ANURAG UNIVERSITY
Department of ECE
R20 Curriculum & Syllabus

IV YEAR I SEMESTER **6T+2L**

S. No	Course Code	Category	Course Title	L	T	P	Credits
1	A57040	PC	Microwave & Radar Engineering	3	0	0	3
2	A57041	PC	Cellular & Mobile Communication	2	1	0	3
3	A57042	PE	**Professional Elective –II** 1. Digital Image Processing	3	0	0	3
	A57043		**2.** Software Defined Radio				
	A57044		3. Low power VLSI				
4	A57045	PE	**Professional Elective –III** 1. Machine Learning & Artificial Neural Networks	3	0	0	3
	A57046		2. Analog VLSI Design				
	A57047		3. Advanced Communications & Networks				
5	A57048	PE	**Professional Elective –IV** 1. Antenna Theory & Design	3	0	0	3
	A57049		2. Optical Communication				
	A57050		3. Bio-Medical Signal Processing and Telemedicine				
6	A57051	PE	**Professional Elective-V** 1. Adaptive Signal Processing	3	0	0	3
	A57052		2. Organic and Flexible Electronics				
	A57053		3. Satellite Communication				
7	A57207	PC	Microwave & Digital Communication Lab	0	0	2	1
8	A57208	PC	Cellular & Mobile Communication Lab	0	0	2	1
9	A57230	PROJ	Industry Oriented Mini Project	0	0	4	2
Total				**17**	**01**	**08**	**22**

IV YEAR II SEMESTER

S. No	Course Code	Category	Course Title	L	T	P	Credits
1	A58002	OE	**Open Elective –II** 1. Intellectual Property Rights	2	1	0	3
	A58016		2. Python Programming				
	A58014		3. Disaster Preparedness and Planning				
2	A58017	OE	**Open Elective –III** 1. Introduction to Deep Learning	2	1	0	3
	A58001		2. Technical and Business Communication Skills				
	A58018		3. Green Technologies				
3	A58201	PROJ	Seminar	0	0	4	2
4	A58202	PROJ	Comprehensive Viva -Voce	0	0	0	2
5	A58203	PROJ	Project Work	0	0	20	10
6	A58501	IE	Industry Elective (MOOCS)	0	0	6	3
Total				**4**	**2**	**24**	**20**

IV - Year B.Tech – ECE – I - Semester **L/T/P C**

3/0/0 3

A57040 Microwave and Radar Engineering

Prerequisite: Electromagnetic Theory and Transmission Lines.

Course Objectives:

- To develop knowledge on waveguides, waveguide components and their applications radar fundamentals and analysis of the radar signals
- To understand and analyze the operation of microwave tubes like klystron, magnetron TWT etc. and different radars like CW radar, pulse radar, MTI radar etc.
- To analyze the operation of microwave solid state devices and radar systems like tracking radars
- To understand the concepts of microwave junctions, scattering parameters and detection of radar signals in presence of noise
- To analyze microwave test bench for measuring different parameters like attenuation, power, VSWR etc. and the radar receivers

Unit-I: Rectangular waveguides and waveguide components:

Introduction to microwaves - characteristic features, advantages and applications. Waveguide basic concepts, TE and TM mode equations in rectangular waveguides. Microwave power flow and power losses, illustrative problems.

Waveguide components and applications: Construction and working of microwave components - coupling mechanisms, waveguide windows, tuning screws and posts, waveguide attenuators and phase shifters, waveguide multiport junctions. [Text Book-1]

Unit-II: Scattering matrix and Microwave tubes:

Scattering matrix for E plane and H plane tees, magic tee, directional coupler, Illustrative problems.

Microwave tubes: Limitations and losses of conventional tubes at microwave frequencies. Basic construction and operation - two cavity klystron, reflex klystron, TWT and Magnetron, (Qualitative treatment only) Illustrative Problems. [Text Book-2]

Unit -III: Microwave Solid State Devices and Measurements:

Classification, construction and working of TEDs and ATDs – gunn diode. Introduction to Avalanche Transit Time Devices – IMPATT & TRAPATT.

Microwave measurements: Set up of microwave bench, precautions, microwave power measurement – bolometer, measurement of attenuation, frequency, low and high VSWR and impedance. [Text Book-2]

Unit -IV: Radar Principles and Types:

Introduction to Radars - radar range equation, radar frequencies and applications, PRF, unambiguous range, radar cross section, integration of radar pulses. Construction and working of CW radar, CW radar with non-zero IF, FM CW radar, MTI and pulse doppler radar, delay Line canceller, blind speeds, staggered PRFs. [Text Book-3]

Unit-V: Tracking Radar and Radar Receivers:

Tracking with radar, basic principle and operation of sequential lobbing, conical scan, monopulse tracking radar – amplitude comparison monopulse (one- and two-coordinates).

Radar Receivers: Noise figure and noise temperature, duplexers – branch type and balanced type, circulators as duplexers. [Text Book-3]

Text Books:

1. Microwave Devices and Circuits – Samuel Y. Liao, Pearson, 3rd Edition, 2003.
2. Micro Wave and Radar Engineering – M. Kulkarni, Umesh Publications, 2008.
3. Introduction to Radar Systems-Merrill I. Skolnik, Third Edition, Mcgraw-Hill, 2001

References:

1. Foundations for Microwave Engineering – R.E. Collin, IEEE Press, John Wiley, 2nd Edition, 2002.
2. Microwave Circuits and Passive Devices – M.L. Sisodia and G.S.Raghuvanshi, Wiley Eastern Ltd., New Age International Publishers Ltd., 2012.
3. Microwave Engineering Passive Circuits – Peter A. Rizzi, PHI, 1999.
4. Elements of Microwave Engineering – R. Chatterjee, Affiliated East-West Press Pvt. Ltd., New Delhi, 2016.

Course Outcomes:

After completing the course, students will be able to

- Describe the significance of waveguides, microwave components, radar fundamentals and signals
- Analyze the working and characteristics of microwave tubes and different radars
- Explain and analyze operations of microwave solid state devices and radar systems
- Apply and analyze concepts of microwave junctions, scattering parameters for different components and radar signals detection
- Analyze and evaluate microwave measurements and radar receiver

IV-Year B.Tech-ECE-I-Semester **L/T/P C**
2/1/0 3

A57041 Cellular & Mobile Communication

Prerequisite: Analog Communication Systems and Digital Communication

Course Objectives:

- To illustrate the working principles and standardization of modern cellular communication systems to the students.
- To enable the student understand the concept of frequency reuse, handoff, channel assignment strategies and system capacity in cellular networks.
- To analyze the impact of fading on signal propagation in cellular networks
- To explore the principles of different equalization and diversity techniques
- To understand the concept of multiplexing and multiple access techniques used in communication networks

Unit-I: Introduction to Cellular Mobile Radio Systems (Text Book1): Limitations of Conventional Mobile Telephone Systems, Electromagnetic Spectrum, Wireless Communication Systems, How a Cellular Telephone Call is made, Comparative Study of Cellular Communication Networks- 2G, 3G, 4G, 5G, and Their Standardizations

Unit-II: Elements of Cellular Radio System Design (Text Book1): Operation of Cellular Systems, Concept of Frequency reuse, Channel Assignment Strategies, Handoff and Its types, Handoff Strategies, Interference and System Capacity, Trunking and Grade of Service, Improving Coverage and Capacity in Cellular Systems - Cell Splitting, Sectoring, Microcell Zone Concept.

Unit-III: Mobile Radio Propagation (Text Book1, Text book 2):

Large Scale Fading: Introduction to Radio Wave Propagation, Free Space Propagation Model, Radio Propagation Mechanisms- Concept Reflection, Diffraction, and Scattering in brief, Phase Difference Between Direct and Reflected Paths, Path Loss Models: Log-distance Path Loss model, Log-normal Shadowing, Okumura model, Hata model

Small Scale Fading and Multipath: Small-Scale Multipath Propagation, Parameters of Mobile Multipath Channels, Types of Small Scale Fading, Rayleigh and Ricean Distribution

Unit–IV: Equalization and Diversity (Text Book1): Brief introduction to ISI and Eye diagram, Fundamentals of Equalization**,** Linear Equalizer, Non-linear Equalizer- Decision Feedback Equalizer, Maximum Likelihood Sequence Estimation (MLSE) Equalizer, Algorithm for Adaptive Equalizer- Zero Forcing (ZF) Algorithm, Least Mean Square (LMS) Algorithm, Diversity Techniques- Space Diversity, Polarization Diversity, Frequency Diversity, Time Diversity, Mathematical Derivation of Selection Diversity Improvement

Unit–V: Multiplexing and Multiple Access Techniques (Text Book1): Introduction to Multiplexing- Frequency Division Multiplexing (FDM), Time Division Multiplexing (TDM), Wavelength Division Multiplexing (WDM), Introduction to Multiple Access- Frequency Division Multiple Access (FDMA), Time Division Multiple Access (TDMA), Code Division Multiple Access (CDMA), Space Division Multiple Access (SDMA), Capacity of Cellular TDMA and CDMA networks

Text Books:

1. Wireless Communications - Theodore. S. Rapport, Pearson education, 2nd Edition, 2002

2. Mobile Cellular Telecommunications – W.C.Y. Lee, Tata McGraw Hill, 2rd Edition, 2006

References :

1. Principles of Mobile Communications – Gordon L. Stuber, Springer International 2nd Edition, 2001

2. Modern Wireless communications- Simon Haykin, Michael Moher, Pearson Education, 2005

3. Wireless Communications and Networking, Vijay Garg, Elsevier Publications, 2007

4. Wireless Communications – Andrea Goldsmith, Cambridge University Press, 2005

Course outcomes:

After completing the course, students will be able to

- Understand the advantages, disadvantages, applications and standardization of different wireless communication technologies.
- Provide algorithms for designing and planning of cellular networks.
- Analyze the impact of fading in designing any cellular networks.
- Identify equalization and diversity techniques for designing efficient receivers
- Provide ideas in cellular network management

B.Tech-ECE IV-Year-I-Semester **L/ T/ P C**

3 / 0 / 0 3

A57042 Digital Image Processing

Prerequisite: Signals and Systems and Digital Signal Processing

Course objectives:

- To understand the fundamentals of digital image processing.
- To design and implement Spatial and frequency domain filtering
- To evaluate the different denoising techniques
- To apply segmentation techniques to isolate the object
- To build various compression algorithms

Unit-I: Digital Image Fundamentals & Image Transforms:
Digital image fundamentals, sampling and quantization, relationship between pixels. Image transforms: 2-D FFT, properties, Walsh transform, Hadamard Transform, Discrete Cosine transform, Haar transform.

Unit-II: Image Enhancement:
Image Enhancement in Spatial Domain: Introduction, image enhancement in spatial domain, enhancement through point processing, types of point processing operations, histogram manipulation, linear and non-linear gray level transformation, local or neighborhood operation, median filter. Image enhancement frequency domain: Filtering in frequency domain, obtaining frequency domain filters from spatial filters. Generating filters directly in the frequency domain, low-pass (smoothing) and high pass (sharpening) filters in frequency domain.

Unit-III: Image Restoration:
Degradation model, Algebraic approach to restoration, Inverse filtering, least mean square filters, Constrained Least Squares Restoration.

Unit-IV: Image Segmentation and Morphological Image Processing:
Image Segmentation: Detection of discontinuities, edge linking and boundary detection, thresholding, region oriented segmentation.

Morphological Image Processing: Dilation and erosion, structuring element decomposition, the strel function. combining dilation and erosion: opening and closing, the hit or miss transformation.

Unit-V: Image Compression:
Redundancies and their removal methods, fidelity criteria, image compression models, source encoder and decoder. Error free compression, lossy compression, JPEG 2000 standards.

Text Books:

1. Rafael C. Gonzalez. Richard E. Woods, *"Digital Image Processing",* Third Edition, Pearson Education, 2008.
2. S. Jayaraman, S. Esakkirajan, T. Veerakumar , "*Digital Image Processing*", Tata McGraw Hill, 2010.

References:

1. Rafael C. Gonalez, Richard E. Woods and Steven L. Eddings, "*Digital Image Processing using MATLAB*", Second Edition, Tata McGraw Hill, 2010
2. A.K. Jain , "*Fundamentals of Digital Image Processing*", Prentice Hall India, 2015
3. Somka, Hlavac, Boyle, "*Digital Image Processing and Computer Vision*", Cengage learning (Indian edition), 2008.
4. Adrian low , "*Introductory Computer vision Imaging Techniques and Solutions*", Second Edition, 2008
5. John C. Russ, J. Christian Russ, "*Introduction to Image Processing & Analysis*", CRC Press, 2010

Course Outcomes:

After completing the course, students will be able to

- Acquire the fundamental knowledge in digital image processing
- Analyze the images in frequency domain and time domain
- Evaluate the existing techniques in image denoising
- Perform various morphological operations like opening and closing
- Categorize different compression techniques

B.Tech-ECE IV-Year-I-Semester **L/ T/ P C**

3 / 0 / 0 3

A57043 Software Defined Radio

Prerequisite: Analog Communication Systems, Digital Communication, Digital Signal Processing

Course Objectives:

- To identify the software and hardware requirements for designing a SDR network
- To explore the front end technology of SDR network
- To develop algorithms for signal processing in SDR network
- To design a SDR Network

Unit-I: Introduction to Software Defined Radio:

What is SDR - Definition of SDR, software radio (SR), adaptive intelligent SR, digital radio, multiband, and multimode. Architectural perspectives for SDR - radio implementer plane, network operator plane., SR Concepts, characteristics and benefits of SR, design principles of SR. (Text book-1,2)

Unit-II: Radio Frequency Translation for Software Defined Radio:

Requirements and specifications - transmitter specifications, receiver specifications. receiver design considerations - basic design considerations, receiver architectures - direct conversion architecture, multiple conversion architecture, low IF architecture., adjacent channel power ratio (ACPR) and noise power ratio (NPR), receiver signal budget. An approach to receiver design, transmitter design considerations: filtering analogies between receiver and transmitter, transmitter architectures- direct conversion, multiple conversion., candidate architectures for SDR: zero IF receivers, problems with zero IF architecture.

Unit-III: Data Conversion in Software Defined Radio:

The importance of data converters in SDR, converter architectures: analog to digital (A/D) converter- flash converter, multistage converter, sigma-delta converter. Digital to analog (D/A) converter- string converter., converter performance impact on SDR - noise sources,

signal to noise ratio (SNR) of data converter, spurious impact on performance, digital to analog converter specification.

Unit-IV: Digital Hardware for Software Defined Radio:

Baseband component technologies, DSP processors: architectures - von Neumann and Harvard archituctures., DSP sotware developmemt cycle, field programmable gate arrays- applications of FPGA in SDR, design principles using FPGA, SDR baseband processing - -limitations of conventional IC Technologies.trade-offs of conventional IC technologies: limitations of microprocessor, DSP and ASIC implementations.

Unit-V: Software Technology for Software Defined Radio:

Overview of Vanu system, the importance of software in SR, Software download for mobile terminals - why software download, downloading technologies for SDR, security for download, software architectures for download., architecture of digital enhanced cordless telecommunications (DECT) reconfigurable demonstrator.

Text Books:

1. Walter Tuttlebee, "*Software Defined Radio: Enabling Technologies*", 1st Edition, John Wiley & Sons, 2003.
2. Jeffrey Hugh Reed, "*Software Radio: A Modern Approach to Radio Engineering*", 1st Edition, Prentice Hall Professional, 2002.

References:

1. Paul Burns, "*Software Defined Radio for 3G*",1st Edition, Artech House, 2003.
2. Markus Dillinger, Kambiz Madani, and Nancy Alonistioti, "*Software Defined Radio: Architectures, Systems and Functions*", 1st Edition, John Wiley & Sons, 2005.

Course Outcomes:

After completing the course, students will be able to

- Understand the principles of SDR.
- Understand the concept of multirate processing, A/D and D/A converter used in signal processing of SDR.
- Understand the design specifications of transmitter and receiver for SDR network
- Understand digital hardware required for SDR network .
- Understand the software technology for SDR network.

B.Tech-ECE IV-Year-I-Semester **L/T/P C**

3/0/0 3

A57044 Low Power VLSI Design

Prerequisite: VLSI design

Course Objectives:

- To understand the necessity of low power circuit design and various sources of power dissipation in CMOS transistors
- To learn the various low power techniques like voltage scaling, architectural level approach and switched capacitance minimization approach
- To apply the low power technique for adder and multiplier design implementation
- To design and analysis of low power RAM and ROM memory cell

Unit-I: Introduction to low power design:

Need for low power circuit design, sources of power dissipation – Switching power dissipation, short circuit power dissipation, leakage power dissipation, glitching power dissipation, short channel effects –drain induced barrier lowering and punch through, surface scattering, velocity saturation, impact ionization, hot electron effect.

Unit-II: Low-Power Design Approaches:

Low-power design through voltage scaling – VTCMOS circuits, MTCMOS circuits, architectural level approach –pipelining and parallel processing approaches.switched capacitance minimization approaches: system level measures, circuit level measures, mask level measures.

Unit-III: Low-Voltage Low-Power Adders:

Introduction, Standard Adder Cells, CMOS Adder Architectures – ripple carry adders, carry look-ahead adders, carry select adders, carry save adders, low-voltage low-power design techniques –trends of technology and power supply voltage, low-voltage low-power logic styles.

Unit-IV: Low-Voltage Low-Power Multipliers:

Introduction, overview of multiplication, types of multiplier architectures-braun multiplier, baugh-wooley multiplier, booth multiplier, wallace tree multiplier.

Unit-V: Low-Voltage Low-Power Memories:

Basics of ROM, low-power ROM technology, future trend and development of ROMs, Basics of SRAM, memory cell, precharge and equalization circuit, low-power SRAM technologies, basics of DRAM, self-refresh circuit, future trend and development of DRAM.

Text Books:

1. Sung-Mo Kang, Yusuf Leblebici, "*CMOS Digital Integrated Circuits Analysis and Design*", New York: McGraw-Hill, Second Edition, 2011.

2. Yeo, Kiat-Seng, and Kaushik Roy," *Low voltage, low power VLSI subsystems*", McGraw-Hill, Inc., 2004.

References:

1. Ming-BO Lin, "*Introduction to VLSI Systems: A Logic, Circuit and System Perspective*", CRC Press, First Edition, 2012.

2. AnanthaChandrakasan, "*Low Power CMOS Design*", IEEE Press/Wiley International, First Edition, 1998.

3. Kaushik Roy, Sharat C. Prasad, "*Low Power CMOS VLSI Circuit Design*", John Wiley & Sons, First Edition, 2009.

4. Gary K. Yeap, "*Practical Low Power Digital VLSI Design*", Kluwer Academic Press, 2002.

5. A. Bellamour, M. I. Elamasri, "*Low Power CMOS VLSI Circuit Design*",Kluwer Academic Press, 1995.

6. Siva G. Narendran, AnathaChandrakasan, "*Leakage in Nanometer CMOS Technologies*" Springer, Third Edition, 2005.

Course Outcomes:

After completing the course, students will be able to

- Understand about the sources of power dissipation and necessity of low power circuit design
- Analyze the low power technique in different levels of circuits
- Design the low power adder with various low power techniques
- Apply various low power architectures for low power multiplier implementation
- Analyze the future trend and development of RAM and ROM cell for low power design

B.Tech-ECE IV-Year-I-Semester **L/T/ P C**

3/0/0 3

A57045 Machine Learning & Artificial Neural Networks

Prerequisite: Introduction to Probability Theory & Statistics

Course Objectives:

- Understand the challenges, applications and models of Machine Learning
- Apply and evaluate supervised machine learning algorithms for classification and regression tasks
- Apply and evaluate unsupervised learning algorithms for clustering tasks
- Understand the Ensemble learning, apply and evaluate different type of these algorithms for better prediction.
- Understand the Artificial Neural Networks computational model

Unit-I: Introduction to Machine Learning

What is machine learning, why machine learning, types of machine learning models, challenges of machine learning, applications of machine learning, essential libraries and tools, generalization overfitting and underfitting, bias–variance trade-off, metrics

Unit-II: Supervised Learning

Classification and regression, linear regression: single and multiple, logistic regression, k-nearest neighbour, naive bayes classifier, decision tree, support vector machine

Unit-III: Unsupervised Learning and Pre-processing

Types of unsupervised learning, challenges in unsupervised learning, applications of unsupervised learning, pre-processing and scaling, clustering, K-Means Clustering, agglomerative clustering, comparing and evaluating the clustering algorithms.

Unit-IV: Ensemble Learning and Random Forest

Voting classifiers, bagging and pasting, random patches and random subspaces, random forest, boosting-AdaBoost and Gradient Boost.

Unit-V: Artificial Neural Networks

Introduction, understanding the biological neuron, exploring the artificial neuron, types of activation functions, early implementations of ANN, architectures of neural network: single-layer & multi-layer feed forward ANNs, recurrent network, learning process in ANN, backpropagation

Text Books:

1. Saikat Dutt, Subramanian Chandramouli, Amit Kumar Das "*Machine Learning*", Pearson Education India, 2018.
2. Aurélien Géron, "*Hands-on Machine Learning with Scikit-Learn, Keras, and TensorFlow Concepts,Tools, and Techniques to Build Intelligent Systems*" O'Reilly Media, Inc, 2017.

References:

1. Andreas C. Müller, Sarah Guido, "*Introduction to Machine Learning with Python*", O'Reilly Media, Inc, October 2016.
2. Tom M. Mitchell, "*Machine Learning*", McGraw-Hill Education (India) Private Limited, 2013.
3. Ethem Alpaydin, "*Introduction to Machine Learning (Adaptive Computation and Machine Learning*)", The MIT Press, 2004.
4. Stephen Marsland, "*Machine Learning: An Algorithmic Perspective*", CRC Press, 2009.

Course Outcomes:

After completing the course, students will be able to

- Understand the essentials of feature engineering, state-of-art tools and concepts of machine learning
- Design and evaluate different types of supervised learning algorithms for classification and regression tasks.
- Design and evaluate different types of unsupervised learning algorithms for clustering tasks.
- Design and evaluate strong learners for better real time prediction ensemble learning algorithms
- Design Artificial Neural Networks computational model.

B.Tech-ECE IV-Year-I-Semester
L/T/P C

3/0/0 3

A57046 Analog VLSI Design

Prerequisite: Electronic Circuit Analysis, Pulse & Integrated Circuits

Course objectives:

- To provide in-depth understanding of the analog circuits and building blocks
- To Understand the MOSFET models, small signal analysis
- To provide a basic knowledge on current mirror and amplifier design
- To understand the operation and analysis of comparators

Unit-I: Introduction to analog designand Basic MOS device physics:

Need of analog design and Complementary MOS (CMOS), Level of abstraction, robust analog design.

Basic MOS device physics:Metal-oxide-semiconductor (MOS) switch, MOS structure, symbols, threshold voltage, derivation of V-I characteristics, body effect, channel length modulation, subthreshold conduction.

Unit-II: MOS device Models:

MOS device capacitances, Small signal model, NMOS versus PMOS devices. Passive and Active current mirrors:basic current mirrors, cascade current mirrors, active current mirrors, large signal analysis, small signal analysis, common mode properties.

Unit-III: Single stage and differential amplifiers:

Common-source stage with resistive load, diode connected load, current source load, source follower, common gate stage.

Differential amplifiers: single-ended and differential operation, basic differential pair: qualitative and quantitative analysis, common - mode response, differential pair with MOS loads.

Unit-IV: Operational Amplifiers:

General considerations- performance parameters, One stage op-amp, Two stage op-amp, gain boosting, comparison, input range limitations, slew rate, power supply rejection.

Unit-V:Comparators:

Comparator specifications, using an op-amp for a comparator, charge-injection errors, latched comparators, example of CMOS comparators.

Text Books:

1. Behzad Razavi, *"Design of analog CMOS integrated circuits"*, Mc - Graw Hill international edition 2001.
2. Tony Chan Carusone, David A. Johns, Kenneth W. Martin *"Analog integrated circuit design",* Wiley, 2nd Edition.

Reference Books:

1. Philip E. Allen and Douglas R. Holberg, *"CMOS analog circuit design"*, oxford university Press, international 2nd edition/Indian edition, 2010.
2. Paul R. Gray, Paul J. Hurst, S. Lewis and R. G. Meyer, *"Analysis and design of analog integrated circuits",* Wiley India, 5th Edition, 2010.
3. Baker, Li and Boyce, *"CMOS: Circuit design, layout and simulation"*, PHI.

Course outcomes:

After completing the course, students will be able to

- Understand the MOS fundamentals, analog and basic building blocks design.
- Know the, small signal models and analysis of MOSFET based circuits such as current mirrors
- Analyze and design analog circuits such as single stage and differential amplifiers.
- Analyze and design of operational amplifiers and the performance parameters
- To design of comparators using operational amplifiers.

IV-Year B.Tech-ECE-I-Semester **L/T/P C**
3/0/0 3

A57047 Advanced Communications and Networks

Prerequisite: Analog Communication Systems and Digital Communications

Course Objectives:

- To illustrate the working principles and standardization of modern cellular communication systems to the students.
- To enable the student understand the concept of frequency reuse, handoff, channel assignment strategies and system capacity in cellular networks.
- To analyze the impact of fading on signal propagation in cellular networks
- To explore the principles of different equalization and diversity techniques
- To understand the concept of multiplexing and multiple access techniques used in communication networks

Unit-I: Orthogonal Frequency Division Multiplexing (OFDM):

Basic Principles of Orthogonality, Single vs Multicarrier Systems, OFDM Block Diagram and Its Explanation, OFDM Signal Mathematical Representation, Selection parameter for Modulation, Pulse shaping in OFDM Signal and Spectral Efficiency, Windowing in OFDM Signal and Spectrum, Synchronization in OFDM, Channel Estimation, Limitations in OFDM, FFT Point Selection Constraints in OFDM

Unit-II: Multiple Input Multiput Output (MIMO):

Introduction, Space Diversity, System Based on Space Diversity, Smart Antenna system and MIMO, MIMO Based System Architecture, MIMO Exploits Multipath, Space – Time Processing, Antenna Consideration for MIMO, MIMO Channel Modelling, MIMO Channel Measurement, MIMO Channel Capacity, Cyclic Delay Diversity (CDD), Space Time Coding, Advantages and Applications of MIMO in Present Context, MIMO Applications in 3G Wireless System and Beyond

Unit-III:Wireless LANs/IEEE 802.11x:

Introduction to IEEE802.11x Technologies, Evolution of wireless LANs, IEEE 802.11 Design Issues, IEEE 802.11 Services, IEEE 802.11 MAC Layer operations, IEEE 802.11

Layer1, IEEE 802.11 a/b/g Higher Rate Standards, Wireless LAN Security, Computing Wireless Technologies, Typical WLAN Hardware

Unit–IV: Wireless PANs/IEEE 802.15x:

Introduction to IEEE 802.15x Technologies: Wireless PAN Applications and Architecture, IEEE 802.15.1 Physical Layer Details, Bluetooth Link Controllers Basics, Bluetooth Link Controllers Operational States, IEEE 802.15.1 Protocols and Host Control Interface. Evaluation of IEEE 802.15 Standards

Unit–V: Broad Band Wireless MANs/IEEE 802.16x:

Introduction to WMAN/IEEE 802.16x Technology, IEEE 802.16Wireless MANs, IEEE 802.16 MAC Layer Details, IEEE 802.16 Physical Layer Details, IEEE 802.16 Physical Layer Details for 2-11 GHz, IEEE 802.16 Common System Operations.

Text Books:

1. Gary J. Mullett, "Introduction to Wireless Telecommunications Systems and Networks", CENGAGE
2. Upena Dalal, "Wireless Communication", Oxford University Press, 2009

References :

1. Ke-Lin Du & M N S Swamy, "Wireless Communication System", Cambridge University Press, 2010
2. Gottapu Sasibhusan Rao, "Mobile Cellular Communication", PEARSON

Course outcomes:

After completing the course, students will be able to

- Understand the advantages, disadvantages, applications and standardization of different wireless communication technologies.
- Provide algorithms for designing and planning of cellular networks.
- Analyze the impact of fading in designing any cellular networks.
- Identify equalization and diversity techniques for designing efficient receivers
- Provide ideas in cellular network management

B.Tech-ECE IV-Year-I-Semester
L/T/ P C

3/0/0 3

A57048 Antenna Theory & Design

Prerequisite: Electromagnetics and Transmission Lines

Course Objectives:

- To understand the applications of the electromagnetic waves in free space.
- To learn the working principles of various types of basic and advanced antennas
- To discuss the major applications of antennas with an emphasis on how antennas are employed to meet electronic system requirements.
- To understand the concepts of different Antennas.

Unit-I: Antenna Basics:

Introduction, basic antenna parameters-patterns, beam area, radiation intensity, beam efficiency, directivity-gain - resolution, antenna apertures, effective height. Fields from oscillating dipole, field zones, antenna theorem. Half wave dipole – current distributions, field components, radiated power, radiation resistance, beam width, directivity, effective area and effective height, related problems

Unit-II: Antenna Arrays:

Point Sources-Definition, patterns, arrays of 2 isotropic sources- different cases, principle of pattern multiplication, uniform linear arrays – broadside, end fire arrays. Derivation of their characteristics and comparison, BSA's with non-uniform amplitude distributions-general considerations and binomial arrays, illustrated problems

Unit-III: VHF, UHF and Microwave Antennas - I:

Arrays with parasitic elements, Yagi - Uda arrays, folded dipoles & their characteristics. Helical antennas- helical geometry, helix modes, practical design considerations for nonfoliar helical antennas in axial mode and normal modes. Horn antennas-types, fermat's principle, optimum horns, design considerations of pyramidal horns, related problems.

Unit-IV: VHF, UHF and Microwave Antennas - II:

Micro strip antennas- advantages and limitations, rectangular patch antennas-geometry and parameters, characteristics of micro strip antennas. Impact of different parameters on characteristics paraboloidal reflectors-geometry, pattern characteristics, feed methods, reflector types-related features. Illustrative problems. Lens antennas – introduction, geometry of non-metallic dielectric lenses, zoning, tolerances, and applications.

Unit-V: Antenna Measurements:

Reciprocity, sources of errors, pattern measurement arrangement, directivity measurement, gain measurements by comparison, absolute and 3-antenna methods. Introduction to turnstile antenna.

Text Books:

1. John D. Kraus, Ronald J. Marhefka and Ahmad S. Khan, *"Antennas and wave propagation*, TMH 4th Edition., Indian edition 2010.

2. C.A. Balanis, *"Antenna Theory and Design"*, John Wiley & Sons, 3rd ed., 2005.

References:

1. E.C. Jordan and K.G. Balmain, *"Electromagnetic Waves and Radiating Systems",* PHI, 2nd ed., 2000.

2. K.D. Prasad, *"Antennas and Wave Propagation",* SatyaPrakashan, Tech India Publications, New Delhi, 2001.

3. E.V.D. Glazier and H.R.L. Lamont, *"Transmission and Propagation - The Services Text Book of Radio, volume 5"*, Standard Publishers Distributors, Delhi.

4. F.E. Terman *"Electronic and Radio Engineering",* McGraw-Hill, 4th edition, 1955.

5. John D. Kraus, *"Antennas",* McGraw-Hill International Edition Second Edition, 1988.

Course Outcomes:

After completing the course, students will be able to

- Apply Maxwell's equations to calculate fields from dynamic current distributions.
- Analyze various antenna types and its radiating systems
- Design antenna system including shape of antenna, feed property, given radiation pattern, gain operating frequency, transmitted / received power.
- Compare different design parameters of different antennas
- Illustrate techniques for measuring antenna parameters

B.Tech-ECE IV-Year-I-Semester
L/T/P C

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A57049 Optical Communication

Prerequisite: Applied Physics, Electronic Devices & Circuits

Course Objectives:

- To realize the significance of optical fiber communications.
- To understand the construction and characteristics of optical fiber cable.
- To develop the knowledge of optical signal sources and power launching.
- To identify and understand the operation of various optical detectors.
- To understand the design of optical systems and wave length division multiplexing.

Unit-I: Optical Fiber Construction & Materials:

Historical development, the general system, advantages of optical fiber communications, optical fiber wave guides – introduction, ray theory transmission, total internal reflection, acceptance angle, numerical aperture, skew rays. cylindrical fibers – modes, v-number, mode coupling, step index fibers, graded index fibers. single modes fibers – cut off wavelength, mode field diameter, effective refractive index. fiber materials – glass, halide, active glass, chalgenide glass, plastic optical fibers.

Unit-II: **Signal Distortion & Connectors**:

Signal distortion in optical fibers – attenuation, absorption, scattering and bending losses, core and cladding losses. Capacity determination, group delay, types of dispersion – material dispersion, wave – guide dispersion, polarization mode dispersion, intermodal dispersion. Pulse broadening. Optical fiber Connectors – Connector types. Fiber splicing – splicing techniques, splicing single mode fibers. Fiber alignment and joint loss.

Unit-III: Optical Sources & Detectors:

Light Emitting Diodes (LED's), structures, materials, quantum efficiency, power modulation, power bandwidth product. injection laser diodes – modes, threshold conditions, external quantum efficiency, laser diode rate equations, resonant frequencies. reliability of light emitting diodes (LED) & Injection Laser Diodes (ILD). Source to fiber power launching – output patterns, power coupling, power launching, equilibrium numerical aperture, laser diode to fiber coupling. Transmission distance, line coding in

optical links, physical principles of pin and avalanche photo diodes (apd), detector response time, temperature effect on avalanche gain, comparison of photo detectors.

Unit-IV: Receivers & Wavelength Division Multiplexing:

Necessity, principles, types of wave length division multiplexing (WDM), measurement of attenuation and dispersion, eye pattern. Optical receiver operation – Fundamental receiver operation, digital signal transmission, error sources, receiver configuration, digital receiver performance, probability of error, quantum limit, analog receivers.

Unit-V: Optical system design:

Considerations, component choice, multiplexing. Point – to – point links, system considerations, link power budget with examples. Overall fiber dispersion in multimode and single mode fibers, rise time budget with examples.

Text Books:

1. Gerd Keiser, *"Optical Fiber Communications"* , McGraw Hill International edition, 3 rd edition, 2000.
2. John M. Senior, *"Optical Fiber Communications"*, PHI, 2nd edition, 2002.

References:

1. D.K.Mynbaev, S.C.Gupta and Lowell L.Scheiner, "*Fiber Optic Communications"*, Pearson Education, 2005.
2. S. C. Gupta, "*Text Book on Optical Fiber Communication and Its Applications"*, PHI, 2005.
3. Govind P Agarwal, *"Fiber Optic Communication Systems"*, 3rd edition,, John Wiley, 2004.
4. Joseph C. Palais, *"Fiber Optic Communication Systems",* 4th edition, Pearson Education, 2004.

Course Outcomes:

After completing the course, students will be able to

- Explain and analyze the constructional parameters of optical fibers.
- Design an optical system.
- Estimate the losses due to attenuation, absorption, scattering and bending
- Compare various optical detectors and choose suitable one for different applications

- Analyze analogue and digital links. describe the various criteria power loss wavelength to be considered for point-to-point link in digital link system

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L/T/ P C

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A57050 Biomedical Signal Processing and Telemedicine

Prerequisite: Signals and Systems and Digital Signal Processing

Course Objectives:

- To understand the fundamentals of discrete-time signals and systems for biomedical signal analysis
- To learn about various types of wavelet transforms that are used to describe, analyze and process biomedical signals
- To analyze and preprocess the EEG signal using spectral analysis, segmentation and filters
- To apply the methods to extract relevant information from EMG signals
- To develop various methods for extracting the ECG signal feature extraction and heart rate variability analysis

Unit-I: Fundamentals of Discrete-Time Signals and Systems:

Concepts of systems and signals, sampling process, impulse response, discrete transfer function**.** Wavelets: Continuous wavelet transform, discrete wavelet transform, reconstruction, recursive multi resolution decomposition, Types of wavelets-Haar wavelet, Daubechies wavelet, Biorthogonal wavelet, Coiflet wavelet.

Unit-II: The Electro Encephalo Gram (EEG):

Applications, signal processing, modeling and artifacts nonparametric and model-based spectral analysis, eeg segmentation, joint time-frequency analysis, evoked potential modalities, noise characteristics, noise reduction by ensemble averaging and linear filtering, single-trail analysis and adaptive analysis using basis functions.

Unit-III: Electro Myo Gram (EMG): The electrical activity of muscles, amplitude estimation in the surface EMG, spectral analysis of the surface EMG, conduction velocity estimation, modelling the EMG, EMG signal decomposition.

Unit-IV: Electrocardiogram (ECG): Heart rhythms, heartbeat morphologies, noise and artifacts, baseline wander, power line interference, muscle noise filtering, QRS detection, wave delineation, data compression, heart rate variability, acquisition and rr interval conditioning, spectral analysis of heart rate variability.

Unit-V: Introduction of Telemedicine:

History of telemedicine, block diagram of telemedicine system, definition of telemedicine, tele health, tele care, origin & development of telemedicine, scope, benefits and limitation of telemedicine.

Text Books:

1. Willis J. Tompkins, "*Biomedical Digital Signal Processing*", Prentice-Hall, first edition, 1993.
2. Leif Sornmo and Pablo Laguna,"*Bioelectrical Signal Processing in Cardiac and Neurological Applications*", Academic Press, 2005

Reference Books:

1. Rangaraj M. Rangayyan, Akay Metin(Editor), "*Biomedical Signal Analysis: A Case Study Approach*", Wiley Interscience John Willey & Sons,INC., Second Edition, 2015.
2. Roberto Cristi, "*Modern Digital Signal Processing*", 2004.
3. James V. Stone, "*Independent Component Analysis: A Tutorial Introduction*", MIT Press,2004

Course Outcomes:

After completing the course, students will be able to

- Learn discrete fourier transform, fast-Fourier transform and z-transform to analyze the biomedical signals for medical applications
- Understand various wavelet transforms to analyze the biomedical signals for medical applications
- Apply spectral analysis, segmentation and filtering for EEG diagnosis.
- Analyze EMG for estimating the amplitude and conduction velocity.
- Utilize the preprocessing techniques and extract the features of ECG signal for diagnosis.

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L/T/ P C

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A57051 Adaptive Signal Processing

Prerequisite: 1. Signals and Systems and Digital Signal Processing

Course Objectives:

- To learn and able to visualize the domain of adaptive signal processing
- To identify a random process and formulate to extract desired information
- To develop algorithms meeting application specific performance criteria
- Toverify the adaptive algorithms in software or hardware

Unit-I: Introduction to Adaptive Systems:

Review of digital signal processing, adaptive System - definitions, characteristics, applications. Adaptive linear combiner – description, weight vectors. desired response performance function – gradient and mean square error.

Unit-II: Wiener Filters:

Linear optimum filtering – Minimum mean-square error,Wiener- Hopf equations, multiple linear regression model, steepest-descent algorithm. Linear prediction – forward linear prediction, Levinson-Durbin algorithm. Kalman filter, extended kalman filter.

Unit-III: Least Mean Square (LMS) Adaptive Filters:

LMS algorithm, LMS adaptation algorithm and applications. Method of least squares – data windowing, normal equations and linear least square filters, recursive least squares algorithm.

Unit-IV: Frequency Domain Filters:
Frequency domain adaptive filters, adaptive lattice filters, adaptive infinite impulse response filtering, blind adaptive filtering, Haykin cost functions. Higher-order statistics.

Unit-V: Applications of Adaptive Signal Processing:

Adaptive modeling and system identification,inverse adaptive modeling, deconvolution and equalization, adaptive control systems, adaptive interference canceling - canceling noise, canceling periodic interference, canceling interference in ECG signals.

Text Books:

1. B. Widrow and S. D. Sterns, ”*Adaptive Signal Processing”*, Pearson Education , 2nd Indian reprint, 2002.
2. Simon Haykins, “*Adaptive Filter Theory*”, Pearson Education, Fifth Edition, 2013.

Reference Books:

1. J. Benesty, Y. Huang,” *Adaptive Signal processing: Applications to Real World Problems”*, Springer, 2003.

2. D. G. Manolakis, V.K. Ingle, S.M. Kogon, ”*Adaptive Signal Processing”*, McGraw-Hill , 2000.

3. John. R. Triechler, C. Richard Johnson (Jr), Michael. G. Larimore, “*Theory and Design of Adaptive Filters*”, Prentice Hall India Private Limited, 2004.

Course Outcomes:

After completing the course, students will be able to

- Devise filtering solutions for optimising the cost function indicating error in estimation of parameters and appreciate the need for adaptation in design.
- Evaluate the performance of various methods for designing adaptive filters through estimation of different parameters of stationary random process clearly considering practical application specifications.
- List and apply the various mathematical models to adaptive signal processing
- Design and implement filtering solutions for applications such as channel equalization, interference cancelling and prediction considering present day challenges.
- Use computer-based simulation tools to understand the theoretical concepts of adaptive signal processing in various communication applications.

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A57052 Organic and Flexible Electronics

Prerequisite: Applied Physics, Engineering Chemistry and Electronic Devices & Circuits

Course Objectives:

- To gain a fundamental understanding to the field of organic and printed electronics.
- Introduction to advanced electronics materials and their potential impact
- Introduction to sophisticated characterisation techniques and advanced electronics devices
- To understand the basic concepts for integration of thin-film devices on flexible platforms and the advantages and disadvantages of emerging technology.
- To provide students with a broad overview of organic electronic materials and devices with emphasis of research and practical applications.

Unit-I: Introduction to Organic and Flexible Electronics

Introduction to flexible and organic electronics, their materials systems, background, trends, emerging technologies, general applications. [Textbook-1]

Unit-II: Organic Semiconducting Materials

Review of inorganic semiconductors, properties. Review of organic semiconductor: Conjugated small molecules and polymers, electronic structure, hybridization of atomic orbitals, molecular orbitals, charge injection and transport. [Textbook-1]

Unit-III: Thin Films Processing Techniques

Thin-film Deposition and Processing Methods: Evaporation Methods-CVD, PECVD, PVD, Coating Techniques-Spin Coating, Slot-die coating, Blade Coating. Printing Technique: Inject printing, Screen Printing, Gravure printing. [Textbook-1&2]

Unit-IV: Characterization Techniques for Flexible Electronics

Structural Characterisation: Scanning Electron Microscopy (SEM), Transmission Electron Microscopy (TEM), Atomic Forced Microscopy (AFM), X-ray Diffraction (XRD). Spectroscopic Characterisation: Infra-Red (IR), UV-visible and Raman. [Textbook-1&2]

Unit-V: Organic and Flexible Electronics Devices: Review of PN junction diodes, Metal Oxide Semiconductor Field Effect Transistors (MOSFETs), Organic Thin-film transistors (OTFTs), Organic Light-emitting Diodes (OLEDs), Organic Solar cells (OSCs) and their electrical measurements. [Textbook-1&2]

Text Books:

1. Giovanni Nisato, Donald Lupo and Simone Ganz, "*Organic and Printed Electronics Fundamental and Applications*", Taylor & Francis, 1st Edition, 2016.
2. Stergios Logothetidis, "*Handbooks of Flexible Organic Electronics- Materials Manufacturing and applications*" Elsevier, 2015.

Reference Books:

1. Zhenan Bao and Jason Locklin, "*Organic Field-Effect Transistors*" CRC Press, 1st Edition, 2007.
2. Ioannis Kymissis, "*Organic Field-Effect Transistors: Theory, Fabrication and Characterization*", 1st Edition, Springer, 2009.
3. Qiquan Qiao, "*Organic Solar Cells: Materials, Devices, Interfaces, and Modeling*", 1st Edition, CRC Press, 2015.

Course Outcomes:

After completing the course, students will be able to

- To know about flexible electronics and its possibilities in the industry.
- To understand about various organic materials and their electronics products.
- To understand about different fabrication and characterization methods used in this field.
- To understand about characterization techniques for flexible electronics
- To understand the opportunities and advancements in this advanced field of electronics.

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L/T/ P C

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A57053 Satellite Communication

Prerequisite: Analog Communication Systems and Digital Communications

Course Objectives:

- To acquire foundation in orbital mechanics and launch vehicles for satellites.
- To gain basic knowledge of link design of satellite.
- To understand multiple access systems and earth station technology
- To understand the concepts of satellite navigation and GPS.

Unit-I: Introduction:

Origin of Satellite Communications, Historical Back-ground, Basic Concepts of Satellite Communications, Frequency Allocations for Satellite Services, Applications, Future Trends of Satellite Communications.

Orbital Mechanics and Launchers: Orbital Mechanics, Look Angle determination, Orbital

Perturbations, Orbit determination, Launches and Launch vehicles, Orbital Effects in Communication Systems Performance.

Unit-II: Satellite Subsystems:

Attitude and Orbit Control System, Telemetry, Tracking, Command and Monitoring, Power Systems, Communication Subsystems, Satellite Antennas, Equipment Reliability and Space Qualification.

Satellite Link Design: Basic Transmission Theory, System Noise Temperature and Gain of Antenna to Temperature of Antenna (G/T) ratio, Design of Down Links, Up Link Design, Design of Satellite Links for Specified Carrier signal to Noise Signal (C/N), System Design Examples.

Unit-III: Multiple Access:

Frequency Division Multiple Access (FDMA), Intermodulation, Calculation of Carrier signal to Noise Signal (C/N), Time Division Multiple Access (TDMA), Frame Structure, Examples, Satellite Switched TDMA Onboard Processing, Demand Assigned Multiple Access (DAMA), Code Division Multiple Access (CDMA), Spread Spectrum Transmission and Reception.

Earth Station Technology: Introduction, Transmitters, Receivers, Antennas, Tracking Systems, Terrestrial Interface, Primary Power Test Methods.

Unit-IV:Low Earth Orbit and Geo-Stationary Satellite Systems:

Orbit Considerations, Coverage and Frequency Consideration, Delay & Throughput Considerations, System Considerations, Operational Non-Geo-Stationary Satellite Orbit (NGSO) Constellation Designs.

Unit-V:Satellite Navigation & Global Positioning System:

Radio and Satellite Navigation, GPS Position Location Principles, GPS Receivers and Codes, GPS Receiver Operation, GPS Coarse Acquisition (C/A) Code Accuracy, Differential GPS, Very Small Aperture Terminal (VAST), Mobile Satellite services: GSM, Direct Broadcast Satellites (BDS), Direct to Home Broadcast (DTH), Specialized Services-Video Conferencing, Internet.

Text Books:

1. Timothy Pratt, Charles Bostian and Jeremy Allnutt, WSE, *"Satellite Communications"*, Wiley Publications, 2nd Edition, 2003.
2. Dennis Roddy,*" Satellite Communications"*, McGraw Hill, 4th Edition, 2009.

Reference Books:

1. M. Richharia, *Satellite Communications*: Design Principles, BS Publications, 2nd Edition, 2003.
2. D.C Agarwal, *Satellite Communication*, Khanna Publications, 5th Ed.

3. K.N. Raja Rao, *Fundamentals of Satellite Communications*, PHI, 2004

4. Wilbur L. Pritchard, Robert A Nelson and Henri G. Suyderhoud, *Satellite Communications Engineering,* 2nd Edition, Pearson Publications, 2003.

Course Outcomes:

After completing the course, students will be able to

- Understand basic concepts and frequency allocations for satellite communication, orbital mechanics and launch vehicles.
- Envision the satellite sub systems and design satellite links for specified C/N.
- Understand the various multiple access techniques for satellite communication systems and earth station technologies.
- Know the underlying concepts of state-of-the-art LEO, GEO Stationary Satellite Systems and satellite navigation

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A57207 Microwave & Digital Communications Lab

Course objectives:

- To establish in micro wave bench and understand, analyze the functionality of different microwave components and devices
- To understand and analyze the functionality of different optical components and devices
- To operate and characterized the behaviour of micro wave and optical sources
- To measure and evaluate different micro wave parameters and quantities
- To measure and evaluate different optical parameters and antennas.

Note: Minimum of 12 Experiments to be conducted

PART –A: Microwave Engineering (Any 6 Experiments):

1. Reflex Klystron Characteristics
2. Gunn Diode Characteristics
3. Directional Coupler Characteristics
4. VSWR Measurement
5. Measurement of Waveguide Parameters
6. Measurement of Impedance of a given load
7. Measurement of Scattering parameters of a Magic Tee
8. Measurement of Scattering parameters of a Circulator
9. Attenuation Measurement
10. Microwave Frequency Measurements.

PART-B: **Digital Communications Lab (Any 6 Experiments):**

1. PCM Generation and Detection
2. Differential Pulse Code Modulation
3. Delta Modulation
4. Time Division Multiplexing of 2 Band Limited Signals
5. Frequency shift Keying: Generation and Detection
6. Phase Shift Keying: Generation and Detection
7. Amplitude Shift Keying: Generation and Detection
8. Study of the Spectral characteristics of PAM, QAM
9. DPSK: Generation and Detection

10. QPSK: Generation and Detection

Requirements:

1. Klystron power supplies
2. Gun Power supplies
3. Reflex Klystron benches
4. Gunndiode benches
5. Optical trainer kits
6. CROs
7. Function Generators
8. Multimeters

Digital Communication Lab
CRO: 0-20MHz ;0-60MHz
Function Generators:0-1MHz
Experimental Kits

Course outcomes:

After completing the course, students will be able to

- Establish and evaluate microwave test bench, microwave components and devices
- Describe and evaluate different optical components and devices
- Operate and analyze the characteristics of micro wave and optical sources
- Measure and evaluate different micro wave parameters and quantities
- Measure and evaluate different optical parameters and antennas

B.Tech-ECE IV-Year-I-Semester

L/T/ P C

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A57208 Cellular & Mobile Communication Lab

Course Objectives:

- To understand the characteristics of small scale and large scale fading
- To analyse the impact of fading on the performance of different modulation techniques
- To observe the impact of Inter Symbol Interference (ISI) with Eye diagram
- To analyse the performance of equalization and diversity techniques in cellular networks
- To observe the performance of different multiple access techniques

List of Experiments (Any Ten Experiments are to be performed)

1. To analyse the characteristics of Friis free space path loss model, Log distance path loss model, Hata path loss model
2. To study different small scale fading parameters such as Power delay profile, Doppler spectrum, Frequency correlation function
3. To analyse the PDFs of Rayleigh and Rician fading channel
4. To analyse the performance of BPSK and QAM modulation techniques under Rayleigh fading channel
5. To analyse the performance of BPSK modulation technique with different diversity combining schemes
6. To observe the performance of 2x2 Multiple Input and Multiple Output (MIMO) technique under AWGN channel
7. To estimate the channel capacity of Single Input and Single Output (SISO) and Multiple Input and Multiple Output (MIMO) communication networks
8. To observe the impact of Inter Symbol Interference (ISI) with Eye diagram
9. To analyse the performance of Zero Forcing (ZF) and Minimum Mean Square Error (MMSE) equalisation techniques
10. To analyse the performance of Code Division Multiple Access (CDMA) technique
11. To simulate Time Division Multiplexing (TDM) and Frequency Division Multiplexing (FDM)
12. To simulate Orthogonal Frequency Division Multiplexing (OFDM) multicarrier technique

Course Outcomes:

After completing the course, students will be able to

- Estimate the behaviour of cellular networks in different network scenarios
- Analyse the error rate of modulation techniques under fading channels
- Explore the efficacy of diversity techniques in cellular networks

- Provide solutions to design receivers that can handle the effects of ISI
- Analyse the impact of multi-carrier modulation and multiple access techniques in cellular networks

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L/T/P C

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A58002 Intellectual Property Rights

Course Objective:
The course aims to help the student understand the concept of Intellectual Property Rights and helps the student to appreciate the purpose and function of a trademark and the process involved in getting copyright, patent and related issues. The student is introduced to the importance of trade Secret and Geographical Indications.

Unit-I: Introduction to IPR:

Concept of intellectual property rights, importance of intellectual property rights. Types of intellectual property, international agencies, and treaties.

Unit-II: Trademarks:

Concept of trademarks, purpose, and function of trademarks. Acquisition of trademark rights, protectable matter, selecting and evaluating trademark, trademark registration processes.

Unit-III: Law of Copyrights:

Concept of copyright right, fundamentals of copyright law, originality of material, rights of reproduction, rights to perform the work publicly, copyright ownership issues, copyright registration.

Unit-IV: Law of patents:

Introduction to patent, foundation of patent law, patent searching process, ownership rights and transfer.

Unit-V: Trade Secrets & Geographical Indication:

Law pertaining to trade secrets, determination of trade secrets. Trade secret litigation. Unfair competitions. Geographical Indication, concept of geographical indication, importance of geographical indication, new development of intellectual property rights.

Textbooks:

1. Deborah. E. Bouchoux,*"Intellectual property right"*, 5/e,cengage learning, 2018.
2. Neeraj Pandey, *"Intellectual property right"*, PHI, 2019.

Reference Books:

1. Ramakrishna Chintakunta and M. Geethavani,
2. Prabuddha Ganguli,*"Intellectual Property Right:Unleashing the Knowledge Economy"*, 2/e, 2017 Tata Mc Graw Hill Publishing company Ltd.

Course Outcomes:

After Completing the course, students will be able to

- Explain the concepts of intellectual property rights and related agencies.
- Describe the purpose and functions of a trademark in a competitive environment.
- Analyze the process of copyright and procedure.
- Understand the process of patent and patent issues.
- Explore the trade secret and geographical indications of its protection from unfair practices.

IV-Year B.Tech-ECE-II-Semester **L/T/P C**
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A58016 Python Programming

Pre requisites
None

Course Objectives
1. Understand the basics and function of Python Programming Language.
2. Understand the string operation and sequences used in Python Programming Languages.
3. Understand the data structures used in Python Programming Languages.
4. Know the classes and objects in Python Programming Language.
5. Use the reusability concepts in Python Programming Language.

Course Outcomes
At the end of this Data Structures course, students will be able to:
1. Apply control structures, functions and packages in Problem Solving. (L3)
2. Analyze various String handling functions and data structures(L4)
3. Model the object-oriented problems with classes and objects (L4)
4. Solve the problems by using Inheritance and polymorphism (L3)
5. Illustrate programs on Exception Handling and various packages(L3)

Unit-I
Introduction to Python:
Features of Python Language, Data Types, Operators, Expressions, Control Statement, Standard I/O Operations.
Functions and Modules:
Declaration and Definition Function Calling, More on Defining Functions, Recursive Functions, Modules, Packages in Python, Doc Strings.

Unit-II
Strings and Regular Expressions:
String Operations, Built-in String Methods and Functions, Comparing Strings, function in Regular Expression.
Sequence: List, Tuples, Dictionaries, Sets.

Unit-III
Introduction to Object Oriented Programming: Features of OOP,Merits and demerits of Object Oriented Programming Languages,Applications of OOP
Implementation of classes and objects in Python:
Classes and Objects, Class Method and Self Argument. The __init__Method, Class Variables and Object Variables, The __del__Method, Public and Private Data Members, Private Methods, Built-in Functions to Check, Get, Set and Delete Class Attributes, Garbage Collection (Destroying Objects).

Unit-IV

Implementation of Inheritance in Python:

Inheriting Classes in Python, Types of Inheritance, Abstract Classes and Interfaces, Meta class,

Implementation of Operator Overloading in Python:

Introduction, Implementing Operator Overloading, Overriding Methods

Exception Handling in Python:

Introduction, Exception hierarchy, Handling Exception, Multiple Except Blocks and Multiple Exceptions, Finally Block.

Unit-V

Python NumPy: NumPy ND array, Data Types, Functions of NumPy Array, NumPy Array Indexing, Mathematical Functions on Arrays in NumPy

Python Pandas: Pandas Features, Dataset in Pandas, Data Frames, Manipulating the Datasets, Describing a Dataset, group by Function, Filtering, Missing Values in Pandas, Concatenating Data Frames. Import data from csv file.

Introduction to Matplotlib:, Plot, Scatterplot, Introduction to Tkinter ,Date and Time Packages

Text Books

1.ReemaThareja,Python Programming using Problem Solving Approach, First Edition,Oxford Higher Eduction,2017

2.James Payne, Beginning Python using Python 2.6 and Python 3,1st Edition

Reference Books

1. Charles Dierach, Introduction to Computer Science using Python, 2013
2. https://www.programiz.com/python-programming
3. https://www.javatpoint.com/python-tutorial
4. https://www.geeksforgeeks.org/python-programming-language/

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A58014 Disaster Preparedness And Planning

Course Objectives

- To know the concept, definition and terminology of the Disaster Management.
- To know the classification and occurrence of disasters in India and elsewhere.
- To know and analyze the socio-economic, environmental aspects of disasters impacts.
- To know the pre, post and emergency management mitigation strategies.
- To know the environment of vulnerable disaster areas

Unit-I: Introduction: Concepts and definitions: disaster, hazard, vulnerability, risk, capacity, impact, prevention, mitigation.

Unit-II: Disasters: Disasters classification; natural disasters (floods, draught, cyclones, volcanoes, earthquakes, tsunami, landslides, coastal erosion, soil erosion, forest fires etc.); manmade disasters (industrial pollution, artificial flooding in urban areas, nuclear radiation, chemical spills etc); hazard and vulnerability profile of India, mountain and coastal areas, ecological fragility

Unit-III:Disaster Impacts:
Disaster impacts (environmental, physical, social, ecological, economic, political, etc.); health, psycho-social issues; demographic aspects (gender, age, special needs); hazard locations; global and national disaster trends; climate-change and urban disasters.

Unit-IV: Disaster Risk Reduction (DRR):
Disaster management cycle – its phases; prevention, mitigation, preparedness, relief and recovery; structural and non-structural measures; risk analysis, vulnerability and capacity assessment; early warning systems, Post-disaster environmental response (water, sanitation, food safety, waste management, disease control); Roles and responsibilities of government, community, local institutions, NGOs and other stakeholders; Policies and legislation for disaster risk reduction, DRR programmes in India and the activities of National Disaster Management Authority.

Unit-V: Disasters, Environment And Development

Factors affecting vulnerability such as impact of developmental projects and environmental modifications (including of dams, land-use changes, urbanization etc.), sustainable and environmental friendly recovery; reconstruction and development methods

.

Textbooks

1. H.K. Gupta, Disaster Management - - University Press, India, 2003.
2. Singh B.K, Handbook of Disaster Management: techniques and Guidelines -., Rajat, Publications, 2008

References

1. Pardeep Sahni, Disaster Mitigation: Experiences and Reflections -
2. Pradeep Sahni, Disaster Risk Reduction in South Asia, Prentice Hall, 2004.

Course Outcomes

After Completing the course, students will be able to

- Acquire knowledge of disaster Management.
- Acquaint with different disasters in India and other parts of the world.
- Classify, assess the magnitude and intensity of various impacts of disasters.
- Learn the management methods.
- Learn effective sustainable environmental modification techniques.

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A58017 Introduction to Deep Learning

Course Objectives

- To understand the concept of Deep Learning
- To understand various CNN Architectures
- To learn various RNN model
- To familiarize the concept of Autoencoder
- To apply Transfer Learning to solve problems

Course Outcomes

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

- Understand the fundamental issues and basics of deep learning
- Understand the concept of CNN to apply it in the Image classification problems
- Analyze the various RNN methods for sequence of input and Generative model for image generation
- Analyze the working of various the Autoencoders methods
- Use Transfer Learning to solve problems with high dimensional data including image and speech

UNIT-I

Deep Learning: Fundamentals, Building Block of Neural Networks, Layers, MLPs, Forward pass, backward pass, class, trainer and optimizer, The Vanishing and Exploding Gradient Problems, Difficulties in Convergence, Local and Spurious Optima, Momentum, learning rate Decay, Dropout, Cross Entropy loss function.

UNIT-II

Deep Learning: Activation functions, initialization, regularization, batch normalization, model selection, ensembles. **Convolutional neural networks**: Fundamentals, architectures, striding and padding, pooling layers, CNN -Case study with MNIST, CNN vs Fully Connected.

UNIT-III

RNN: Handling Branches, Layers, Nodes, Essential Elements-Vanilla RNNs, GRUs, LSTM, video to text with LSTM models.

UNIT-IV

Autoencoders and GAN: Basics of auto encoder, comparison between auto encoder and PCA, variational auto encoders, denoising auto encoder, sparse auto encoder, vanilla

auto encoder, Multilayer autoencoder. Convolutional autoencoder, regularized auto encoder. GAN, Image generation with GAN.

UNIT-V

Transfer Learning- Types, Methodologies, Diving into Transfer Learning, Challenges

Text Books

1. Seth Weidman, “Deep Learning from Scratch”, O'Reilly Media, Inc.,2019
2. Ian Goodfellow, Yoshua Bengio and Aaron Courville,“Deep Learning”, MIT Press, 2015
3. Dipanjan Sarkar,Raghav Bali, “Transfer Learning in Action”, Manning Publications,2021

References

1. Giancarlo Zaccone, Md. Rezaul Karim, Ahmed Menshawy "Deep Learning with TensorFlow: Explore neural networks with Python", Packt Publisher, 2017.
2. Antonio Gulli, Sujit Pal, "Deep Learning with Keras", Packt Publishers, 2017.
3. Francois Chollet, "Deep Learning with Python", Manning Publications, 2017.

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L/T/P C

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A58001 Technical and Business Communication Skills

Introduction

The course is intended to expose the students to learn and practice the five communication skills thinking, listening, speaking reading, and writing in English, the global language of communication. It reflects some of the approaches in English language teaching and learning currently in practice around the world.

Objective

To help the students to develop effective communication skills in all communicative contexts for professional advancement

Unit-I: E-World & E-Communication:
E-language **-** E-governance **-** E-commerce/E-business **-** E-banking **-** E-waste

Unit-II: Business Establishment & Infrastructure Development:
Power Supply **-** Industrial Park **-** Business Correspondence: Follow-up letters - Acceptance & Rejections **-** Persuasive letters **-** Resignation letters

Unit-III: Technology and Society:
Robot Soldiers **-** For a Snapshot of a Web **-** Placing an order - Proposal Writing **-** Patents & Rights (National & International) **-** Intellectual Property - Nanotechnology

Unit-IV: Ethics in Business Communication:
Ethical issues involved in Business Communication - Ethical dilemmas facing managers **-** Ethical Code & Communication - Standards in Daily Life - Total Quality Management - World University Ranking

Unit-V: Management Information System:
Corporate Governance **-** Business Process Outsourcing **-** Project Management Communication **-** Marketing Communication

Text Books:
1. Anderson, V. Paul" *Technical Communication",* Cengage. 2014.
2. Kalkar, Anjali. et.al. "*Business Communication*", Orient Black Swan. 2010.

References:

1.Anderson, V. Paul" *Technical Communication",* Cengage. 2014.
2.Kalkar, Anjali. et.al. "*Business Communication*", Orient Black Swan. 2010.
3.Knisely, W. Charles. and Knisely, I. Karin,"*Engineering Communication",* Cengage. 2015.
4.Kumar, Sanjay. and Pushp Lata" *Language and Communication skills for Engineers",* Oxford University Press. 2018.
5.Raman, Meenakshi and Singh, Prakash,"*Business Communication",* (Second Edition.). Oxford University Press. 2012.

Course outcomes:

After completing the course, students will be able to:

- communicate technical and business correspondence
- reflect on the themes discussed
- recognize ethical implications of technical communication in professional contexts
- identify the contemporary issues in engineering from environmental, societal, economic, and global perspectives
- demonstrate ethical decisions in complex situations

B.Tech-ECE IV-Year-II-Semester **L/T/ P C**

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A58018 Green Technologies

Course Objectives:

- familiarize with the terminology of solar radiation and solar energy collection techniques
- know the different methods of solar energy storage and types of wind mills
- study the principles of bio-conversion, methods of harnessing Geothermal and Ocean energy
- study the benefits of green systems and improved processes over current systems and processes
- acquaint with features and benefits of green buildings

Unit-I: Introduction:

SOLAR RADIATION: Role and potential of new and renewable sources – The solar energy option – Environmental impact of solar power – Structure of the sun – The solar constant – Extraterrestrial and terrestrial solar radiation – Solar radiation on titled surface – Instruments for measuring solar radiation and sun shine, solar radiation data – Photo voltaic energy conversion – types of PV cells

SOLAR ENERGY COLLECTION: Flat plate and concentrating collectors – Classification of concentrating collectors – Orientation – Advanced collectors

Unit-II:

SOLAR ENERGY STORAGE AND APPLICATIONS: Different methods – Sensible heat, latent heat and stratified storage, solar ponds – solar applications: solar heating/cooling technique, solar distillation and drying, solar cookers – Central power tower concept and solar chimney

WIND ENERGY: Sources and potentials – Horizontal and vertical axis windmills – Types of winds – Wind data measurement

Unit-III:BIO-MASS: Principles of bioconversion – Anaerobic/aerobic digestion – Types of biogas digesters – Gas yield – Combustion characteristics of biogas – Utilization for cooking, bio fuels – Economic aspects

GEOTHERMAL ENERGY: Resources – Types of wells – Methods of harnessing the energy – potential in India

OCEAN ENERGY: OTEC – Principles of utilization – Setting of OTEC plants – Thermodynamic cycles – Tidal and wave energy: Potential and conversion techniques – Mini-hydel power plants and their economics

Unit-IV: ENERGY EFFICIENT SYSTEMS AND PROCESSES:

SYSTEMS: Fuel cells – Principle, thermodynamic aspects – Selection of fuels & working of various types of fuel cells – Environmental friendly and Energy efficient compressors and pumps

PROCESSES: Environmental impact of the current manufacturing practices and systems – Benefits of green manufacturing systems – Selection of recyclable and environment friendly materials in manufacturing – Design and implementation of efficient and sustainable green production systems with examples like environmental friendly machining, vegetable based cutting fluids, alternate casting and joining techniques, zero waste manufacturing

Unit-V: SUSTAINABLE MATERIALS FOR BUILDINGS: Definition – Features and benefits – Sustainable site selection and planning of buildings for maximum comfort – Environmental friendly building materials like bamboo, timber, rammed earth, hollow blocks, lime & lime pozzolana cement, agro materials and industrial waste, Ferro cement and Ferro-concrete, alternate roofing systems, paints to reduce heat gain of the buildings – Energy management

Text books:

1. Sukhatme S.P. and J.K.Nayak,"*Solar Energy – Principles of Thermal Collection and Storage*", TMH
2. Khan B.H,*"Non-Conventional Energy Resources"*,Tata McGraw Hill, New Delhi, 2006
3. J. Paulo Davim, "*Green Manufacturing Processes and Systems"*, Springer 2013.

References:

1. K.S Jagadeesh, B.V Venkata Rama Reddy and K.S Nanjunda Rao,*" Alternative Building Materials and Technologies* ,New age international
2. D.Yogi Goswami, Frank Krieth & John F Kreider*," Principles of Solar Engineering",* Taylor & Francis
3. G.D Roy,*"Non-conventional Energy Source"*,Standard Publishers.
4. Gregor Hoogers,*"Fuel Cell Technology –Hand Book ",* BSP Books Pvt. Ltd.

Course Outcomes:

After completing the course, students will be able to:

- understand the basic concepts of solar radiation, measurement and its collection
- identify the different solar energy storage techniques and its applications and methods of taping wind energy
- know the biogas production methods, its applications as fuel, the potential of geothermal and ocean energy in India and methods to tap those energies
- understand the environmental impact by the current systems and manufacturing processes and benefits of green systems and improved processes
- discover various building materials, their features and benefits in the context of green buildings