBT to symmetric or asymmetric structure.
HIGH POWER SEMICONDUCTOR DEVICES

Credits: 01  
Teaching Scheme:-Tutorial 1 Hr/Week

List of Tutorials

1. Temperature dependence of silicon mobility
2. Life time control
3. Breakdown voltage of PTNT structure
4. On state losses for PiN rectifier
5. Quasi saturation of BJT
6. Kirk current density for BJT
7. Threshold voltage of power MOSFET
8. Drift region resistance of Laterally Diffused Metal Oxide Semiconductor (LDMOS)
9. Drift region of symmetric IGBT

Text Books


References

Theory Course Syllabus

EC42107 : MICROWAVE ENGINEERING

Credits: 03
Teaching Scheme: - Theory 3 Hrs/Week

Unit I
MICROWAVE TRANSMISSION LINES


Unit II
WAVEGUIDE COMPONENTS AND APPLICATIONS

A. Cavity Resonators: Introduction, Rectangular and Cylindrical Cavities, Dominant Modes and Resonant Frequencies, Q factor and Coupling Coefficients. Waveguide Multiport Junctions – E plane Tee, Magic Tee.


B. Study H-plane, Directional Coupler, Circulator & find out S Matrix Calculations for H-plane, Directional Coupler, Circulator.

Unit III
MICROWAVE TUBES

A. Limitations and Losses of conventional tubes at microwave frequencies. Microwave tubes – O type and M type classifications.


ii) M-type Tubes Introduction, Cross-field effects, Magnetrons – Different Types, 8-Cavity Cylindrical Travelling Wave Magnetron – Hull Cut-off, Modes of Resonance and PI-Mode Operation, o/p characteristics.

Travelling Wave Magnetron – Hull Cut-off, Modes of Resonance and PI-Mode Operation, o/p characteristics.

Unit IV

MICROWAVE SOLID STATE DEVICES

A. Principle, Construction, Characteristics and applications of Gunn Diode, Tunnel Diode, PIN diode, Varactor diode, MASER.

B. Principle, Construction, Characteristics and applications of PIN diode, IMPATT and TRAPATT.

Unit V

REAL WORLD APPLICATIONS OF MICROWAVE ENGINEERING

A. Study of Microwave engineering such as in
   i) Radars
   ii) Communication
   iii) Industrial applications


Text Books

2. Microwave and Radar Engineering – M. Kulkarni, Umesh Publications

Reference Books


Course Outcomes:
The student will be able to-

1. Model microwave sources and components mathematically.
2. Describe structure, characteristics and applications of Microwave solid state devices.
3. Design Microwave communication system.
4. Apply knowledge of Microwave Engineering to design RADAR system.
FF No. : 654 C

Tutorial Course Syllabus

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<th>Credits: 01</th>
<th>Teaching Scheme: - Tutorial 1 Hr/Week</th>
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1. Study of Microwave components.
2. Derive the expressions for Waveguide parameters.
4. Study the characteristics of Reflex klystron.
5. Study the domain formation in Gunn diode.
6. Study V-I characteristics of Gunn diode.
7. Calculate Scattering matrix for Magic Tee.
8. Study port parameters of Magic Tee.
9. Study construction details of Circulator.
10. Calculate port parameters of Circulator.
11. Calculate Directivity, Coupling factor and insertion loss for 10 dB / 20 dB Directional Coupler.

Text Books

Reference Books
FF No. : 654 A

Theory Course Syllabus

<table>
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<tr>
<th>Credits: 03</th>
<th>Teaching Scheme: - Theory 3 Hrs/Week</th>
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### Unit 1
**Introduction to ANN :-**


**PART (B)** Applications of neural networks.

### Unit 2
**Supervised Learning**


**PART (B)** Radial basis functions, probabilistic networks.

### Unit 3
**Unsupervised & Associative Learning**


**PART (B)** Principal Component Analysis, Boltzman machines, Hetero-associators

### Unit 4
**Evolutionary Optimization**


**PART (B)** Hybrid evolutionary Approaches.

### Unit 5
**Fuzzy Logic**

**PART (A)** Fuzzy sets and fuzzy rules, Fuzzy relations, Properties of Fuzzy sets, Fuzzy graphs, Fuzzy numbers, Functions with Fuzzy arguments, Arithmetic operations on fuzzy numbers.

**PART (B)** Applications of fuzzy logic.

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**Text books**

EC42110: ARTIFICIAL NEURAL NETWORKS AND FUZZY LOGIC
Reference books
1. Neural Network and Fuzzy system by Bart Kosko, John c. Burgess.
2. Fundamental of Artificial Neural Networks. By M.H. Hassoun.
3. Introduction to Artificial Neural Network system by M.Zurada.

Course Outcomes:
The student will be able to-
1. Solve problems using supervised, unsupervised, associative learning techniques.
2. Solve real word problem using fuzzy logic.
**Tutorial Course Syllabus**

<table>
<thead>
<tr>
<th><strong>ARTIFICIAL NEURAL NETWORKS AND FUZZY LOGIC</strong></th>
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<td><strong>Credits:</strong> 01</td>
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To build and test following Neural Networks:

1. Perceptron Neural Network.
2. Hebbin Neural Network.
3. Hamming Neural Network.
4. Hanning Neural Network.
5. McCulloach Pitts Neural Network.
7. Max Net Neural Network.
8. Competitive Neural Network.
9. Mini project.

**Text books**


**Reference books**

1. *Neural Network and Fuzzy system* by Bart Kosko, John c. Burgess.
2. *Fundamental of Artificial Neural Networks* by M.H. Hassoun.
3. *Introduction to Artificial Neural Network system* by M.Zurada.
## Theory Course Syllabus

<table>
<thead>
<tr>
<th>EC 42111 : WIRELESS SENSOR NETWORKS</th>
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<td>Credits: 03</td>
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</table>

### Unit I
**Introduction and Wireless Sensor Networks (WSN) Infrastructure** (8 Hrs)
B. WSN Applications

### Unit II
**Localization and Sensor - Medium Access Control** (8 Hrs)
A. Sensor management and Bayesian networks, Time Synchronization, Types of Localization, Key assumptions, Localization algorithms, IEEE 802.11 standard, IEEE 802.15.4 standard. Fundamentals of MAC protocols
B. MAC protocols like S-MAC, P-MAC, Z-MAC, T-MAC, L-MAC etc,

(Swapped the underlined topics in Part A & B)

### Unit III
**Routing protocols for WSN and Network simulators** (8 Hrs)
A. Delaunay triangulation, Prim’s algorithm, Euclidean minimum spanning tree, DSR algorithm, Introduction to Network simulators
B. Network Simulators TinyOS, Nes C, TOSSIM, NS-2, NS-3, Qualnet

(Shifted a topic of Part A into Part B. The earlier topic of Part B is removed since it is covered in tutorials.)

### Unit IV
**Security Issues in WSN** (8 Hrs)
A. Attacks in WSN, Wormhole attack, DOS attack, Sybil attack, Sinkhole attack, Phantom Nodes, Methods for increasing immunity to attacks, Effect of attacks on QoS
B. Countermeasures to sustain the attacks in WSN

### Unit V
**Performance and traffic management in WSN** (8 Hrs)
A. Introduction to Convex Optimization, Optimizing Placement and location of Sensor Nodes Performance modeling – Traffic model, Energy model etc, Performance Metrics,

B. Modification of energy models to suit the various operating environments of WSN.

**Text Books**

**Reference Books**
1. IEEE papers on MAC protocols.
2. IEEE papers on Attacks in WSN.
3. “Getting started with ns-2” http://nsnam.isi.edu
4. “NS by example” http://nile.wpi.edu/NS/menu.html
5. IEEE papers on Localization Algorithms

**Course Outcomes:**
The student will be able to-
1. Design WSN nodes.
2. Design a basic WSN system.
3. Simulate basic WSN routing scenario in ns-2.
4. Explain security issues in WSN.
Tutorial Course Syllabus

WIRELESS SENSOR NETWORKS

Credits: 01 Teaching Scheme: - - Tutorial 1 Hr/Week

List of Contents

1. Installation of Linux.
2. Installation of Linux.
3. Installation of ns-2 network simulator.
4. Installation of ns-2 network simulator.
5. Simulation of 2-node topology.
7. Simulation of shared link communication.
8. To generate a trace file & study its contents.
9. To create output files for XGraph.
10. To generate node movement and traffic connection files for large wireless scenarios.
11. To design a wireless sensor node.

Text Books


Reference Books

1. IEEE papers on MAC protocols.
2. IEEE papers on Attacks in WSN.
3. “Getting started with ns-2” http://nsnam.isi.edu
4. “NS by example” http://nile.wpi.edu/NS/menu.html
Theory Course Syllabus

EC42131 : COMPUTER VISION

| Credits: 03 | Teaching Scheme: - Theory 3 Hrs/Week |

Unit I (8 Hrs)
Introduction To Computer Vision

A. Human Vision System; Computer Vision System; Camera Geometry Fundamentals
B. Common Probability Distributions; Fitting Probability Models

Unit II (8 Hrs)
Image Formation and Image Preprocessing

A. Geometric primitives and transformations; Photometric image formation; The digital camera; Point Operators; Linear Filtering; Neighborhood Operators; Pyramids and Wavelets
B. Fourier Transforms; Geometric transformations

Unit III (8 Hrs)
Feature Detection and Extraction

A) Feature detection; Feature Descriptors; Feature Matching; Feature Tracking; Low Level Feature Extraction; Feature Extraction by Shape Matching
B) Hough Transform; Edge Linking

Unit IV (8 Hrs)
Object Recognition, Segmentation and Classification

A. Global Methods; Active Contours; Split and Merge; Mean Shift and Mode Finding; Normalized Cuts; Support Vector Machine; Histogram of Oriented Gradients; Adaboost classifiers
B. Graph cuts and energy-based methods

Unit V (8 Hrs)
Dense Motion Estimation

A. Triangulation; Two-frame structure from motion; Factorization; Bundle adjustment; Translational alignment; Parametric motion; Spline-based motion; Optical flow; Tracking
B. Constrained structure and motion; Layered motion; Stereo Vision
Text Books


Reference Books


Course Outcomes:
The student will be able to-
1. Compare human and computer vision system.
2. Explain camera geometry fundamentals and image formation.
3. Develop feature vectors for object detection purpose.
Tutorial Course Syllabus

COMPUTER VISION

| Credits: 01 | Teaching Scheme: - Tutorial 1 Hr/Week |

List of Tutorials

1. To study contrast adjustment of a given image
2. Fixed and adaptive thresholding of an image
3. Image denoising
4. 2-D spatial transformation to image
5. Implementation of filters - averaging / linear / non-linear / Gaussian / Butterworth
6. Detection of an edge / curvature in a given image and curve fitting
7. Implementation of SURF / SIFT / HOG / edgelet / shapelet detector
8. Object detection using Hough transform / Template matching
9. Object classification using SVM / Adaboost classifier
10. Object tracking using Kalman filter approach

Text Books


Reference Books

**Theory Course Syllabus**

**EC4213: SPEECH AND VIDEO PROCESSING**

<table>
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<tr>
<th>Credits: 03</th>
<th>Teaching Scheme: - Theory 3 Hrs/Week</th>
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**Unit I: Speech processing concepts (8 Hrs)**
A. The speech production mechanism, Discrete time speech signals, Pole-Zero modeling of speech, relevant properties of the fast Fourier transform for speech recognition, convolution, linear and non linear filter banks, spectral estimation of speech using DFT.
B. Linear Prediction analysis of speech.

**Unit II: Speech recognition (8 Hrs)**
A. Real and Complex Cepstrum, application of cepstral analysis to speech signal, feature extraction for speech, static and dynamic feature for speech recognition, robustness issues, discrimination in the feature space, feature selection, MFCC, LPCC, Distance measures, vector quantization models.
B. Gaussian Mixture model, HMM.

**Unit III: Basics of Video Processing (8 Hrs)**
A. Video formation, perception and representation: Principle of color video, video cameras, video display, pinhole model, CAHV model, Camera motion, Shape model, motion model, Scene model, two dimensional motion models.
B. Three Dimensional Rigid Motion, Approximation of projective mapping.

**Unit IV: Motion estimation Techniques (8 Hrs)**
A. Optical flow, motion representation, motion estimation criteria, optimization methods, pixel based motion estimation, Block matching algorithm, gradient Based, Intensity matching, feature matching, frequency domain motion estimation, Depth from motion.
B. Motion analysis applications: Video Summarization, video surveillance.

**Unit V: object tracking and segmentation (8 Hrs)**
A. 2D and 3D video tracking, blob tracking, kernel based counter tracking, feature matching, filtering Mosaicing, video segmentation, mean shift based, active shape model, video short boundary detection.
B. Interframe compression, Motion compensation,
Text Books:
1. Digital Video processing, A Murat Tekalp, Prentice Hall.
4. Video Processing and Communications, Yao Wang, J. Ostermann and Qin Zhang, Pearson Education

Reference Books:
2. “Digital image sequence processing, Compression, and analysis”, Todd R. Reed, CRC Press

Course Outcomes:
The student will be able to-
1. Describe the mechanisms of human speech production system and methods for speech enhancement.
2. Understand basic algorithms of speech analysis and speech recognition.
3. Explain basic techniques in digital video processing, including imaging characteristics and sensors.
4. Apply motion estimation and object tracking algorithms on video sequence.
Speech and Video Processing

Credits : 01  
Teaching Scheme : Tutorial 1 Hrs/ Week

List of Tutorials

1. Pole Zero modeling of speech signal
2. Linear and nonlinear filter bank
3. LPC
4. Cepstral Analysis
5. MFCC
6. Vector Quantization
7. Motion estimation
8. Frequency domain motion estimation
9. Kernel based tracking
10. Video short boundary detection

Text Books:

1. Digital Video processing, A Murat Tekalp, Prentice Hall.

Reference Books:

2. “Digital image sequence processing, Compression, and analysis”, Todd R. Reed, CRC Press
Unit I
INTRODUCTION TO FIBER OPTIC COMMUNICATION
(8+1 Hrs)
A. Overview of optical fiber communication: Fiber optic communication system, Advantages of optical fiber communication, Ray theory transmission, total internal reflection. Parameters of fiber optic cable: Acceptance angles, Numerical aperture, skew rays, Mode, Index Profile, V number. Types of fiber optic cable.
B. Material of fiber optic cable, Manufacturing process of fiber optic cable.

Unit II
SIGNAL DEGRADATION IN FIBER OPTIC CABLE
(8+1 Hrs)
A. Signal distortion in optical fibers: Attenuation, Material absorption, Scattering losses (linear), Bending losses, Dispersion present in FOC, Fiber attenuation measurement, Optical Time Domain reflectometer (Principle, concept & applications).
B. Nonlinear scattering losses, Fiber dispersion measurement

Unit III
OPTICAL SOURCES, DETECTORS AND SENSORS
(10+1 Hrs)
B. Optical Connectors & splices to connect Fiber optic cables.

Unit IV
FIBER OPTIC SYSTEM
(8+1 Hrs)
A. Optical transmitter circuit, Optical receiver circuit, Link power budget, Rise time budget, Analog system design.
B. Digital system design

Unit V
(6+1 Hrs)
REAL WORLD APPLICATIONS OF FIBER OPTICS

A. Study of fiber optics such as in
   i) Underwater communication
   ii) Telephone system
   iii) Military applications

B. Optical Networks: SONET/SDH, Wavelength Division multiplexing

**Text Books**


**Reference Books**


**Course Outcomes:**

The Student will be able to-

1. Explain the key aspects of propagation through different types of fiber.
2. Analyze losses of signals.
3. Describe fiber optic communication system.
4. Prepare the budget for implementing the fiber optic communication system.
5. Relate type of fiber optic communication to a specific application.
Laboratory Course Syllabus

EC42301 : FIBER OPTIC COMMUNICATION

Credits: 01  Teaching Scheme: - Laboratory 2Hrs /week

List of Practicals

3. Study of transmission of Analog and Digital signals through fiber optic cable.
4. Study and plot V-I characteristics of optical source.
5. Study and plot frequency response of optical receiver.
6. Study of transmission of Voice through fiber optic cable.
7. Study of transmission of FM signal through fiber optic cable.

Text Book


Course Outcomes:

The Student will be able to-
1. Classify different types of fibers and losses in fibers.
2. Analyze distortion, desperation and losses of signals.
3. Select detectors and sensors depending on type of fiber.
4. Explain working of transmitter and receiver circuit.
5. Calculate parameters of fiber optic cable.
6.
Theory Course Syllabus

EC42105: VLSI DESIGN

Credits: 03  Teaching Scheme: - Theory 3 Hrs/Week

Unit I: MOSFET SPICE Modeling

(8 Hrs)

A. Modeling of semiconductor devices, Small signal model for MOS transistor, Modeling of secondary & short channel effects, sub threshold modeling, understanding role of parameters in model, MOSFET scaling.

B. Industry standard models like PSP, Bsim

Unit II: Analog CMOS sub-circuits

(8 Hrs)

A. MOS Switch, Charge feed through error, MOS diode, Current Sink and Sources, Basic current mirror, Output impedances: Basic current mirror, Source degenerated current mirror, Cascode current mirror. Designing of cascode current mirror for high swing with and without channel length modulation effect Aspect ratio error, Reduction of the aspect ratio error Current and voltage references.

B. Design of a Bandgap voltage reference.

Unit III: CMOS Amplifiers

(8 Hrs)

A. CMOS Amplifiers, Inverters, Active load Inverter, Current Source Inverter, Push pull inverter, Noise analysis of inverter, Differential amplifier, Large Signal analysis, Calculation of the worst case input common mode range of the N channel input differential amplifier, Small signal analysis of differential amplifier, Slew rate and noise, Current source load differential amplifier, Design of a CMOS differential amplifier with a current mirror as a load.

B. Cascode amplifier.

Unit IV: Advanced combinational blocks and Memory Design

(8 Hrs)

A. Adder- Improved Single bit adder, Manchester carry adder, Multipliers- Array multiplier, Wallace tree multiplier, Booth Multiplier, Shifters-Barrel shifter, logarithmic shifter, Synchronizers and Arbiters. CMOS Memories-classification of memories, Memory architecture, read only memories, Design of ROM with NAND and NOR based ROM; RAM: 6T SRAM, Design issues in SRAM, 3T and 1T DRAM.

B. Carry Save adder, Carry Select adder, Parity generator, Comparator.
Unit V: Fabrication and Layout (8 Hrs)

A. Basic CMOS fabrication flow, Design of process flow and optimization of Mask. Self aligned CMOS process, N well, Twin tub, Stick diagram, Design rules, Layout of CMOS Inverter, LVS.

B. P well, Layout of combinational circuits.

Text Books
3. “VLSI Technology”, S.M.Sze, , TMH.

Reference Books

Course Outcomes:

The Students will be able to –
1. Describe the operation and I-V characteristics of MOSFET.
2. Design the MOS based circuits like CMOS, Pseudo NMOS inverter.
3. Analyze the performance of basic building block of OTA.
4. Evaluate the performance of carry save adder, Manchester carry adders, carry select adder.
5. Draw the layout of MOS based circuit.
Laboratory Course Syllabus  
EC42302: VLSI DESIGN  

Credits: 01  
Teaching Scheme: - Laboratory 2 Hrs/Week

List of Practical

1. I-V characteristics of MOS using SPICE  
2. To simulate MOS as a switch  
3. To simulate Current mirror  
4. To simulate Differential Amplifier  
5. To simulate Adder.  
6. To simulate Latch.  
7. To draw the layout of CMOS inverter.  
8. To draw the layout of two input logic gate.  
9. Course project based on Spice and/or Layout tool

Text Books

3. “VLSI Technology”, S.M.Sze, , TMH.

Reference Books


Course Outcomes:
The Student will be able to-

1. Write SPICE netlist for analog and digital circuits.  
2. Simulate the spice code for MOS based analog and digital circuits.  
3. Draw the layout for MOS based circuit in editor.  
4. Back annotate the drawn layout and simulate.
Theory Course Syllabus

EC42106: DIGITAL IMAGE PROCESSING

Credits: 03  
Teaching Scheme: - Theory 3 Hrs/Week

Unit I  
Digital Image Fundamentals and Image Enhancement  
(8 Hrs)  
A) Elements of visual perception, Image sampling & Quantization, Basic grey level transformations, histogram processing, enhancement using arithmetic and logic operators, spatial filtering – smoothing and sharpening filters, Median Filter  
B) Colour fundamentals, colour models, pseudo colour

Unit II  
Morphological Image Processing  
(6 Hrs)  
A) Neighbourhood concepts, adjacency and distance measures, dilation & erosion, opening & closing operations, basic morphological operations such as region filling, thinning, thickening, skeletons, pruning for binary images.  
B) Morphological operations for gray scale images

Unit III  
Image Segmentation  
(8 Hrs)  
A) Detection of discontinuities, edge linking and boundary detection, thresholding, Region based segmentation, use of watersheds, image representation- chain codes, boundary descriptors & regional descriptors  
B) Other segmentation techniques

Unit IV  
Image Transforms  
(10 Hrs)  
A) Coding, inter pixel and image redundancy, 2-D Discrete Fourier Transform and frequency domain filters, Discrete Cosine Transform – its application in Baseline JPEG, Walsh Hadamard Transform, Fast Walsh Transform, Introduction to Gabor Transform.  
B) Hough Transform

Unit V  
Wavelet Transform in image processing  
(8 Hrs)  
A) Sub band coding, Haar Transform – it’s application as a Wavelet, multi resolution expansions, Wavelet Transform in one dimensions; Wavelet transforms in two dimensions.  
B) Fast Wavelet Transform, Other Applications of Wavelet in image processing

Text Books

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**Course Outcomes:**
The Student will be able to-
1. Explain image model.
2. Perform spatial filtering on image.
3. Analyze image using morphological techniques.
4. Apply segmentation techniques to divide image into parts.
5. Use various image transforms to analyze and modify image.
Laboratory Course Syllabus

EC42303 : DIGITAL IMAGE PROCESSING

Credits: 01  Teaching Scheme: - Laboratory 2 Hrs/Week

List of Practical
1. Conversion of 24 bit color image to 8 bit , 4 bit, 1 bit image
2. Image negation, power Law correction
3. Histogram mapping & equalisation, stretching
4. Image smoothing, sharpening
5. Edge detection – use of Sobel, Prewitt and Roberts operators
6. Morphological operations on binary images
7. DCT/IDCT computation
8. Transform application assignment.

Text Books

Reference Books

Course Outcomes:
The Student will be able to-
1. Perform point operations and filtering in spatial domain.
2. Apply various morphology techniques on an image.
3. Segment image into regions.
4. Use various image transforms on an image.
## EC42112: AUDIO VIDEO ENGINEERING

| Credits: 03 | Teaching Scheme: - Theory 3 Hrs/Week |

### Unit I

#### Basics of Television

A) Scanning process, Composite Video Signal, Horizontal Blank and Sync standard, Vertical Blank and Sync standard, Vestigial Sideband Transmission, TV Channels and Bands, CCIR-B standards, Negative modulation, Inter-carrier Sound System.

B) Construction & working principle of CCD camera, software defined radio.

### Unit II

#### TV Transmission and Reception

A) High Level modulated TV Transmitter, IF modulated TV Transmitter, Transmitting Antenna, Receiving Yagi Antenna, Block Diagram of Monochrome TV Receiver, Pattern Generator, Wobbuloscope.

B) Basic satellite theory (Transponder), Cathode Ray Tube of CRO.

### Unit III

#### Color TV Systems

A) Color fundamentals, Mixing of colors, Color perception, Color Characteristics, Chromaticity diagram, Color TV camera, Frequency Interleaving Principle, Color Bandwidth, Chroma Signal Generation, Color Burst, Simple PAL & PAL-D System, PAL Encoder, PAL Decoder, CTV Receiver Block Diagram, Monochrome and Color Picture Tubes, PAL,NTSC, SECAM systems.

B) Chromaticity diagram, SAW, Ceramic & Comb filters.

### Unit IV

#### Digital Television
A) Merits of DTV, Digitization formats, Source Coding : Compression of Video Signal (JPEG&MPEG), Scrambling and Conditional Access, Channel Coding, Modulation by Digital Signal, Reception of Digital TV Signal, Digital TV Receiver block diagram, LCD and Plasma Displays, Types of digital TV (SDTV, EDTV, HDTV), DTH system.

B) Closed Circuit Television (CCTV), Cable Television (CATV), TV connectors.

Unit V  
Recording And Reproduction

A) A. Principle of MPEG Audio compression, MPEG audio layer III (MPIII format), MPEG-1 audio encoder & decoder, Methods of Recording and Reproduction : Magnetic Recording, Optical Recording, CD/DVD/MP3 Player, Digital Satellite Radio.

B) Construction & working principle of camcorder, Video cassette recorder

Text Books

Reference Books

Course Outcomes:
The student will be able to -
1. Explain the working of a TV receiver.
2. Describe transmission & reception of a TV signal.
3. Compare between analog & digital TV.
4. Interpret compression techniques used in digital TV.
Laboratory Course Syllabus

EC42304: AUDIO VIDEO ENGINEERING

| Credits: 01 | Teaching Scheme: - Laboratory 2 Hr/Week |

List of practicals

1. Study of Pattern Generator
2. Study of Wobbuloscope
3. Tracing of block schematic of color TV
4. Voltage & waveform analysis of color TV
5. Direct to Home (DTH)
6. Visit to Doordarshan Studio, Pune
7. Visit to Sinhgad TV Transmitter
8. Digital TV (DTV)
9. Digital Satellite Radio (DSR)
10. DVD Player
11. High Definition TV
12. Compression Technique.

Note: From this list, any 10 experiments will be carried out.

Course Outcomes:
The student will be able to-
1. Analyze TV transmitter & receiver.
2. Describe DTH and DSR signal reception.
3. Explain recording techniques and playback of audio-video signals.
**Theory Course Syllabus**

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**Unit I**

3 Phase AC/DC Converters

A. Operation and Analysis of 3 phase Semi/ Full Converter with R and R-L load, Effect of Source Impedance(Ls) on Single phase converter, Single phase and Three Phase Dual Converters (Ideal and Practical), Control schemes for non circulating type dual converter, Analysis of circulating current type dual converter.

B. Calculation of converter output with Ls, Microprocessor based firing scheme for dual Converter converter.

**Unit II**

3 Phase Inverters

A. 3 Phase Transistorized Voltage Source Inverter(VSI)- 120° and 180° mode of operation and analysis, PWM Inverters- Techniques and comparison, Voltage Control and Harmonic Reduction in inverters, Introduction to Current Source Inverter.

B. Space Vector Modulation, Multilevel inverters

**Unit III**

PF Improvement and Instrumentation

A. Series and Parallel Operation of Power Devices- String Efficiency, Derating, Triggering requirements, Need of equalizing Network.

Power Factor Improvement Techniques-PAC, Forced Commutation (SAC, EAC), Sequence Control of Series Connected Converters.

Sensing and measurement of Sinusoidal and non-sinusoidal Voltage and Current, Speed, Power Factor etc.

B. Protection and Cooling of power switching devices

**Unit IV**

DC Motor Drives

A. Motor Performance Parameters, 1phase and 3phase converter drives for separately-excited and series DC motors for continuous and discontinuous operation, Braking techniques for DC and AC (IM) motors.

B. Suitability/ Selection of a drive based on process requirements (Matching of load, Motor, and converter), Brushless dc motor and drive.
Unit V  
AC Motor Drives and Power Quality  
(8+1 Hrs)


Power Quality- Types of Power line disturbances, Sources and Measurement of power line disturbances, Preventive Techniques.

B. Slip Power Recovery control of Induction motors, Energy Audit

Text Books

Reference Books

Course Outcomes:
The student will be able to-
1. Analyze three phase AC-DC and DC-AC power converters.
2. Evaluate performance parameters of AC-DC and DC-AC power converters.
3. Describe the role of converters in speed control of AC/DC motors.
Laboratory Course Syllabus

EC42305 : ADVANCED POWER ELECTRONICS

| Credits: 01 | Teaching Scheme: - - Laboratory 2 Hr/Week |

List of Practicals

1. Study of 3 Φ VSI (180º or 120º)
2. Study of Chopper fed / Converter fed DC Drive.
3. Study of Stator Voltage Control of IM Drive
4. Power factor improvement technique (SAC or EAC or PWM)
5. Study of VVVF 3 phase IM Drive.
6. Sensing and Protection circuits for AC and DC Drives
7. Sensing and Protection circuits for AC and DC Drives
8. Simulations of 3 phase LCC (HCB or FCB or dual Converter).
9. Simulation of 3 phase VSI (180º or 120º) / Simulation of DC/AC drive.

Text Books


Reference Books


Course Outcomes:
The student will be able to-

1. Apply suitable power converter for speed control of motors.
2. Evaluate the performance of converters and correlate the results with theoretical values.
3. Demonstrate the importance of power factor in AC/DC converters.
Unit I

**Introduction to Biomedical System**  
(9+1 Hrs)


B. Transducers and sensors related to biomedical measurements, Fiber Optic sensor for temp.

Unit II

**Cardiography**  
(9+1 Hrs)


B. Grounding and Shielding, Patient Safety.

Unit III

**Laboratory Equipments**  
(7+1 Hrs)

A. Basic working principle use calibration and maintenance of - Colorimeter, Spectrophotometer, Flame photometer, PH/Blood Gas Analyzer, Pulse Oximeter, Hemodialysis, Blood Cell Counter.

B. Autoanlyzer

Unit IV

**Nervous System**  
(8+1 Hrs)

A. Nervous system Anatomy, Human Brain Recording of EEG Signal, EEG Amplifier, Electroencephalography, Electromyography.

B. Analysis of Diseases using EEG and EMG signals.

Unit V

(7+1 Hrs)
Radiology equipments

A. Diagnostic Medical instruments: X – ray, CT scan, MRI, Ultrasonic Doppler Machine, Lasers in Medicine.

B. Use of Laser in Vision Correction, Dermatological.

Text Books
1. Cromwell, “Biomedical Instrumentation and Measurement”, PHI.
2. Carr and Brown, “Biomedical Instrumentation”.

Reference Books
2. Webster, “Application and Design of Medical Instruments”.

Course Outcomes:
The Student will be able to-

1. Specify methods for interfacing sensors to electronic systems in biomedical applications.
2. Characterize various bioelectrical signals.
3. Design biomedical instruments such as ECG, EEG, EMG, BP, Lab devices.
4. Measure various physiological parameters.
5. Observe the safety issues involved in bioelectrical measurement and medical instrumentation
6. Describe different types of imaging instrumentation and their applications.
Laboratory Course Syllabus

EC42306: BIOMEDICAL ELECTRONICS

Credits: 01  Teaching Scheme: Laboratory 2 Hr/Week

List of Practicals:
1. Recording and interpretation of ECG.
2. To Study Phonocardiography
3. To measure Blood Pressure using Sphygmomanometer.
4. Study of defibrillators
5. Study of EEG/EMG Machine.
7. Study of Clinical Lab Instrumentation - COLORIMETER.

List of mini projects:
1. To design a Clinical Thermometer.
2. To design and record/monitor heart sounds using Electronic Stethoscope
3. To design Heart rate Meter.

Text Books
1. Cromwell, “Biomedical Instrumentation and Measurement”, PHI.
2. Carr and Brown, “Biomedical Instrumentation”.

Course Outcomes:
The Students will be able to
1. Record biomedical signals.
2. Interpret biomedical signals.
3. Design biomedical instruments such as Electronic thermometer, heart rate meter and electronic stethoscope.
Unit I Introduction to SOC.  

Part A: Introduction to CMOS basics and SoC architecture, Technology Constraints: CMOS characteristics, Dependence of power on clock frequency, Leakage current, Implications for energy management.

Part B: Power dissipation in CMOS.

Unit II Processors, Memory, and Concurrency.  

Part A: Abstraction and implementation, Processor architecture, Instruction processing, Instruction-level parallelism – pipelining, superscalar, hazards, dependence, Task-level parallelism, Memory structures – registers, buffers, caches, bulk storage, Synchronization

Part B: Multicore structures, Dataflow computer architecture.

Unit III Interconnects and Functional units.  


Part B: CODECs.

Unit IV HW/SW Co-Design.  


Part B: Co-Simulation of HW/SW.
Unit V Behavior Synthesis. (8Hrs)


Part B: Packaging design.

Text Books


Reference Books


Course Outcomes:-

The student will be able to-
1. Describe the major function of each step in a top-down SoC design flow.
2. Select the techniques that improve a specific design metric.
3. Explain the SOC chip and packaging process.
4. Analyze the performance of a SoC based on the given architecture.
5. Perform static timing analysis for a given circuit.
6. Select chip I/O based on criteria including noise, power, and cost trade-offs.
7. Debug and fix the function errors in a peripheral component.
Laboratory Course Syllabus

EC42313: SYSTEM ON CHIP

Credits: 01  Teaching Scheme: 2 HrS/Week

List of Practicals.

1) Study of Xilinx Platform Studio (XPS) and Embedded Development Kit (EDK).

2) VHDL program template to implement a hardware accelerator for a loop of arithmetic operations.

3) Modify and fill in the C program template to properly access the specific memory addresses and thus to send/load the data to the hardware accelerator.

4) System integration and software/hardware co-simulation in XPS environment

Text Books


Reference Books


Course Outcomes:-

The student will be able to-

1. Access the data from hardware relying on the specific memory address.
2. Develop a hardware accelerator using VHDL.
3. Integrate the developed hardware into an embedded system environment.
FF No. 654 D

Project Course Syllabus

EC47301: Major Project II

Credits: 4  
Teaching Scheme: 8 Hours / Week

Guidelines:

1. Group should maintain a logbook of activities throughout the project stages.
2. Regular discussions should be carried out with project guide.
3. Both the review reports for this stage should be submitted in the prescribed format after approval from the guide.
4. A report on the work done in Stage-2 in prescribed format should be submitted at the time of stage II evaluation.

Course Outcomes:

The student will be able to-

1. Implement integrated hardware and software in compliance with design standard and safety rules.
2. Collect the data analyze the results and redesign if required.
3. Endure the responsibility to complete the task cost-effectively with time constraint.
Project Course Syllabus

EC47302: Major Project III

Credits: 6  
Teaching Scheme: 12 Hours / Week

Guidelines:

1. Students should participate in various activities like project competitions, paper presentations, publications, Intellectual property - patent registration or other suitable activities suggested by guide.

2. Both the review reports for this stage should be submitted in the prescribed format only after approval from the guide.

3. Final project report must be submitted in the prescribed format at the time of stage-III evaluation.

Course Outcomes:

The student will be able to-

1. Test the project for verification of the results.

2. Publish the research work done.

3. Participate in the project competitions.

4. Write technical report on the completed project.