PROPOSED CURRICULA AND SYLLABI
FOR

B. Tech.

(Electronics & Telecommunication Engineering)

with effect from
Academic Year 2017-2018
onwards

Department of Electronics and Telecommunication Engineering
Shri Guru Gobind Singhji Institute of Engineering & Technology
Vishnupuri, Nanded (M.S.) PIN 431606 INDIA

SYLLABUS SCHEME for
Final Year B. Tech. (Electronics and Telecommunication Engineering)
Academic Year 2017-18 onwards
Scheme – A

Sr. No.	Course Code	Course Title	Teaching Scheme				Credits
			L	T	P	Total Hours	
Semester VII							
1	EC451	Microwave and Satellite Communication	3	1	2	6	5
2	EC452	Data Communication and Networking	3	-	2	5	4
3	EC453	Industrial Organization	2	-	-	2	2
4	EC454	Students can register for any three elective subjects from the list provided	3	-	2	5	4 per-elective
5	EC455	Industrial Training Seminar	-	-	2	2	2
Total			**17**	**1**	**12**	**30**	**25**
Semester VIII							
6	EC456	Project	0	0	40	40	20
7	EC457	Self-Learning (Audit)*	0	0	-	-	0
Total			**0**	**0**	**40**	**40**	**20**

N.B.: Lectures/Tutorials/Practical are mentioned in Hours/Week

*For self-study student's need to study their own.

Elective List	
Communication: EC454A: Optical Communication Engineering EC454B: Cryptography and Network Security EC454C: Mobile & Wireless Communication EC454D: RF Devices and Circuits EC454E: Smart Antenna EC454F: T.V. and Display Technology EC45G: Error Control & Coding	**Image and Signal Processing:** EC454N: Digital Image Processing EC454O: Adaptive Signal Processing EC454P: Multimedia System EC454Q: Speech and Audio Processing EC454R: Bio Medical Image Processing EC454S: Neural Network and Fuzzy Logic EC454T: Machine vision and Learning
VLSI and Embedded System: EC454H: Embedded Operating System EC454I: Analog VLSI Design EC454J: Verification Methods EC454K: VLSI Signal Processing EC454L: Nano Electronics EC454M: Internet of Things	**General:** EC454U: Indian Patents Act EC454V: Material Science & Engineering EC454W: Alternate Energy Recourses **Computer:** EC454X: Data Mining and Data Warehousing EC454Y: Big Data and Cloud Computing EC454Z: Computer Architecture
Self-Study Elective List	
EC457A: Advance 3G and 4G wireless Mobile Communication	
EC457B: High Speed Semiconductor Devices	
EC457C: Economics/ Management/ Entrepreneurship	
EC457D: Artificial Intelligence	
EC457E: Digital Video Processing	

SYLLABUS SCHEME for
Final Year B. Tech. (Electronics and Telecommunication Engineering)
Academic Year 2017-18 onwards
Scheme – B

Sr. No.	Course Code	Course Title	Teaching Scheme				Credits
			L	T	P	Total Hours	
Semester VII							
1	EC456	Project	0	0	40	40	20
2	EC457	Self-Learning (Audit)*	0	0	-	-	0
Total			**0**	**0**	**40**	**40**	**20**
Semester VIII							
3	EC451	Microwave and Satellite Communication	3	1	2	6	5
4	EC452	Data Communication and Networking	3	-	2	5	4
5	EC453	Industrial Organization	2	-	-	2	2
6	EC454	Students can register for any three elective subjects from the list provided	3	-	2	5	4 per-elective
7	EC455	Industrial Training Seminar	-	-	2	2	2
Total			**17**	**1**	**12**	**30**	**25**

N.B.: Lectures/Tutorials/Practical are mentioned in Hours/Week

*For self-study student's need to study their own.

Elective List	
Communication: EC454A: Optical Communication Engineering EC454B: Cryptography and Network Security EC454C: Mobile & Wireless Communication EC454D: RF Devices and Circuits EC454E: Smart Antenna EC454F: T.V. and Display Technology EC45G: Error Control & Coding	**Image and Signal Processing:** EC454N: Digital Image Processing EC454O: Adaptive Signal Processing EC454P: Multimedia System EC454Q: Speech and Audio Processing EC454R: Bio Medical Image Processing EC454S: Neural Network and Fuzzy Logic EC454T: Machine vision and Learning
VLSI and Embedded System: EC454H: Embedded Operating System EC454I: Analog VLSI Design EC454J: Verification Methods EC454K: VLSI Signal Processing EC454L: Nano Electronics EC454M: Internet of Things	**General:** EC454U: Indian Patents Act EC454V: Material Science & Engineering EC454W: Alternate Energy Recourses **Computer:** EC454X: Data Mining and Data Warehousing EC454Y: Big Data and Cloud Computing EC454Z: Computer Architecture
Self-Study Elective List	
EC457A: Advance 3G and 4G wireless Mobile Communication	
EC457B: High Speed Semiconductor Devices	
EC457C: Economics/ Management/ Entrepreneurship	
EC457D: Artificial Intelligence	
EC457E: Digital Video Processing	

SEMESTER I

EC451 MICROWAVE AND SATELLITE COMMUNICATION (L-3, T-1, P-2, Credits-5)

Teaching Scheme	*Examination scheme*
Lectures: 3 hrs/week	Theory: Mid-term 30 marks, End-term 70 marks
Practical: 2 hrs/week	Mid-term 50 marks, End-term 50 marks

Course Educational Objectives (CEO):

- To understand the theory of transmission line and develop ability to solve numerical on it.
- To study the wave equation and wave propagation and reflection phenomenon.
- To understand wave propagation through bounded and unbounded medium.
- To understand operation of different microwave tubes and solid state microwave devices.
- To learn and understand basic concept of satellite communication systems.

Course Syllabus:

1. **Interaction between electrons and Fields:** Introduction, Electron motion in an electric field, Electron motion in a magnetic field, Electron motion in electromagnetic field.

2. **Electromagnetic plane waves**: Introduction, Electric and magnetic wave equation, Poynting theorem, Uniform plane waves and reflection, Plane wave propagation in free space and lossless dielectric, plane wave propagation in lossy media

3. **Microwave transmission lines:** Introduction, transmission line equations and solutions, Reflection coefficient and transmission coefficient Standing wave and standing wave ratio, Line impedance and Admittance, Impedance matching.

4. **Microwave waveguide and components:** Introduction, Rectangular waveguide and circular waveguide, Microwave cavities, Microwave hybrid circuits, Directional couplers, circulator and isolator

5. **Transferred electron devices:** Gunn diode, RWH theory, Microwave generation and amplification, LSA diode

6. **Avalanche transit time devices:** Read diode, IMPATT diode, TRAPATT diode, BARITT diode

7. **Microwave linear and crossed Field tubes**: Klystron, Reflex klystron, TWT, magnetron

8. **Strip lines:** Introduction, Micro strip lines, Parallel strip lines

9. **Satellite communication:** Introduction, History of satellite communication, Satellite parameters and configurations, Satellite subsystems, Satellite transponder model

10. Multiple access formats Time division multiple access format, Frequency division multiple access format, Code division multiple access format, Application of the satellite communication

Text/Reference Books:

1. Samuel Y Liao, Microwave Devices and Circuits, Third Edition, Phil.
2. David M Pozar, Microwave Engineering, Wiley Publication.
3. Robert M Gaglardi, Satellite communication
4. Timothy Pratt, Charles Bostain, Jeremy Allnutt, Satellite communication, John Wiley and Sons

Course Outcomes (COs):

At the end of the course the student is expected to understand:

- Understand the behavior of electromagnetic wave propagation in free space and dielectric medium.
- Study wave propagation along waveguide and waveguide components as tees,
- Apply concepts of transmission lines to waveguides and study basics of satellite communication.
- Understand the operation of transferred electron devices, avalanche transit time devices, microwave linear and crossed field tubes and strip lines.

EC452 DATA COMMUNICATION AND NETWORKING (L-3, T-0, P-2, Credits-4)

Teaching Scheme	*Examination scheme*
Lectures: 3 hrs/week	Theory: Mid-term 30 marks, End-term 70 marks
Practical: 2 hrs/week	Mid-term 50 marks, End-term 50 marks

Course Educational Objectives (CEO):

- Describe network components and architectures of computer network.
- Explain the fundamental principles of computer communication at different layers of OSI Model.
- Explain the principles of network programming.
- Design and implement security issues and client-server applications.

Course Syllabus:

1. **Introduction**: Data Communications, Networks, the internet, Protocols and Standards.
2. **Network Models:** Layered Tasks, the OSI Model, Layers in OSI Model, TCP/IP Protocol Suite and Addressing.
3. **Data and Signals:** Analog and digital, Transmission Impairments, Data Rate Limits and Performance.
4. **Digital Transmission**: Digital to Digital Conversion, Analog to Digital Conversion and Transmission Modes.
5. **Analog Transmission**:- Digital to Analog Conversion, Analog to Analog Conversion
6. **Transmission Media**: Guided Media and Unguided Media: Wireless.
7. S**witching**: Circuit Switch Networks, Datagram networks, Virtual Circuit network, structure of switch,
8. **Error Detection and Correction**: Introduction, Block Coding, Linear Block Codes, Cyclic Codes and Checksum.

9. **Data link control**: Framing, Flow and Error Control, Protocols, Noiseless Channels, Noisy Channels, HDLC and point to point protocol.

10. **Multiple Accesses**: Random Access, Controlled Access and Channelization.
11. **Network Layer**: Network Layer Design Issues, Routing Algorithms, Congestion Control Algorithms, Internetworking, Network Layer in the Internet, and Network layer in ATM Networks.

12. Process to process Delivery, User Datagram Protocol, TCP, and SCTP: Process to Process Delivery, User Datagram Protocol, TCP and SCTP.

13. **Domain Name System**: Name Space, Domain Name space, Distribution of Name Space, DNS in Internet, Resolution, DNS Messages, Types of Records, Registrars, DDNS and Encapsulations.

14. **Cryptography**: Introduction, Symmetric Key Cryptography and Asymmetric Cryptograph, and RSA Public Key Algorithm

Text/Reference Books

1. Behrouz A. Forouzan, Data communications and Networking, McGraw-Hill Publications, Fourth Edition.
2. Andrew S.Tanenbaum, Computer Networks, Prentice Hall India,Third edition.
3. William Stallings, Data and computer communication, Pearson Education

Course Outcomes (COs):

At the end of the course the student is expected to understand:

- Identify the issues and challenges in the architecture of a computer network.
- Understand the ISO/OSI seven layers in a network.
- Achieve practical experience in network programming.
- Realize protocols at different layers of a network hierarchy.
- Recognize security issues in a network, Design and Evaluate short path algorithm.

EC453 INDUSTRIAL ORGANIZATION (L-2, T-0, P-0, Credits-2)

Teaching Scheme	*Examination scheme*
Lectures: 2 hrs/week	Theory: Mid-term 30 marks, End-term 70 marks
Practical: 2 hrs/week	Mid-term 50 marks, End-term 50 marks

Course Educational Objectives (CEO):

- To provides a foundation for the study of many other fields that rely on an understanding of interactions among firms in the economy, including business strategy, corporate finance, marketing, international trade, banking, and the economics of organizations.
- To produce general principles applicable to business situations for Conduct a critical analysis, evaluation and synthesis of new and complex ideas.
- To develop awareness of student toward industrial laws, acts, preventions and settlement of industrial disputes.
- Advanced knowledge of market structuring and functioning, comprehension of the interaction between different actors (companies, consumers and regulators) involved in them.
- To understand the concepts developed by the economists regarding transaction costs, ability to analyze these costs within organizations and to compare them with those that have an alternative market.

- Capability to apply game theories to the analysis of conflict situations of organizations and market related.

Course Syllabus:

1. Introduction Management, administration, organization, concept, definition, scope and importance of management

2. Principles of Management Division of labor, authority, responsibility, discipline, unity of command, and direction/centralization.

3. Functions of Management Planning, organizing, staffing, directing, controlling, coordination, decision making, locus of control innovation.

4. Types of Organization Proprietorship, partnership, and joint stock Company, private limited, public sector, cooperatives, their comparison.

5. Industrial Law Indian Factories Act, Payment of wages act, Employees, State insurance Act, Strike and Lockouts, Causes, prevention, and settlement.

6. Financial Management Concepts, capital structure, fixed capital, working capital, depreciation, assignment and management budget and budgetary control, rent interest and profits distinction between profits and interest.

7. Production Practices in Electronic Industry Organization setup, materials management, quality assurance, and allied functions and comparison.

Text/Reference Books:

1. Buffa Kooutz and O'Donnel, Principles of Management.
2. O. P. Khanna, Industrial Engineering and Management.
3. P. T. Ghan, Introduction to Industrial Organization.
4. Banga and Sharma, TIDM.

Course Outcomes (COs):

At the end of the course the student is expected to understand:

- Understand the basic principles, approaches and functions of management and apply concepts to specific situations.
- Identify and utilize various techniques for improving productivity using industrial organization study.
- Study the market structures and product differentiation, R&D competition, Advertising, Pricing strategies, of information.
- Understand and use appropriate methods of inventory classification and control in industry.
- Develop the skills in Industrial Law, various industrial Acts, causes, prevention, and settlement.
- Understand the management Concepts for Industry setup, materials management and quality assurance.

Elective list related to subjects of Communication:

EC454A OPTICAL COMMUNICATION ENGINEERING (L-3, T-0, P-2, Credits-4)

Teaching Scheme	*Examination scheme*
Lectures: 3 hrs/week	Theory: Mid-term 30 marks, End-term 70 marks
Practical: 2 hrs/week	Mid-term 50 marks, End-term 50 marks

Course Educational Objectives (CEO):

- Understand optical communication system, light propagation in optic fiber.
- Signal loss in fiber.
- Optical transmitter, characteristics, analysis, launching light in fiber.
- Design and analysis of optical receiver.
- Digital transmission analytical, and design concept.

Course Syllabus:

1. **Overview of Optical Fiber Communication**: Forms of communication systems, Electromagnetic spectrum, Evolution of optical fiber systems, Elements of optical fiber transmission link, Introduction to vector nature of light, Importance of optical fiber for communication.

2. **Light propagation through fiber:** Types of optical fibers, Optical fiber fabrication, Propagation of light in a cylindrical dielectric rod, ray model, wave model. Modes of propagations in step index fiber and graded index fiber. Attenuation characteristics, Dispersion, Distortion in fiber, Integrated optic components

3. **Signal Degradation in Optical Fibers**: Pulse broadening in step and graded index waveguides, Mode coupling

4. **Optical Sources**: Light-emitting diodes, Laser diodes, Modal, partition and reflection noise, Power Launching and Coupling, Source to fiber power launching, lensing schemes for coupling improvement, fiber-to-fiber joints, LED coupling to single-mode fibers, fiber splicing, optical fiber connectors.

5. **Photo detectors**: Physical principles of photodiodes, Review of PIN diode: structure and performance, hetero-junction diode - materials systems, avalanche photodiodes, Photodetector noise, Detector noise, Detector response time, Avalanche multiplication noise

6. **Optical Receiver Operation**: Fundamental receiver operation, Digital receiver performance calculation, Pre-amplifier types, Analog receivers.

7. **Digital Transmission Systems**: Point-to-point links, Line coding, Eye pattern, Link power budget

8. **Advanced Systems:** Coherent systems, WDM, WDM devices, Photonic switching.

Text/Reference Books:

1. J.Gowar, Optical communication systems, Prentice Hall India, 1987.
2. G.Agrawal, Nonlinear fiber optics, Academic Press, 2nd Ed. 1994.
3. G. Agrawal, Fiber optic Communication Systems, John Wiley and sons, New York, 1992
4. J.Keiser, Fibre Optic communication, McGraw-Hill, 2nd Ed. 1992.

Course Outcomes (COs):

At the end of the course the student is expected to understand:

- Identify and characterize different components of an Optical Fiber Communication link.
- Analyze optical source, Fiber and Detector operational parameters.
- Compute optical fiber link design parameters.
- Understand coherent system, WDM,WDM devices, optical switching-photonic switching.
- Able to understand fabrication process in fibers.

EC454B CRYPTOGRAPHY AND NETWORK SECURITY (L-3, T-0, P-2, Credits-4)

Teaching Scheme	*Examination scheme*
Lectures: 3 hrs/week	Theory: Mid-term 30 marks, End-term 70 marks
Practical: 2 hrs/week	Mid-term 50 marks, End-term 50 marks

Course Syllabus:

1. **Security:** Need, security services, Attacks, OSI Security Architecture, one time passwords, Model for Network security, Classical Encryption Techniques like substitution ciphers, Transposition ciphers, Cryptanalysis of Classical Encryption Techniques.

2. **Number Theory:** Introduction, Fermat's and Euler's Theorem, The Chinese Remainder Theorem, Euclidean Algorithm, Extended Euclidean Algorithm, and Modular Arithmetic.

3. **Private-Key (Symmetric) Cryptography**: Block Ciphers, Stream Ciphers, RC4 Stream cipher, Data Encryption Standard (DES), Advanced Encryption Standard (AES), Triple DES, RC5, IDEA, Linear and Differential Cryptanalysis.

4. **Public-Key (Asymmetric) Cryptography**: RSA, Key Distribution and Management, Diffie-Hellman Key Exchange, Elliptic Curve Cryptography, Message Authentication Code, hash functions, message digest algorithms: MD4 MD5, Secure Hash algorithm, RIPEMD-160, HMAC.

5. **Authentication:** IP and Web Security Digital Signatures, Digital Signature Standards, Authentication Protocols, Kerberos, IP security Architecture, Encapsulating Security Payload, Key Management, Web Security Considerations, Secure Socket Layer and Transport Layer Security, Secure Electronic Transaction.

6. **System Security**: Intruders, Intrusion Detection, Password Management, Worms, viruses, Trojans, Virus Countermeasures, Firewalls, Firewall Design Principles, Trusted Systems.

Text/Reference Books:

1. William Stallings, "Cryptography and Network Security, Principles and Practices", Pearson Education, 3rd Edition.
2. Charlie Kaufman, Radia Perlman and Mike Speciner, "Network Security, Private Communication in a Public World", Prentice Hall, 2nd Edition
3. Christopher M. King, Ertem Osmanoglu, Curtis Dalton, "Security Architecture, Design Deployment and Operations", RSA Pres,
4. Stephen Northcutt, Leny Zeltser, Scott Winters, Karen Kent, and Ronald W. Ritchey, "Inside Network Perimeter Security", Pearson Education, 2nd Edition
5. Richard Bejtlich, "The Practice of Network Security Monitoring: Understanding Incident
6. Detection and Response", William Pollock Publisher, 2013.

EC454C: MOBILE & WIRELESS COMMUNICATION (L-3, T-0, P-2, Credits-4)

Teaching Scheme	*Examination scheme*
Lectures: 3 hrs/week	Theory: Mid-term 30 marks, End-term 70 marks
Practical: 2 hrs/week	Mid-term 50 marks, End-term 50 marks

Course Educational Objectives (CEO):

- Describe components and architectures of mobile and wireless communication network network.
- Describe components and architectures of mobile and wireless communication network network.
- Explain the principles of cellular system and concept of frequency reuse, cell capacity , analytical view for cellular system design.
- Understand different emerging technology for wireless communication.

Course Syllabus:

1. **Introduction to Wireless Communication:** Evolution of Wireless Communication, Advantages and Disadvantages, Wireless Network Generations, Different Types of Wireless Systems, Evolution to Next-Generation Wireless Networks, and Applications.

2. **Cellular Concept:** Frequency Reuse, Channel Assignment Strategies, Handoff Strategies, Interference and System Capacity, Trunking and Grade of Service, Improving Coverage and Capacity in Cellular Systems.

3. **Mobile Radio propagation (Large-Scale Path Loss):** Introduction to Radio Propagation, Free Space Propagation Model, The Basic Propagation Mechanisms, Reflection, Ground Reflection (2 Ray) Model, Diffraction, Scattering, Outdoor Propagation Models, Introduction to Indoor Propagation Models, Signal Penetration in to Buildings, Small-Scale Fading and Multipath.

4. **Mobile Radio propagation (Small-Scale Fading and Multipath):**Small-Scale Multipath Propagation, Parameters of Mobile Multipath Channels, Types of Small Scale Fading, Rayleigh and Ricean Distribution.

5. **Equalization and Diversity**: Introduction, Fundamentals of Equalization, Classification of Equalizers, Diversity Techniques, and Types of Diversity.

6. **Global System for Mobile**: GSM Network Architecture, GSM Protocol Architecture, GSM Channels, Frame Structure of GSM, and GSM Call Procedures.

7. **CDMA Digital Cellular Standards:** Concept of Spread Spectrum, Architecture of CDMA System, and Power control in CDMA.

8. **Emerging Wireless Network Technologies:** IEEE 802.11 WLAN Technology, ETSI HIPERLAN Technology, IEEE 802.15 WPAN Technology, IEEE 802.16 WMAN Technology, and Mobile Adhoc Network (MANET).

Text/Reference Books:

1. Theodore S Rappaport, Wireless Communications, second edition, Pearson Education
2. T L Singal, Wireless Communications, Tata McGraw Hill Education
3. Jochen Schiller, Mobile Communications, Pearson Education

Course Outcomes (COs):

At the end of the course the student is expected to understand:

- Understand the evolution of cellular communication systems .
- Design concept in improving capacity in cellular system.
- Choose proper multiple accessing methods depending on channel model.
- Identify traffic channels for call processing.
- Techniques to improve signal quality.
- understand two basic cellular communication system i.e GSM and CDMA
- Understand Emerging Wireless Network Technology.

EC454D RF DEVICES AND CIRCUITS (L-3, T-0, P-2, Credits-4)

Teaching Scheme	*Examination scheme*
Lectures: 3 hrs/week	Theory: Mid-term 30 marks, End-term 70 marks
Practical: 2 hrs/week	Mid-term 50 marks, End-term 50 marks

Course Educational Objectives (CEO):

- To study linear RF Amplifier, small signal RF Amplifier, High power RF transistor amplifier.
- To study active RF device modelling.
- To study device parasitic RF modeling.
- To study radio system applications.

Course Syllabus:

1. **Introduction to RF Electronic**: The electromagnetic spectrum; unit and physical constant; Microwave band; RF component layout and construction; Cox cable transmission line; Tuned resonant circuit Tuned RF/IF Transformer; Variable capacitor in RF circuit; Measuring inductor and capacitor at RF frequency; Impedance matching.

2. **Linear RF Amplifier:** Introduction ; power gain ; Neutralization ; unilateral transducer gain ; stability consideration ;stability an active two port; stabilization of a bipolar transistor at radio frequency; RF power transistor characteristics ;transistor biasing.

3. **Small Signals RF Amplifier**: Introduction to small signals RF amplifier; Bilateral RF amplifier design for maximum small signal gain; multistage amplifier; Broadband amplifier ; Noise in RF.

4. **Active RF Device And Modeling:** The diode model ; two port device model ; the output terminal of at two port RF device The bipolar transistor ; the hetero junction bipolar transistor; the GaAs MESFET High electron mobility transistor ; Silicon LDMOS and CMOS technique.

5. **High Power RF Transistor Amplifier:** Nonlinear concept; Quasi linear power amplifier design; categories of amplifier (class A; class B ; class F) ; switching mode amplifier; cascade amplifier; distortion reduction.

6. **Radio System Application:** Mobile telephony system ; software defined ratio; A 1.9 GHz radio chip set design overview; integrated system chip (RF receiver fronts end ; RF up converter and Transistor driver amplifier ; power amplifier modules)

7. **Device Parasitic:** RF modeling; Parasitic sensitive to RF. Issue in RF IC a brief review; Impedance matching; use and design of passive circuits; LNA Design; Matching Techniques using algebra techniques; Basic Bond circuits; UHF Mixer design.

Text/Reference Books:

1. Rowan and Les Besser, "RF Circuit Design", CRC Press, 3rd Edition, 2003
2. Esketrim, Pekka, "Introduction to RF Equipment and System Design", 4th Edition Artech House,2004
3. Golio, Mike, "Semiconductor Device", 5th Edition, CRC Press, 2002
4. Razavi, "RF Microelectronics", 3rd Edition, Prentice Hall of India, 1998

Course Outcomes:

At the end of this course students will be able to

- analyze linear RF Amplifier, small signal RF Amplifier, High power RF transistor amplifier.
- Do active RF device modelling.
- Do device Parasitic: RF modeling
- Understand radio system applications.

EC454E SMART ANTENNA (L-3, T-0, P-2, Credits-4)

Teaching Scheme	*Examination scheme*
Lectures: 3 hrs/week	Theory: Mid-term 30 marks, End-term 70 marks
Practical: 2 hrs/week	Mid-term 50 marks, End-term 50 marks

Course Educational Objectives (CEO):

- To study key benefits of smart antenna technology, wide band smart antennas, Propagation Channels.
- To study Multiple Input - Multiple Output (MIMO) Communications Systems.
- To study the channel models for smart antenna systems.
- To study the environmental parameters for signal processing of smart antenna systems.
- To study the requirements for the design and implementation of smart antenna systems

Course Syllabus:

1. **Introduction:** Antenna Basics, Phased array antenna, power pattern, beam steering, degree of freedom, adaptive antennas, smart antennas – key benefits of smart antenna technology, wide band smart antennas, Propagation Channels

2. **Smart Antennas For Wireless Communications**: Spatial Processing for Wireless Systems, Key Benefits of Smart Antenna Technology, The Vector Channel Impulse Response and the Spatial Signature, Spatial Processing Receivers, Fixed Beam forming Networks, Switched Beam Systems, Adaptive Antenna Systems, Wideband Smart Antennas, Diversity Techniques, Multiple Input - Multiple Output (MIMO) Communications Systems, MIMO for frequency selective scenarios.

3. **Adaptive Processing:** Sample matrix inversion algorithm, unconstrained LMS algorithm, normalized LMS algorithm, Constrained LMS algorithm, Perturbation algorithms, neural network approach, Adaptive beam space processing, and Implementation issues.

4. **Direction of Arrival Estimation (DOA) Methods**: Spectral estimation methods, linear prediction method, Maximum entropy method, Maximum likelihood method, Eigen structure methods, MUSIC algorithm – root music and cyclic music algorithm, the ESPRIT algorithm.

5. **Implementation of Smart Antenna System:** DOA based beam former design using simulation and hardware. Adaptive beam forming implementation using Altera Stratix series FPGA, QRD RLS Algorithm. CORDIC algorithm.

Course Outcomes:

At the end of this course Students will be able to

- Understand key benefits of smart antenna technology, wide band smart antennas, Propagation Channels.
- Do analysis of Multiple Input - Multiple Output (MIMO) Communications Systems.
- analyze the channel models for smart antenna systems.
- study the environmental parameters for signal processing of smart antenna systems.
- evaluate the requirements for the design and implementation of smart antenna systems.

EC454F T.V. AND DISPLAY TECHNOLOGY (L-3, T-0, P-2, Credits-4)

Teaching Scheme	*Examination scheme*
Lectures: 3 hrs/week	Theory: Mid-term 30 marks, End-term 70 marks
Practical: 2 hrs/week	Mid-term 50 marks, End-term 50 marks

Course Educational Objectives (CEO):

- To study the working principle of Basic Television System.
- To study the analysis and synthesis of TV Pictures, Composite Video Signal, Receiver Picture tubes and Television Camera Tubes.
- To study the various Color Television systems with a greater emphasis on television standards.
- To study the advanced topics in digital television and High definition television

Course Syllabus:

1. **Elements of Basic Television System:** Introduction to video system, sound and picture transmission, scanning process, video signal, aspect ratio, horizontal and vertical resolution, video bandwidth and interlaced scanning, composite video signal for monochrome TV, video signal standard, sound and video modulation, VSB transmission and reception, (CCIR – B standards).

2. **Color TV**: Compatibility consideration, Color theory, chromaticity diagram, generation of color TV signals, luminance signal, chrominance signal, frequency interleaving process, color sub-carrier frequency, color picture tubes, color picture tube requirements, degaussing, purity convergence, circuit color receivers set up procedure

3. **Color TV system:** NTSC encoder and decoder, SECAM encoder and decoder, PAL encoder and decoder.

4. **Television Receiver and its Testing**: Block schematic, VSB correction, Choice of IF's, RF tuner, AGC, video IF section, sync separation, AFC, sound section, SMPS, Troubleshooting-procedure of troubleshooting, television test charts, Introduction to various test instruments, Color TV receivers, antenna, RF tuner, AFT, video IF amplifier, video detector sound section, first video amplifier delay line color burst circuit, AGC amplifier, phase discriminator, phase identification amplifier and color killer, reference oscillator, vertical deflection system, horizontal deflection system, EHT

5. **Advanced TV systems**: CCTV, Cable TV, Direct Broadcasting Satellites, and Digital TV.

6. **IPTV**: Multicasting, RTSP, RTCP

Text/Reference Books:

1. Monochrome and color television, Gulati R.R, Wiley Eastern Limited publication.
2. Video Demystified, 4e, Keith Jack, Elsevier

Course Outcomes:

At the end of this course Students will be able to

- Understand the working principle of Basic Television System.
- do analysis and synthesis of TV Pictures, Composite Video Signal, ReceiverPicture tubes and Television Camera Tubes.
- understand the various Color Television systems with a greater emphasis on television standards.
- understand the advanced topics in digital television and High definition television.

EC45G ERROR CONTROL & CODING (L-3, T-0, P-2, Credits-4)

Teaching Scheme	*Examination scheme*
Lectures: 3 hrs/week	Theory: Mid-term 30 marks, End-term 70 marks
Practical: 2 hrs/week	Mid-term 50 marks, End-term 50 marks

Course Educational Objectives (CEO):

- To study the principles of error-control coding and their application to communications systems with noise.
- To study Quality/ Correctness of received information in terms of parameters such as error detection and correction capacity.
- To study encoders and decoders for linear block codes, convolutional codes and understand the principles of ML decoding, Viterbi decoding and MAP decoding for iteratively-decoded codes.
- To study various schemes for encoders and decoders deployability either in software orin hardware forms and its consequences.
- To study basic error-correcting code properties such as minimum distance, error correcting and detecting ability, and code rate.

Course Syllabus:

1. **Coding for Reliable Digital Transmission and Storage:** Introduction. Types of Codes, Modulation and Demodulation. Maximum Likelihood Decoding, Types of Errors and Error Control Strategies, Turbo Codes

2. **Cyclic Codes:** Description. Generator and Parity-Check Matrices, Encoding, Syndrome and Error Detection. Decoding, Cyclic Hamming Codes

3. **BCH Codes**: Description. Encoding/Decoding, Nonbinary BCH Codes and Reed Solomon Codes, Weight Distribution and Error Detection Capability

4. **Convolutional Codes:** Encoding, Structural Properties of Convolutional Codes, Distance Properties of Convolutional Codes, convolutional codes, and modern graph-based codes (Turbo-Codes and LDPC codes).

5. **Maximum Likelihood Decoding of Convolutional codes**: The Viterbi Algorithm, Performance Bounds for Convolutional Codes, Construction. Implementation of Viterbi

Algorithm, Sequential Decoding of Convolutional Codes, Introduction to Trellis Coded Modulation

Text/Reference Books:

1. S. Lin and D. Costello, Error Control Coding, Prentice-Hall, 200, 2nd edition Richard E. Blahut,
2. Theory and Practice of Error Control Codes Addison Wesley Publishing Company, 1983
3. Smart Antenna for Wireless Communication , T.S.Rappaport and J.C.Liberti, Prentice Hall, 1999
4. Smart Antennas, L.C.Godra, CRC Press, 2004
5. Adaptive Filter Theory, S. Haykin. Prentice Hall, 1985
6. Introduction to Smart Antennas, C.A.Balanis, Morgan and Claypool, 2007

Course Outcomes (COs): At the end of this course students will demonstrate the ability to

- Learn the principles of error-control coding and their application to communications systems with noise.
- Learn Quality/ Correctness of received information in terms of parameters such as error detection and correction capacity.
- Design both encoders and decoders for linear block codes, convolutional codes and understand the principles of ML decoding, Viterbi decoding and MAP decoding for iteratively-decoded codes.
- Deciding various schemes for encoders and decoders deploy ability either in software or in hardware forms and its consequences.
- Understand basic error-correcting code properties such as minimum distance, error correcting and detecting ability, and code rate.

Elective list related to subjects of VLSI and Embedded System:

EC454H EMBEDDED OPERATING SYSTEM (L-3, T-0, P-2, Credits-4)

Teaching Scheme	*Examination scheme*
Lectures: 3 hrs/week	Theory: Mid-term 30 marks, End-term 70 marks
Practical: 2 hrs/week	Mid-term 50 marks, End-term 50 marks

Course Educational Objectives (CEO):

- To distinguish a real-time system from other systems and evaluate need for real-time operating system
- Implement the real-time operating system principles such as multitasking techniques
- To study Inter-task Communication and synchronization
- To get familiar with linux development environment.
- To Understand need and structure of implementation of real-time systems.

Course Syllabus:

1. **µCOS II:** History and Definition of RTOS, Key Characteristics of RTOS, Features of µCOS II,Kernel structure, µCOS II RTOS services: Task management: Tasks, Task states and Control block, Task scheduling, task level context, switching, Idle task, Time management: Clock Tick, Implementing delay in RTOS, resuming the delayed task, getting system time, Placing task in ECB wait list, Removing a task from ECB, List of Free ECBs, Initializing an ECB, Making a Task Ready and wait for and event. Implementing timeout in RTOS,

2. **Inter-Task Communication and Synchronization**: Semaphore, Creating/deleting a Semaphore, Waiting, signaling semaphore, Mutex, Creating/deleting and handling Mutex, Event flag management, Timer Interrupt Service Routines (ISR), Soft Timers, Mail box, sending / getting a message using mailbox as semaphore, message queue and its management, Memory control block. Case studies of uCOS based applications

3. **Embedded Linux Development Environment**: Need of Linux, Embedded Linux Today, Open Source and the GPL, BIOS and Boot loader, Anatomy of an Embedded System, Storage Considerations, Embedded Linux Distributions, Processors for embedded Linux stand alone and integrated processors, ARM9 architecture and ARM9 based processors. ARM flavors and features of various chipsets/architectures, Anatomy of embedded Linux setup, Booting and Initialization of Kernel. Storage considerations, Flash file systems, Execution contexts, Commercial embedded linux distributions, Embedded Development Environment, Cross-Development Environment, Development Tools, GNU Debugger, Tracing and Profiling Tools, Binary Utilities, Overview of Commands, File I/O (open, create, close, lseek, read, write), Process Control (fork, vfork, exit, wait, waitpid, exec),

4. **Linux Kernel Construction**: Linux Kernel Background, Linux Kernel Construction, Kernel Build System, Kernel Configuration, Role of a Bootloader, Bootloader Challenges. A Universal Bootloader: Das UBoot, Porting U-Boot, Device Driver Concepts, Module Utilities, Driver Methods, Linux File, System & Concepts

5. **Embedded Software Development, Testing Process and Tools**: Embedded Software development process and tools, Host and Target Machines, Target System Tools and Image transfer, Embedded Loader, Monitor, linking and Locating Software, Getting Embedded Software into the Target System, Issues in Hardware- Software Design and Co-design. Testing on Host Machine, Simulators, Laboratory Tools, Case study of embedded system like Automatic Chocolate Vending Machine, Mobile Phone.

Text/Reference Books:

1. Jean Labrosse: MicroC/OS-II The Real Time Kernel: CMP Books, 2nd Edition
2. Raj Kamal: Embedded Systems – Architecture: Programming and Design: TMH
3. Real-Time Concepts for Embedded Systems Qing Li, Caroline Yao Elsevier
4. Embedded Linux System Design and Development b P Raghvan, Amol Lad, Sriram Neelakandan, Auerbach Publications

Course Outcomes (COs):

At the end of the course the student is expected to :

- Use real-time system for various applications.
- Can perform multitask using real-time operating system.
- Can be able to use different protocols for Inter-task communication and synchronization
- Can use linux environment for various applications.

EC454I ANALOG VLSI DESIGN (L-3, T-0, P-2, Credits-4)

Teaching Scheme	*Examination scheme*
Lectures: 3 hrs/week	Theory: Mid-term 30 marks, End-term 70 marks
Practical: 2 hrs/week	Mid-term 50 marks, End-term 50 marks

Course Educational Objectives (CEO):

- To understand basics of MOSFET and behavior of MOSFET as analog device.
- To study different configurations of single stage amplifiers and its frequency response.
- To study differential amplifier and its analysis.
- To study passive and active current mirrors.
- To study effects of noise in analog circuits and noise removal techniques.
- To study operational amplifiers, its stability and frequency compensation.
- To study analog IC units PLL and references.

Course Syllabus:

1. Introduction to Analog Design, MOS FET as analog device, MOS Device Models, Single Stage Amplifiers, Common Source, Source Follower, Common Gate, Cascode, Folded Cascode

2. Differential Amplifiers, Single ended Differential operation, Basic Differential pair, qualitative and quantitative analysis, Common mode response, Differential pair with MOS loads

3. Passive and active current mirrors, Basic current mirrors, Cascode Current Mirrors, Active current mirrors, Large and small signal analysis, Common Mode properties

4. **Frequency response of Amplifiers**: General Considerations, Miller effect, Association of poles with nodes, Common Source stage, Source Followers, Common gate stage, Cascade stage, differential pair

5. **Noise:** Representation of noise in circuits, Noise ins single stage amplifiers, Common source, common gate, Source followers, cascade stage, noise in differential pairs, noise bandwidth

6. **Feedback**: General considerations, Feedback topologies, Effect of loading, effect of feedback on noise

7. **Operational amplifiers**: One stage and two stage op amps, gain boosting, common mode feedback, Input range limitation, Slew rate, Power supply rejection, Noise in Opamp

8. **Stability and Frequency compensation**: Multi pole system, Phase margin, Frequency compensation, Compensation of two stage opamps, other compensation techniques

9. **Band gap references**: Supply independent biasing, temperature independent references, PTAT current generation, speed and noise issues

10. **Phase locked loops**: Simple PLL, Charge pump PLLS, Nonideal effects in PLL, delay locked loops, applications

Text/Reference Books:

1. Behzad Razavi, Design of Analog CMOS integrated circuits, Tata McGraw Hill Edition, 2002
2. Philip E Allen, Douglas R. Holberg, CMOS Analog Circuit Design, Oxford, 2002
3. David A Johns, Ken Martin, Analog Integrated Circuit Design, Wiley Students edition, 2002.

Course Outcomes (COs):

At the end of the course the student is expected to :

- Understand modern transistor behavior.
- Design and analyze different amplifier configurations.
- Use the current mirrors in IC.
- Design OP-amp knowing factors to improve output without noise.
- Characterize the frequency response of amplifier and OP-amp.
- Able to implement different Analog Mixed signal design components in IC.

EC454J VERIFICATION METHODS (L-3, T-0, P-2, Credits-4)

Teaching Scheme	*Examination scheme*
Lectures: 3 hrs/week	Theory: Mid-term 30 marks, End-term 70 marks
Practical: 2 hrs/week	Mid-term 50 marks, End-term 50 marks

Course Educational Objectives (CEO):

- An ability to use modern engineering techniques for verification purpose.
- To understand logic verification using system Verilog simulation.
- To learn how to write test benches and perform verification of the relatively complex digital system
- Identify techniques to improve functional coverage.
- To understand logic verification using UVM.

Course Syllabus:

1. **Verification**: Advanced Testbench Structures, Evolution of verification techniques. Role of re-use in verification. Verification stages in ASIC design flow, Understanding sign off criteria for verification.

2. **Transaction level modelling (TLM)** : Fundamentals of TLM.

3. **System Verilog Basics of SV** : User defined types, Enumeration, Casting, Parameterized types Dynamic Arrays, Associative Arrays, Queues / Lists, StructuresSystem Verilog Scheduler, Program Control, structures, Packages, Tasks & Functions, Dynamic Processes control Interposess Sync & Communication, Semaphore, mailbox

4. **Classes :** Constructors, Inheritance, Virtual methods, Protection, Parameterized classes, Polymorphism, Virtual Classes Interfaces : Interface, Virtual Interfaces

5. **Randomization & Constraints :** Stimulus Generation techniques, Constraint blocks, Randomize, Random sequences

6. **Functional Coverage :** Covergroup, Coverpoint, Cross Coverage methods

7. **SV-Assertions** : Immediate assertions, Concurrent assertions, Boolean Expressions, Sequences, Property Block, Verification Directives, Local Data values

8. **DPI**: Matlab-SV integration, C models to SV integration.

9. **UVM** : UVM Transactions, Core Utility Functions and Implementation UVM Components, Phases, Creating Components & Running the Simulation, Factory, Starting the Test, Ending the Test, Connection to the DUT Transactions, Configuration, UVM Resources and config_db

10. **Introduction to Sequences** : Sequence Elements, Sequences, Sequencers, Drivers to Sequencer to sequence Connection, Virtual Sequences, Prioritized Item Selection and Arbitration

11. **UVM Registers**: The Register Model, Creating Register Models, Integrating Register Models, Backdoor Access.

Text/Reference Books:

1. System Verilog Assertions by Srikanth Vijayaraghavan, MeyyappanRamanathan Publisher: Springer IEEE 1800-2012 SV LRM
2. Getting Started with UVM: A Beginner's Guide Kindle Editionby Vanessa R. Cooper
3. Doulos UVM Golden Reference Guide Kindle Editionby John Aynsley, David Long, Doug Smith
4. SystemVerilog for Design Second Edition: A Guide to Using SystemVerilog for Hardware Design and Modeling Hardcover by P. Moorby, Stuart Sutherland, Simon Davidmann
5. SystemVerilog for Verification: A Guide to Learning the Testbench Language Featuresby Chris Spear, Greg Tumbush IEEE 1666-2011
6. https://verificationacademy.com/

Course Outcomes (COs):

At the end of the course the student is expected to:

- Expertise the verification skills with System Verilog.
- Apply the concept of coverage, assertions and test benches.
- Understand functional verification and its use.
- Develop skills of Transaction Level Modeling.
- Know the UVM environment and its importance.

EC454K VLSI SIGNAL PROCESSING (L-3, T-0, P-2, Credits-4)

Teaching Scheme	*Examination scheme*
Lectures: 3 hrs/week	Theory: Mid-term 30 marks, End-term 70 marks
Practical: 2 hrs/week	Mid-term 50 marks, End-term 50 marks

Course Educational Objectives (CEO):

- To learn low power and improved performance VLSI signal processing architectures
- To learn importance of pipelining and parallel processing
- To learn retiming techniques for improving performance, area, power of digital circuits.
- To learn unfolding transformation technique to increase the throughput of the DSP program.
- To learn folding transformation technique for register minimization.

Course Syllabus:

1. **Introduction to digital processing systems Iteration bound:** data-flow graph representations; loop bound and iteration bound; algorithms for computing iteration bound; iteration bound for multi-rate data-flow graphs.

2. **Pipelining and parallel processing**: pipelining for FIR digital filters, parallel processing; pipelining and parallel processing for low power.

3. **Retiming:** definitions and properties; solving system inequalities; retiming techniques.

4. **Unfolding:** an algorithm for unfolding; properties for unfolding; critical path, unfolding and retiming; applications of unfolding.

5. **Folding:** folding transformation; register minimization techniques; register minimization in folded applications; folding of multi-rate systems.

Text/Reference Books:

1. VLSI signal processing systems: design and implementation, Keshab Parhi, John Wiley and Sons 2003.

Course Outcomes (COs):

At the end of the course the student is expected to :

- Design low power and improved performance VLSI processing architectures.
- Design VLSI circuit using pipelining and parallel processing techniques.
- Can design VLSI circuit with high performance, reduction in area, power using retiming techniques.
- Improve throughput of the DSP program.
- Use folding transformation technique for register minimization

EC454L NANO ELECTRONICS (L-3, T-0, P-2, Credits-4)

Teaching Scheme	*Examination scheme*
Lectures: 3 hrs/week	Theory: Mid-term 30 marks, End-term 70 marks
Practical: 2 hrs/week	Mid-term 50 marks, End-term 50 marks

Course Educational Objectives (CEO):

- Study of overview of Nano materials and its relation to MOSFET.
- Fabrication methodology of basic and advanced MOSFET.
- To study details of secondary effect of MOSFET.
- To study different types of MOSFETs with compound semiconductors and metals.
- To study Synthesis of Nanomaterials.
- Characterization techniques and Applications of nanomaterials.

Course Syllabus:

1. **Overview:** Nano devices, Nano materials, Nano characterization, Definition of Technology node, Basic CMOS Process flow. MOS Scaling theory, Issues in scaling MOS transistors: Short channel effects, Description of a typical 65 nm CMOS technology. Requirements for Non classical MOS transistor.

2. MOS capacitor, Role of interface quality and related process techniques, Gate oxide thickness scaling trend, SiO2 vs High-k gate dielectrics. Integration issues of high-k. Interface states, bulk charge, band offset, stability, and reliability - Qbd high field, possible candidates, CV and IV techniques.

3. **Metal gate transistor:** Motivation, requirements, Integration Issues. Transport in Nano MOSFET, velocity saturation, ballistic transport, injection velocity, velocity overshoot. SOI - PDSOI and FDSOI. Ultrathin body SOI - double gate transistors, integration issues. Vertical transistors - FinFET and Surround gate FET.

4. Metal source/drain junctions - Properties of schotky junctions on Silicon, Germanium and compound semiconductors -Work function pinning. Germanium Nano MOSFETs: strain, quantization, Advantages of Germanium over Silicon, PMOS versus NMOS. Compound semiconductors - material properties, MESFETs Compound semiconductors MOSFETs in the context of channel quantization and strain, Hetero structure MOSFETs exploiting novel materials, strain, and quantization.

5. **Synthesis of Nanomaterials**: CVD, Nucleation and Growth, ALD, Epitaxy, MBE. Compound semiconductor hetero-structure growth and characterization: Quantum wells and Thickness
measurement techniques: Contact - step height, Optical - reflectance and ellipsometry. AFM.

6. **Characterization techniques for nanomaterials**: FTIR, XRD, AFM, SEM, TEM, EDAX etc.

7. **Applications and interpretation of results. Emerging Nano materials**: Nanotubes, Nano rods and other Nano structures, LB technique, Soft lithography etc. Microwave assisted synthesis, Self-assembly etc.

Text/Reference Books:

1. Fundamentals of Modern VLSI Devices, Y. Taur and T. Ning, Cambridge University Press.
2. Silicon VLSI Technology, Plummer, Deal , Griffin , Pearson Education India.
3. Encyclopedia of Materials Characterization, Edited by: Brundle, C.Richard; Evans, Charles A. Jr.; Wilson, Shaun ; Elsevier.

Course Outcomes (COs):

At the end of the course the student is expected to :

- Understand modern transistor structures and characteristics.
- Use transistor as nano electronics component.

EC454M INTERNET OF THINGS (L-3, T-0, P-2, Credits-4)

Teaching Scheme	*Examination scheme*
Lectures: 3 hrs/week	Theory: Mid-term 30 marks, End-term 70 marks
Practical: 2 hrs/week	Mid-term 50 marks, End-term 50 marks

Course Educational Objectives (CEO):

- To assess the vision and introduction of IoT.
- To Understand IoT Market perspective.
- To Implement Data and Knowledge Management and use of Devices in IoT Technology.
- To Understand State of the Art - IoT Architecture.
- To classify Real World IoT Design Constraints, Industrial Automation in IoT..

Course Syllabus:

1. **The Internet of Things**: Complete Overview, What is the Internet of Things?, History of IoT, About IoT, Overview and Motivations, Examples of Applications, Internet of Things Definitions and Frameworks : IoT Definitions, IoT Architecture, General Observations, ITU-T Views, Working Definition, IoT Frameworks, Basic Nodal Capabilities, Identification of IoT Objects and Services, Structural Aspects of the IoT, Environment, Characteristics, Traffic Characteristics, Scalability, Interoperability, Security and Privacy, Open Architecture, Key IoT Technologies, Device Intelligence, Communication Capabilities, Mobility Support, Device Power, Sensor Technology, RFID Technology, Satellite Technology, Transport services: TCP, UDP, socket programming.

2. **Embedded Communication Protocols**: Embedded Networking: Introduction – Serial/Parallel Communication – Serial communication protocols -RS232 standard – RS485 – Synchronous Serial Protocols -Serial Peripheral Interface (SPI) – Inter Integrated Circuits (I2C) – PC Parallel port programming - ISA/PCI Bus protocols –Firewire Local Area Networks, MAC level, link protocols such as: point-to-point protocols, Ethernet, WiFi 802.11, cellular Internet access, and Machine-to-machine.

3. **Mobile Networking**: roaming and handoffs, mobile IP, and ad hoc and infrastructure less networks.

4. **Design Principles for Connected Devices**: Technology, Web Thinking for Connected Devices, Affordances, Prototyping, Sketching, Familiarity, Costs versus Ease of Prototyping,

Prototypes and Production, Changing Embedded Platform, Physical Prototypes and Mass Personalisation, Climbing into the Cloud, Open Source versus Closed Source, Mixing Open and Closed Source, RFID: Introduction, Principle of RFID, Components of an RFID system, Issues.IoT definitions: overview, applications, potential & challenges, and architecture.

5. Case studies, e.g. sensor body-area-network and control of a smart home.

Text/Reference Books:

1. Adrian McEwen, Hakim Cassimally, "Designing the Internet of Things", ISBN 978-1-11843062-0 (paperback); ISBN 978-1-118-43063-7 (ebook); 978-1-118-43065-1 (ebook), 2014 John Wiley and Sons, Ltd.
2. Hakima Chaouchi, " The Internet of Things Connecting Objects to the Web" ISBN:978-184821-140-7, Willy Publications

Course Outcomes:

After successfully completing the course students will be able to:

- Interpret the vision of IoT from a global context.
- Determine the Market perspective of IoT.
- Compare and Contrast the use of Devices, Gateways and Data Management in IoT.
- Implement state of the art architecture in IoT.
- Illustrate the application of IoT in Industrial Automation and identify Real World Design Constraints.

Elective list related to subjects of Image and Signal Processing:

EC454N DIGITAL IMAGE PROCESSING (L-3, T-0, P-2, Credits-4)

Teaching Scheme	*Examination scheme*
Lectures: 3hrs/week	Theory: Mid-term 30 marks, End-term 70 marks
Practical: 2 hrs/week	Mid-term 50 marks, End-term 50 marks

Course Educational Objectives (CEO):

- Introduce the scope of the field of image processing and basic concepts in digital image processing.
- Demonstrate different of image enhancement techniques.
- Describe different segmentation & compression techniques.
- Analyze different morphological techniques.
- Construct a model for object recognition.

Course Syllabus:

1. **Introduction:** Digital Image Representation, Fundamental steps in Image Processing, Elements of Digital Image Processing systems.

2. **Digital Image Fundamentals:** Elements of Visual Perception, A Simple Image Model, Sampling and Quantization, Some basic relationship between Pixels, Image Geometry, Photographic Film.

3. **Image Transforms**: Introduction to the Fourier Transform, The Discrete Fourier Transform, Some properties of the Two Dimensional Fourier Transform, The Fast Fourier Transform, Other Separable Transforms, and The Hotelling Transforms.

4. **Image Enhancement:** Background, Enhancement by Point Processing, Spatial Filtering, Enhancement in the Frequency Domain, Generation of Spatial Mask from Frequency Domain Specification, Color Image processing.

5. **Image Restoration:** Degradation Model, Diagonalixation of Circulant and Block Circulant Matrices, Algebraic approach to Restoration, Inverse Filtering, Least Mean Square (Wiener) Filter, Constrained Least Squares Restoration, Interactive Restoration, Restoration in the Spatial Domain, Geometric Transformations.

6. **Image Compression:** Fundamentals, Image Compression Models, Image Compression Models, Elements of Information Theory, Error Free Compression, Lossy Compression, Image Compression Standards.

7. **Image Segmentation:** Detection of Discontinuities, Edge Linking and Boundary Detection, thresholding, Region Oriented Segmentation, The use of Motion in Segmentation.

8. **Representation and Description**: Representation Schemes, Boundary Descriptors, Regional Descriptors, Morphology, and Relational Descriptors.

Text/Reference Books:

1. R.C. Gonzalez, R.E.Woods, Digital image processing, Pearson Education India, Third Edition, 2002.
2. Anil K. Jain, Fundamentals of digital image processing, Prentice Hall of India.

Course Outcomes (COs):

After successfully completing the course students will be able to:

- Understand image transforms and their properties.
- Perform hands-on experience in using software tools for processing digital images.
- Understand technique for image enhancement both in spatial and frequency domains.
- Perform the image compression techniques in spatial and frequency domains using matlab.
- Get the knowledge of Image restoration and image segmentation techniques.
- Select different feature extraction techniques for image analysis and recognition.

EC454O ADVANCED SIGNAL PROCESSING (L-3, T-0, P-2, Credits-4)

Teaching Scheme	*Examination scheme*
Lectures: 3 hrs/week	Theory: Mid-term 30 marks, End-term 70 marks
Practical: 2 hrs/week	Mid-term 50 marks, End-term 50 marks

Course Educational Objectives (CEO):

- Design of FIR, Half band, and IIR filters.
- Compute and Interpret Discrete Fourier Transform, Short Time Four Transform.
- Analyze multirate DSP systems.
- Determine coefficients for perfect reproduction filter banks and wavelets.
- Understand Wavelet Transform, Choose parameters to take a wavelet transform, interpret and process the result.
- Use software packages such as MATLAB for the analysis and design of signal processing systems.

Course Syllabus:

1. Fundamentals of DSP background and review of discrete time random signals.

2. **Discrete Fourier Transform**: representation, properties and computation of the DFT (FFT), decimation in time and frequency.

3. **Filter design techniques**: Design of IIR filters, Impulse invariance, bilinear transformation, Design of FIR filters by windowing and frequency sampling

4. **Multirate digital signal processing:** Fundamentals of Multirate systems, Basic multirate operations, Decimation, interpolation, filter design and implementation of sampling rate conversion, polyphase filter structures, time variant filter, structures, multistage implementation of sampling rate conversion of BP signals, sampling rate conversion by an arbitrary factor, interconnection of building blocks, polyphase representation, multistage implementations.

5. **Wavelet Transform:** Introduction to wavelets, wavelets and wavelet expansion systems, discrete wavelet transform, multiresolution formulation of wavelet systems, Haar Wavelet and other wavelet representations, scaling function, wavelet functions, Parseval's theorem

Text/Reference Books:

1. S. K. Mitra, Digital signal processing: A computational approach, TMH
2. P. P. Vaidyanathan, Multirate filters and Filter banks, PH International, Englewood Cliffs
3. Rabiner and Schafer, Multirate signal Processing, PH International, Englewood Cliffs
4. C. S. Burrus, Ramose and A. Gopinath, Introduction to Wavelets and Wavelet Transform, Prentice Hall Inc.

Course Outcomes (COs):

After successfully completing the course students will be able to:

- Ability to design of FIR, Half band, and IIR filters.
- Acquired the knowledge of Discrete Fourier Transform, Short Time Four Transform.
- Ability to analyze multirate DSP systems.
- Ability to determine coefficients for perfect reproduction filter banks and wavelets.
- Understand Wavelet Transform, Choose parameters to take a wavelet transform, interpret and process the result.
- Ability to do the analysis and design of signal processing systems using MATLAB software.

EC454P MULTIMEDIA SYSTEM (L-3, T-0, P-2, Credits-4)

Teaching Scheme	*Examination scheme*
Lectures: 3 hrs/week	Theory: Mid-term 30 marks, End-term 70 marks
Practical: 2 hrs/week	Mid-term 50 marks, End-term 50 marks

Course Educational Objectives (CEO):

- Understand multimedia information representation and relevant signal processing aspects, multimedia networking and communications, and multimedia standards especially on the audio, image and video compression.
- achieve a basic understanding of multimedia systems.
- Able to evaluate more advanced or future multimedia systems.
- motivate students towards developing their career in the area of multimedia and internet applications.

Course Syllabus:

1. **Introduction to Multimedia and Data Representation**
    a. Introduction to Multimedia: What is Multimedia?, Multimedia and Hypermedia, World Wide Web, Overview of Mu1timedia Software Tools,
    b. Fundamentals of Audio, Image and Video Processing
    c. Graphics and Image Data Representations: Graphics Image Data Types, Popular File Formats
    d. Color in Image and Video: Color Science, Color Models in Images, Color Models in Video.
    e. Fundamental Concepts in Audio and Video
2. **Multimedia Data Compression:**
    a. Lossless Compression Algorithms: Introduction, Basics of Information Theory, Run-Length Coding, Variable-Length Coding (VLC), Dictionary-Based Coding, Arithmetic Coding, Lossless Image Compression
    b. Lossy Compression Algorithms: Introduction, Distortion Measures, The Rate-Distortion Theory, Quantization, Transform Coding, Wavelet-Based Coding, Wavelet Packets, Embedded Zerotree of Wavelet Coefficients, Set Partitioning in Hierarchical Trees (SPIHT)
    c. Image Compression Standards: The JPEG Standard, The JPEG2000 Standard, The JPEG-LS Standard, Bilevel Image Compression Standards
    d. Basic Video Compression Techniques: Introduction to Video Compression, Video Compression Based on Motion Compensation, H.261, H.263
    e. MPEG Video Coding I - MPEG-1 and 2: Overview, MPEG-1, MPEG-2
3. **Multimedia Communication and Retrieval:**
    a. Computer and Multimedia Networks: Basics of Computer and Multimedia Networks, Multiplexing technologies, LAN and WAN, Access Networks, Common peripheral interfaces.
    b. Content-Based Retrieval in Digital Libraries: - How Should We Retrieve Images?, C-BIRD - A Case Study, Synopsis of Current Image Search Systems

Text/Reference Books:

1. Zi-Niam Li and Mark Drew, Fundamentals of Multimedia, Pearson, 2004
2. Khalid Sayood, Data Compression, PHI

Course Outcomes (COs):

After successfully completing the course students will be able to:

- Understand different types of multimedia data and basics of image and video.
- Understand colour models of image and video.
- Analyse and design different compression algorithms.
- Analyse and implement different compression standards for image and video.
- Understand the transmission of multimedia data over communication networks.

EC454Q SPEECH AND AUDIO PROCESSING (L-3, T-0, P-2, Credits-4)

Teaching Scheme	*Examination scheme*
Lectures: 4 hrs/week	Theory: Mid-term 30 marks, End-term 70 marks
Practical: 2 hrs/week	Mid-term 50 marks, End-term 50 marks

Course Educational Objectives (CEO):

- To understand basic concepts and methodologies for the analysis and modeling of speech Signal.
- To characterize the speech signal as generated by a speech production model.

- To understand the mechanism of speech and audio perception.
- To understand the motivation of short-term analysis of speech and audio.
- To extract the information of the speech or audio signals in terms of cepstral features.
- To provide a foundation for developing applications in this field.

Course Syllabus:

1. **Introduction:** Production and transmission of acoustic signals: articulation of human speech. Acoustic-phonetic structure of Speech and Music: music synthesis and speech synthesis. A history of Voders & Vocoders and early speech recognition methods.

2. **Acoustic-Phonetic classification:** Phonemes, Auto-spectra. Review of Digital Signal Processing and FFT.Short-term Spectral Analysis and STFT, the ARPA and DARPA projects, Pattern matching, introduction to Hidden Markov (HMM) Models. Adaptive segmentation of speech.

3. The stochastic parameters of human speech, Gaussian densities and statistical model training, voiced and unvoiced speech, voice-box modeling, resonance. Acoustic travelling waves. Psycho-acoustics, Physiological exploration of periodicity, audio-spectrograms and sonograms, pitch-perception models.

4. Physiology of the ear and hearing mechanism, the Auditory System modeled as a Filter-bank, Gamma-tone and Roex filters, Spectrum and Complex Cepstrum analysis of speech as perceived by detectors, Automatic Speech Recognition (ASR), Linear Prediction analysis

5. Phonetic and phonemic alphabets, phonological models of ASR, Linear and Dynamic Time-warping, connected word recognition Statistical sequence recognition and model training in speech pattern recognition, HMM training, Viterbi training, MLP architecture and training,

6. Speech Synthesis and coding, Formant synthesizers, Vocoders, Speech transformation, Speaker verification, Music synthesizers, speech-assisted applications in industry, defense and medicine.

Text/Reference Books:

- B.Gold & N.Morgan:- Speech & Audio Signal Processing -Processing and Perception of Speech
- Music (Wiley Student edition)
- L.R. Rabiner & B.H.Juang:- Fundamentals of Speech Recognition (Prentice-Hall Signal Processing series)
- B.Plannerer: An Introduction to Speech Recognition
- Mihelic & J.Zibert : Speech Recognition (InTech) Mcloughlin: Applied Speech and Audio Processing with MATLAB examples
- G. Young:-The Application of Hidden Markov Models in Speech Recognition
- M.Grimm & K.Kroschel:-Robust Speech Recognition & Understanding (Intech) x)
- L. R.Rabiner & R.W.Schafer: Theory and Applications of Digital Speech Processing
- C. Schmandt:- Voice Communication with Computers-Conversational Systems
- SOUND FORGE software package (SONY) for practice sessions

Course Outcomes:

After successfully completing the course students will be able to:

- Acquired the knowledge of basic concepts and methodologies for the analysis and modeling of speech Signal.
- Ability to characterize the speech signal as generated by a speech production model.
- Ability to understand the mechanism of speech and audio perception.
- Ability to understand short-term analysis of speech and audio.
- Ability to extract the information of the speech or audio signals in terms of cepstral features.

EC454R BIO MEDICAL IMAGE PROCESSING (L-3, T-0, P-2, Credits-4)

Teaching Scheme	*Examination scheme*
Lectures: 3 hrs/week	Theory: Mid-term 30 marks, End-term 70 marks
Practical: 2 hrs/week	Mid-term 50 marks, End-term 50 marks

Course Educational Objectives (CEO):

- To introduce students to basic signal processing techniques in analyzing biological signals.
- To develop the students mathematical, scientific, and computational skills relevant to the field of biomedical signal processing.
- To enhance the students ability in formulating problems and designing analysis tools for biological signals.
- To increase the student's awareness of the complexity of various biological phenomena .

Course Syllabus:

1. **Sources of Medical Images**: physics of X-ray, CT, PET, MRI, and ultrasound; Properties of the resulting images, Advantages and disadvantages of each imaging modality

2. Biomedical Signals and Images

a Imaging Modalities: Survey of major modalities for medical imaging: ultrasound, X-ray, CT, MRI, PET, and SPECT.

b MRI: Physics and signal processing for magnetic resonance imaging. Guest lecture.

c Surgical Applications: A survey of surgical applications of medical image processing. Guest lecture.

3. Fundamentals of Deterministic Signal and Image Processing

a Image processing I: Extension of filtering and Fourier methods to 2-D signals and systems.

b Image processing II: Interpolation, noise reduction methods, edge detection, homomorphic filtering.

4. Probability and Random Signals

a PDFs: Introduction to random variables and probability density functions (PDFs).

b Classification: Bayes' rule, detection, statistical classification.

c Estimating PDFs: Practical techniques for estimating PDFs from real data.

d Blind source separation: Use of principal component analysis (PCA) and independent component analysis (ICA) for filtering.

5. **Registration (alignment):** Intensity-based methods, Cost functions (correlation, least squares, mutual information, robust estimators), and optimization techniques (fixed-point iteration, gradient descent, Nelder-Mead simplex method, etc.). Implement registration for rigid and non-rigid transformations, Transform based registration, Image Fusion methods: Spatial domain and frequency domain.

6. **Segmentation:** Simple methods such as thresholding, dynamic thresholding, region growing and watershed. Texture based tissue classification methods. More depth on the method of snakes (adaptive mesh), level set method (numerical solution of partial differential equations), and clustering (classifiers).

7. **Reconstruction Methods**: Reconstruction techniques for CT (filtered back projection) and MRI (using the FFT).The Radon transform, the Fourier transform, and how they relate to each other.

Text/Reference Books:

1. Macovski, A. Medical Imaging Systems. Upper Saddle River, NJ: Prentice Hall, 1983. ISBN: 9780135726853.
2. Digital Image Processing using Matlab, R.C. Gonzalez, R.E. Woods and S.L. Eddins, Prentice Hall, 2004.

Course Outcomes (COs):

After successfully completing the course students will be able to:

- Acquired the knowledge of basic signal processing techniques in analyzing biological signals.
- Ability to apply the mathematical, scientific, and computational skills relevant to the field of biomedical signal processing.
- Enhanced the ability of students in formulating problems and designing analysis tools for biological signals

EC454S NEURAL NETWORK AND FUZZY LOGIC (L-3, T-0, P-2, Credits-4)

Teaching Scheme	*Examination scheme*
Lectures: 3 hrs/week	Theory: Mid-term 30 marks, End-term 70 marks
Practical: 2 hrs/week	Mid-term 50 marks, End-term 50 marks

Course Educational Objectives (CEO):

- To understand the fundamental theory and concepts of neural networks and fuzzy logic.
- To provide knowledge of neural network modeling, several neural network paradigms and its applications.
- To analyze feed forward and feedback neural networks.
- To provide knowledge of fuzzy sets, knowledge representation using fuzzy rules, approximate reasoning, fuzzy inference systems, and fuzzy logic .
- To understand, implement and analyze different fuzzy inference systems.
- To explore hands-on experience in applying and analyzing the neural and fuzzy logic algorithms.

Course Syllabus:

1. **Introduction:** Fundamentals and Models of Artificial Neural Systems, Neural computation: Examples and applications, Biological neurons and their artificial models, Models of artificial networks, Neural processing, Learning and adaptation, Neural network learning rules, Overview of neural networks

2. **Single-Layer Perception Classifiers:** Classification model, features, and decision regions, Discriminate functions, Linear machine and minimum distance classifier, Non parametric training concept, SDPTA, SCPTA, R-category discrete Perception training algorithm

3. **Multilayer Feed forward Networks**: Linearly non separable pattern classification, Delta learning rule for multiperceptron layer, Generalized delta learning rule, feed forward recall and error back propagation training, Learning factors

4. **Single Layer Feedback Networks** : Basic concepts and dynamical systems, Mathematical foundations of discrete-time and gradient-type Hopfield networks

5. **Applications of Neural Networks**: Introduction to applications in characters recognition and control systems.

6. **Introduction to Fuzzy Logic**: Uncertainty and imprecision, Classical sets and Fuzzy sets, Classical relation and fuzzy relations, Operations on crisp and fuzzy relations. Fuzzy tolerance and equivalence

7. **Fuzzyfication and Defuzzification**: Membership functions, Membership assignment, lambda cuts, Defuzzification methods.

8. **Fuzzy Arithmetic:** Fuzzy numbers, vectors, extension principle, crisp functions, mapping, fuzzy transforms, interval analysis

9. **Applications of Fuzzy Logic:** Introduction to applications in data classification, image processing, and control systems.

10. **Neuro-Fuzzy Approach:** Examples of neuro-fuzzy approach, application in image processing.

Text/Reference Books

1. J. M. Zurada, Introduction to Artificial Neural Networks, Jaico Publishing house.
2. T. M. Ross, Fuzzy logic, Mc-Graw Hill Inc.
3. Kosoko, Neural Networks and Fuzzy Systems, PHI
4. Zimermann, Fuzzy set Theory, Allied Pub.

Course Outcomes (COs):

After successfully completing the course students will be able to:

- Understand the basic models of artificial neural network, their limitations, concept of learning and adaptation using the learning rules developed in artificial neural network, implementation of learning rule.
- Describe the concepts of feed forward neural networks using single layer and multilayer networks to solve classification problem, and its implementation, single layer feedback networks to study the concept of memory using neural networks.
- Analyse and implement the applications of neural networks in character recognition and control systems.
- Understand the Fuzzy logic principles such as fuzzy set, fuzzy relations, and membership functions, concepts of fuzzification and defuzzification, methods of deffuzification, and its implementation.
- Analyse the application of fuzzy logic in data classification, image processing, and control systems.

EC454T MACHINE VISION AND LEARNING (L-3, T-0, P-2, Credits-4)

Teaching Scheme	*Examination scheme*
Lectures: 3 hrs/week	Theory: Mid-term 30 marks, End-term 70 marks
Practical: 2 hrs/week	Mid-term 50 marks, End-term 50 marks

Course Educational Objectives (CEO):

- To introduce basic concepts of machine vision, machine learning and their interrelation.
- To understand the vision technology in conjunction with real world applications
- To analyse algorithms for classification, clustering and Markov decision processes
- To provide hands-on experience in analysing and applying machine learning techniques in practical problems

Course Syllabus:

1. **Introduction:** Machine vision and computer vision, Applications in real world. Machine learning approaches: Statistical, Neural Networks, Soft computing

2. **Machine Vision Basic**

   1.Image Formation - basic issues of digital imagery: geometry, radiometry, photometry and digitization. Digitization process, how an image can be viewed as a mapping of the actual scene
   2.Image Enhancement – linear and non-linear filtering, histogram equalization, and other image enhancement techniques
   3.Edge and Line extraction and description – various types of edge detection schemes such as first and second derivative, Sobel, Prewitt and facet models, edge thresholding and edge thinning
   4.Morphology – binary and gray scale morphology from the basic filtering techniques (open, close, top-hat) etc.
   5.Image segmentation, Convolution, filtering and Fourier transform

3. **Machine Vision Application:**

   1.Bays decision theory: Introduction, bays decision theory continuous case, two category classification, minimum error rate classification, classifier, discriminate functions and decision surfaces (multi-category and two category case). The normal density function (Univariate and multivariate normal density function)

   2.Parameter estimation and supervised learning: maximum likelihood estimation Bayes classifier, general Bayesian learning, problem of dimensionally, non-parametric techniques, density estimation, Parzen window, k-nearest estimation, nearest neighbor rule
   3.Unsupervised learning: k means clustering

4. **Introduction to Machine Vision Software Packages**: OpenCV, Sapera LT & Architect, Aphelion etc

Text/Reference Books:

5. R. O. Duda and P. E. hart, Pattern classification and scene analysis, Wiley Interscience publication
6. Robert Schaloff, Pattern recognition: statistical, structural and neural approaches, John Wiley and Sons Inc.
7. R. C. Gonzalez and R. E. Woods, Digital image processing, Addison-Wesley Publishing House.
8. Forsyth and Ponce, Computer vision: A modern approach, PHI
9. Barnesh Jain, Rangachar Kasturi, Brain G. Schunck, Machine vision, McGraw-Hill

Course Outcomes (COs):

After successfully completing the course students will be able to:

- Understand the basic of machine vision, Types of learning
- study of Image formation, Image enhancement, edge and line description, morphology

- Understand Bays decision and design classifiers, discriminant functions, parameter estimation, Supervised learning
- Study Machine vision tools

EC454U INDIAN PATENTS ACT (L-3, T-0, P-2, Credits-4)

Teaching Scheme	*Examination scheme*
Lectures: 3 hrs/week	Theory: Mid-term 30 marks, End-term 70 marks
Practical: 2 hrs/week	Mid-term 50 marks, End-term 50 marks

Course Syllabus:

1. Importance of Indian Patent Act in the field of R & D and innovation.

2. IP is an important element of the institutional fabric of an efficiently organized society. Indian Patent Act is an attempt to safeguard the rights of original contributor of ideas, concept, and creativity of individuals.

3. Indian Patent Act are regarded as a source of national wealth and mark of an economic leadership in the context of global market scenario. Created internal vigilance and enlightenment among students to generate new ideas.

4. Indian Patent Act protection provides an incentive to inventors for further research work and investment in R & D, which leads to creation of new and better products, and in turn brings about, economic growth and social benefits.

EC454V MATERIAL SCIENCE & ENGINEERING (L-3, T-0, P-2, Credits-4)

Teaching Scheme	*Examination scheme*
Lectures: 3 hrs/week	Theory: Mid-term 30 marks, End-term 70 marks
Practical: 2 hrs/week	Mid-term 50 marks, End-term 50 marks

Course Educational Objectives (CEO):

- Know the fundamental science and engineering principles relevant to materials.
- Understand the relationship between nano/microstructure, characterization, properties and processing and design of materials.
- Have the experimental and computational skills for a professional career or graduate study in materials.
- Possess a knowledge of the significance of research, the value of continued learning and environmental/social issues surrounding materials.
- Be able to communicate effectively, to work in teams and to assume positions as leaders.

Course Syllabus:

1. Structure of Solids: Atoms and their binding, Bonds, Crystal Systems, Bravais Lattice Miller Indices, Crystalline, Polycrystalline and Amorphous Materials; Metals, Semiconductors and Insulators, Lattice defects-Qualitative ideas of point, line, surface and volume defects.

2. Dielectric Properties : Dielectric Polarization and Mechanism- Internal or local field, Dielectric Loss, Temperature and Frequency dependence of dielectric constant, Elementary ideas of Piezo electrics, Ferroelectrics and Pyroelectric Materials and its Applications.

3. Magnetic Properties: Elementary ideas of classification of magnetic materials – Diamagnetism, Paragnetism, Ferrognetism, Ferrimagnetism, Magnetic Domains.

4. Superconductors: Basic concepts of superconductivity, Transition temperature, Meissner effect High-T superconductors, Haed and Soft Materials, SQUID.

5. Optical properties: Absorption, Emission, Luminescence, Electro-optic and Acousto-optic effects, Photorefractive effects.

6. Materials for Optical Communication: LED and Laser Materials, Optical Fibre.

7. Materials for Data Storage : Magnetic Cores, Tapes, Disks, Hard disk, Floppy disk, Magneto-optic devices, Bubble memories, Magnetoelectronic Materials, CD, DVD, CCD.

8. Materials for Display Devices: CRT, LED, LCD, TFT, Plasma Display.

9. Advanced Materials: Metallic Glasses, Nanomaterials, etc.

Text/Reference Books:

1. Electrical Engineering Materials – A. J. Dekker (PHI)
2. Material Science and Engineering–A First Course – V. Raghavan (PHI Learning Pvt. Ltd)
3. Principles of Electronic Materials and Devices – S. Kasap (McGraw-Hill)
4. An Introduction to Solid State Physics - Charles Kittel (John Wiley & sons)
5. An Introduction to Electronic Materials for Engineers – W. Kao, Z. Lee and N. Sannes (World Scientific)

Course Outcomes:

After successfully completing the course students will be able to:

- Apply general math, science and engineering skills to the solution of engineering problems.
- Aware of the social, safety and environmental consequences of their work, and be able to engage in
- Apply core concepts in Materials Science to solve engineering problems.
- Select materials for design and construction.
- Understand the importance of life-long learning.
- Design and conduct experiments, and to analyze data.
- Understand the professional and ethical responsibilities of a materials scientist and engineer.
- Work both independently and as part of a team.

EC454W ALTERNATE ENERGY RECOURSES (L-3, T-0, P-2, Credits-4)

Teaching Scheme	*Examination scheme*
Lectures: 3 hrs/week	Theory: Mid-term 30 marks, End-term 70 marks
Practical: 2 hrs/week	Mid-term 50 marks, End-term 50 marks

Course Syllabus:

1. Classification of Energy Sources: Advantages of Non-Conventional Energy Sources over Conventional Sources Economics, Impact on Environment

2. Electricity Generation from Non-Conventional Energy Sources:

3. Solar Energy: Solar radiation and its Characteristics, Solar Collector: flat Plate, focusing, Solar Energy use for water heating, solar thermal power

4. generation, Hybrid solar power Principle of energy conversion in solar cells, Photovoltaics, Different types of PV Cells, Mono-poly crystalline and amorphous Silicon solar cells. Design of PV array. Efficiency and cost of PV systems.

5. Wind Energy: Wind as energy source, Design of Wind turbine, Selection of site of Wind farm, characteristics of different types of wind generators used with wind turbines

6. Hydel Energy: Electricity generation from micro hydel plants, location, auxiliaries and associated problems.

7. Bio Energy: Resources and conversion process: bio gas conversion, bio gas plant, bio mass gasifier. Co-generation

8. Bio diesel; Sources, usability and advantages over mineral product,

9. Tidal Energy: Principle, selection of site, Economics and future prospect

10. Wave Energy: Principle , selection of site and future prospect
11. Geo thermal Energy: Principle , location , economics and prospect

12. Fuel Cells: Principle of fuel cells, Different types of fuel cells, advantages and limitations

13. Magneto hydrodynamics energy conversion: Principle, Economics and environmental aspect of MHD generation

Elective list related to subjects of Computer:

EC454X: DATA MINING AND DATA WAREHOUSING (L-3, T-0, P-2, Credits-4)

Teaching Scheme	*Examination scheme*
Lectures: 3 hrs/week	Theory: Mid-term 30 marks, End-term 70 marks
Practical: 2 hrs/week	Mid-term 50 marks, End-term 50 marks

Course Syllabus:

1. **Data Warehouse**: Introduction, a Multi-dimensional data model, Data Warehouse Architecture, Data Warehouse Implementation.

2. **Data Mining**: Introduction, Data Mining, on what kind of Data, Data Mining Functionalities, Classification of Data Mining Systems, Major issues in Data Mining.

3. **Data Preprocessing**: Data cleaning, Data Integration & Transformation, Data Reduction, Discretization & Concept Hierarchy Generation, Data Mining Primitives.

4. **Mining Association roles in large databases:** Association rule mining, mining single-dimensional Boolean Association rules from Transactional Databases, Mining Multi-dimensional Association rules from relational databases & Data Warehouses.

5. **Classification & Prediction**: Introduction, Classification by Decision tree induction, Bayesian Classification.

6. Other Classification Methods, Classification by Back propagation, Prediction, Classifier accuracy.

7. Cluster Analysis: Introduction, Types of data in Cluster analysis, A categorization of major clustering methods, partitioning methods, Hierarchical methods, Density-Based Methods: DBSCAN, Gridbased Method: STING; Model-based Clustering Method: Statistical approach, Outlier analysis.

Text/Reference Books:

1. Data Mining Concepts & Techniques, Jiawei Han Micheline Kamber, Morgan Kaufmann Publishers.
2. Data Warehouse Toolkit, Ralph Kinball, John Wiley Publishers.
3. Data Mining, Introductory and Advanced Topics, Margaret H.Dunham, Pearson Education.
4. Data warehousing in the real world, A Practical guide for Building decision support systems, Sam Anahory, Dennis Murray, Pearson Education.

EC454Y BIG DATA AND CLOUD COMPUTING (L-3, T-0, P-2, Credits-4)

Teaching Scheme	*Examination scheme*
Lectures: 3 hrs/week	Theory: Mid-term 30 marks, End-term 70 marks
Practical: 2 hrs/week	Mid-term 50 marks, End-term 50 marks

Course Educational Objectives (CEO):

- To provide the knowledge of how cloud computing and big data techniques can be used to solve massive scale problems.
- To provide the knowledge of processing of large datasets using Big Data techniques,Hadoop ecosystem, map-reduce and other techniques will be a large focus.
- To provide the knowledge of the SQL language and HIVE e HIVEQL.
- To provide the knowledge of data centre foot prints & concepts, introduction to cloud, virtualization concepts.
- To provide the knowledge of cover approaches to building applications and managing them on the cloud.

Course Syllabus:

1. **Big Data introduction**: Big data: definition and taxonomy, big data value for the enterprise, setting up the demo environment, First steps with the Hadoop "ecosystem"

2. **The Hadoop ecosystem:** Introduction to Hadoop, Hadoop components: MapReduce/Pig/Hive/HBase, Loading data into Hadoop, Handling files in Hadoop, Getting data from Hadoop

3. **Querying big data with Hive:** Introduction to the SQL Language, From SQL to HiveQL, Querying big data with Hive, Introduction to HIVE e HIVEQL, Using Hive to query Hadoop files

4. **Data centre foot prints & concepts, introduction to cloud, virtualization concepts:** types of virtualization & its benefits, introduction to various virtualization OS: VMware , KVM etc., HA/DR using virtualization, moving VMs, SAN backend concepts cloud fundamentals: cloud building blocks, understanding public & private cloud environments

5. **Cloud as IaaS, private cloud environment**: basics of private cloud infrastructure, QRM cloud demo, public cloud environment: understanding & exploring Amazon Web services, Managing and Creating Amazon EC2 instances, Managing and Creating Amazon EBS volumes, Tata Cloud details & demo, Managing Hybrid Cloud environment

6. Cloud Domain and scope of work, Cloud as PaaS, SaaS, cloud Computing Programming Introduction, Trends and market of cloud

Text/Reference Books:

1. Big data. Architettura, tecnologie e metodi per l'utilizzo di grandi basi di dati, A. Rezzani, Apogeo Education, 2013
2. Hadoop For Dummies, Dirk deRoos, For Dummies, 2014

Course Outcomes (COs):

After successfully completing the course students will be able to:

- To utilize the knowledge of how cloud computing and big data techniques for solving massive scale problems.
- To process the large datasets using Big Data techniques.
- To learn about the SQL language and HIVE e HIVEQL.
- To utilize the knowledge of data centre foot prints & concepts, introduction to cloud and virtualization concepts.
- To utilize the knowledge of cover approaches to build applications and manage them on the cloud.

EC454Z COMPUTER ARCHITECTURE (L-3, T-0, P-2, Credits-4)

Teaching Scheme	*Examination scheme*
Lectures: 3 hrs/week	Theory: Mid-term 30 marks, End-term 70 marks
Practical: 2 hrs/week	Mid-term 50 marks, End-term 50 marks

Course Educational Objectives (CEO):

- To provide the knowledge of : how Computer Systems work & its basic principles, concepts behind advanced pipelining techniques, current state of art in memory system design, how I/O devices are being accessed and its principles.
- To provide the knowledge of basics of systems topics: single-cycle (MIPS), multi-cycle (MIPS), parallel, pipelined, superscalar, and RISC/CISC architectures.
- To provide the knowledge of Instruction Level Parallelism.
- To provide the knowledge ofMemory Hierarchy Design.
- To provide the knowledge ofStorage Systems.

Course Syllabus:

1. **Fundamentals of Computer Design**: Introduction to computer design, Changing face of computing and task of computer designer, Technology trends, Cost, price and their trends, Measuring and reporting performance, Quantitative principles of computer design, RISC versus CISC, Major organizational issues of processor design: data path and control design.

2. **Instruction set principles**: Introduction, Classifying instruction set architectures, Memory addressing, Addressing modes for signal processing, Type and size of operands and operations, type of operands and operations for media and signal processing, Instructions for control flow, encoding of an instruction set, Role of compilers, MIPS architecture, fallacies and pitfalls.

3. **Instruction level parallelism and it's dynamic exploitation:** Instruction level parallelism concepts and challenges, overcoming data hazards with dynamic scheduling, Basic and intermediate concepts of pipelining: Introduction, the major hurdle of pipelining, RISC pipelined data path.

4. **Memory Hierarchy Design:** Introduction, Review of ABCs of caches, cache performance, reducing

cache miss penalty, reducing cache miss rate, reducing cache hit time, virtual memory: protection and examples of virtual memory.

5. **Parallel processing:** Trends towards parallel processing, parallelism in uniprocessor systems, classification of parallel computers and their structures, applications of parallel processing.

6. **Storage Systems:** Introduction, types of storage devices, I/O performance measures, RAID: Redundant array of inexpensive disks, errors and failures in real systems.

Text/Reference Books:

1. John L. Hennessy and David A. Patterson, Computer Architecture, A Quantitative Approach (2nd. Ed.), Morgan Kaufmann
2. P. Chaudhuri, Computer Organization and Design (2nd Ed.), PHI
3. J.P.Hays, Computer Architecture and Organization (3rd Ed.), Mc Graw Hill
4. Kai Hwang and Fay'e A. Briggs, Computer Architecture and Parallel Processing, Mc Graw Hill.

Course Outcomes (COs):

After successfully completing the course students will be able to:

- To utilize the knowledge of : how Computer Systems work, advanced pipelining techniques, memory system design, I/O devices.
- To utilize the knowledge of basics of systems topics: single-cycle (MIPS), multicycle (MIPS), parallel, pipelined, superscalar, and RISC/CISC architectures.
- To utilize the knowledge of Instruction Level Parallelism.
- To utilize the knowledge of Memory Hierarchy Design.
- To utilize the knowledge of Storage Systems

EC455 INDUSTRIAL TRAINING SEMINAR (L-0, T-0, P-2, Credits-2)

Teaching Scheme	*Examination scheme*
Lectures: 2 hrs/week	Theory: Mid-term 30 marks, End-term 70 marks

Course Syllabus: The students will undergo industrial training for duration of one month after sixth semester examination. The student shall submit a report regarding industrial training, duly certified by the authorities from industry. The assessment of the students will be based on the confidential feedback from the industry and the report submitted by the student.

Course Outcomes (COs):

After successfully completing the course students will be able to:

- Understand the role of engineering in systemic change
- Form opinions on how technology contributes to changes in society and vice-versa.
- Demonstrate effective communications

SEMESTER II

EC456 PROJECT (L-0, T-0, P-40, Credits-20)

Course Syllabus:

The projects in semesters-I and II should preferably be on a single topic. The topic may include two components, hardware and software implementation (hardware design, implementation and/or simulation). A project batch may consist of two or three students. At the end of semester-I, students will have to submit a Progress report of the project. Students must maintain a Project diary duly signed by their guides weekly. It is mandatory on the part of the students to submit the project diary during the internal end semester evaluation.

Course Outcomes (COs):

After successfully completing the course students will be able to:

- Understand the role of engineering in systemic change
- Form opinions on how technology contributes to changes in society and vice-versa.
- Demonstrate effective communications

EC457 SELF-LEARNING (Audit)* (L-0, T-0, P-0, Credits-0)

Self-Study Elective List

EC457A ADVANCE 3G AND 4G WIRELESS MOBILE COMMUNICATION

EC457B HIGH SPEED SEMICONDUCTOR DEVICES

EC457C ECONOMICS/ MANAGEMENT/ENTREPRENEURSHIP

EC457D ARTIFICIAL INTELLIGENCE

EC457E DIGITAL VIDEO PROCESSING