EC – 1871(A) Advanced Communication

Course Title	Course Code	Credits - 4		
Advanced Communication	EC 1871(A)	L	T	P
		3	1	-

COURSE OBJECTIVE	The objective of the course is to familiarize students with the advanced technologies used in Modern Communication.
PRE-REQUISITES	• Signal & System • Analog Communication • Digital Communication • Data Communication
COURSE CONTENTS	**Unit I**: Spread Spectrum Communication: Introduction, frequency hopping multiple access, Generation of PN sequence, and direct sequence spread spectrum system, processing gain, jamming margin, application of direct sequence spread spectrum signal, frequency hopped spread spectrum signal, time hopping spread spectrum signal, CDMA, cellular CDMA systems. **Unit II**: Satellite Systems: Introduction, Frequency allocations for satellite systems. Orbits and launching methods, orbital elements, apogee and perigee heights, orbit perturbations, Satellite Sub Systems, uplink and downlink Analysis and Design, link budget, E/N calculation, Earth station Technology. **Unit III**: Wireless Sensor Networks: Introduction: Introduction to Sensor Networks, unique constraints and challenges, Advantage of Sensor Networks, Applications of Sensor Networks, Mobile Adhoc Networks (MANETs) and Wireless Sensor Networks, Devices in WSN.Local Access Networks: Improvement in Convention Cables: XDSL, ADSL, ISDN: Architecture, Services and Protocols, ATM. **Unit IV**: Optical Communication: Overview of Optical Fiber Communications (OFC): Motivation, optical spectral bands, key elements of optical fiber systems.Optical fibers: basic optical laws and definitions, optical fiber modes and configurations, single mode fibers, multi-mode fiber, graded-index fiber structure, Optical sources: Light emitting diodes (LEDs): Laser Diodes, SONET. **Unit V**: Cognitive Radio: Problem description, cognitive transceiver architecture, principle of interweaving, spectrum sensing, spectrum management, spectrum sharing, overlay, underlay.
COURSE OUTCOMES:	**On successful completion of this course student should be able to:** **CO 1:** Understand the concept of spread spectrum communication, hopping based system, implementation method of performance criteria, types of OFDM communication satellite system and different parameters, cost, optical communication and cognitive radios. –(BL1, BL2) **CO 2:** Analyze different parameter of Spread Spectrum communication system, optical communication system, wireless sensor Network and cognitive radios .(BL3, BL4) **CO 3:** Use concepts of probability theory and stochastic process to solve the problems in different communication system and design sensor Network and communication system.-(BL3, BL6)

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TEXT BOOKS& REFERENCES:

- J G Proakis, M Salehi —Communication System Engineering, 2nd Ed. Pearson Edition (LPE).
- Holger Kerl, Andreas Willig, "Protocols and Architectures for Wireless Sensor Network", John
- Wiley and Sons, 2005 (ISBN: 978-0-470-09511-9)
- Raghavendra, Cauligi S, Sivalingam, Krishna M., ZantiTaieb, "Wireless Sensor Network",
- Springer 1st Ed. 2004 (ISBN: 978-4020-7883-5).
- Gerd Keiser, "Optical Fiber Communication" Mc Graw -Hill International, 4th Edition.
- John M. Senior, "Optical Fiber Communication", Second Edition, Pearson Education, 2007.
- Tao Jiang, Lingyang Song, Yan Zhang, "Orthogonal Frequency Division Multiple Access (OFDMA)
- Fundamentals and Applications", Auberbach Publications, Taylor & Francis Group 2010.
- Aditya K. Jagannatham, "Principles of Modern Wireless Communication Systems", McGraw-Hill Education, 2016.
- Joseph MitolaIII,"Software Radio Architecture: Object-Oriented Approaches to Wireless System Engineering", John Wiley & Sons Ltd. 2000.
- Bruce A. Fette, "Cognitive Radio Technology", Elsevier, 2009.
- B. A. Forouzan and Sophia Chung Fegan: Data Communications and Networking, 4th Ed, TMH

END

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EC – 1871(B) Error Correcting Codes

Course Title	Course Code	Credits - 4		
		L	T	P
Error Correcting Codes	EC – 1871(B)	3	1	-

COURSE OBJECTIVE

The course covers theory and application of error detecting, correcting codes, encoding, decoding,error correcting techniques and system control with emphasis on hardware implementation.

PRE-REQUISITES

- Digital Logic Design

COURSE CONTENTS

Unit I: Introduction to Coding, Basic Definitions, Block Codes and Maximum Likelihood Decoding, Decoding Tables, Hamming Weight and Distance, Error Correction vs Detection

Unit II: Linear Block Codes, Definitions, Generator Matrix, Parity-Check Matrix, Error-Correcting Capability of a Linear Code, The Standard Array

Unit III: Binary Cyclic Codes, Description of Cyclic Codes, Encoding with (n-k)-Stage Shift Register, Syndrome Calculations and Error Detection, A General Decoder for Cyclic Codes, Shortened Cyclic Codes

Unit IV: Error Trapping Decoding for Cyclic Codes, Error Trapping Decoding, Hamming Codes, Double-Error-Detecting and Single-Error-Correcting Hamming Codes, A Modified Error-Trapping Decoding, Goley Code

Unit V: BCH Codes, Description of Codes, Decoding of the BCH Codes, Implementation of Error Correction, Nonbinary BCH Codes and Reed-Solomon Codes, Single-Burst-Error-Correcting Codes, Burst-and-Random-Error-Correcting Codes, Error Detecting and Correcting Systems Design and Hardware Implementation

COURSE OUTCOMES:

After completion of the course, the student is able to

CO1: Understand the concepts of coding and decoding, and gain deep knowledge about linear, cyclic and BCH codes, , error detection and correction methods, and decoding methods.-(BL1,BL2)

CO2: Analyze coders and decoders based on different coding algorithm and analyze the transmissions for detecting and correction data errors.-(BL3,BL4)

CO3: Develop codes for implementing hardware's for coding-decoding and error detection-correction using various methods.-(BL3,BL6)

TEXT BOOKS & REFERENCES:

- Shu Lin, "An Introduction to Error-Correcting Codes", Prentice-Hall
- Wakerly, John, "Error Detecting Codes, Self-Checking Circuits and Applications."
- Peterson, W. W. and E.J. Weldon, Jr., "Error-Correcting Codes", the M.I.T. Press, Cambridge, MA 1970
- Lin, Shu/D. J. Costello, Jr., "Error Control Coding: Fundamentals and Applications", Prentice-Hall, 1983
- 5. Nagi El Naga, "Error Detecting and Correcting Systems Design," Lecture Notes, ECE Department, California State University, Northridge.

END

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EC – 1871(C) Wide Band Communication

Course Title	Course Code	Credits - 4		
Wide Band Communication	EC 1871 (C)	L	T	P
		3	1	-

COURSE OBJECTIVE	To build an understanding of the fundamental concepts of wideband communication. To familiarize the student with the basic taxonomy, model and working of wideband communication system. To understand channel modal and signal processing in wideband communication.
PRE-REQUISITES	Basics of Digital and wireless communication
COURSE CONTENTS	**Unit I**: History, Definition, FCC Mask, UWB features, UWB Interference: IEEE 802.11.a Interference, Signal to Interference ratio calculation, Interference with other wireless services. **Unit II**: Impulse Radio, Pulsed Multiband, Multiband OFDM, features: Complexity, Power Consumption, Security and achievable data rate. MIMO Multiband OFDM, Differential multiband OFDM, Performance characterization, Ultra Wide Band Wireless Channels Channel model: Impulse Response Modeling of UWB Wireless Channels, IEEE UWB channel model, Path loss, Delay profiles, Time and frequency modeling. **Unit III**: Data Modulation schemes, UWB Multiple Access Modulation, BER, Rake Receiver, Transmit- Reference (T-R) Technique, UWB Range- Data Rate Performance, UWB Channel Capacity, UWB Wireless Locationing: Position Locationing Methods, Time of Arrival Estimation, NLOS Location Error, Locationing with OFDM **Unit IV**: Antenna Requirements, Radiation Mechanism of the UWB Antennas, Types of Broad band antennas, Parameters, Analysis of UWB Antennas, Link Budget for UWB System. Design examples of broad band UWB antennas. **Unit V:** Wireless Ad hoc Networking, UWB Wireless Sensor, RFID, Consumer Electronics and Personal, Asset Location, Medical applications, UWB Regulation and standards in various countries, UWB Regulation in ITU, IEEE Standardization
COURSE OUTCOMES:	**On successful completion of this course student should be able to:** **CO1:** understand international regulation and standard in UWB technology, modulation schemes, basic specifications of antenna systems and wireless networks.- (BL1,BL2) **CO2:** Analyze the wireless technology based systems for performance based on modulation schemes, specifications of antenna systems, and protocols adopted for the design.-(BL3,BL4) **CO3:** Design wireless technology based systems for different protocols, modulation schemes using various kinds of Antenna systems and Wireless Ad Hoc Systems. (BL3,BL6)

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TEXT BOOKS& REFERENCES:	• Homayoun Nikookar and Ramjee Prasad, "Introduction to Ultra Wideband for Wireless Communications"1st Edition, Springer Science & Business Media B.V. 2010. • Thomas Kaiser, Feng Zheng "Ultra Wideband Systems with MIMO", 1st Edition, John Wiley & Sons Ltd, New York, 2010. • W. Pam Siriwongpairat and K. J. Ray Liu, "Ultra-Wideband Communications Systems: Multiband OFDM approach" John Wiley and IEEE press, New York 2008.

END

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EC – 1872(A) Radar Engineering

Course Title	Course Code	Credits - 4		
Radar Engineering	EC 1872 (A)	L	T	P
		3	1	-

COURSE OBJECTIVE

To introduce the fundamental issues, concepts, and design principles in "various radar systems".
To introduce the fundamental issues, concepts, and design principles in "phased arrays" - phase shifters, frequency scan arrays, multiple beams, direction finder.

PRE-REQUISITES

- Electromagnetic Field Theory
- Antenna Theory and display devices

COURSE CONTENTS

Unit I: Radar and Radar Equation: Introduction, Radar block diagram and operation, frequencies, applications, types of displays, derivation of radar equation, minimum detectable signal, probability of false alarm and threshold detection, radar cross-section, system losses.

Unit II: CW Radar – Doppler Effect, CW Radar, applications, FM – CW radar, altimeter, Multiple Frequency Radar. Pulse Radar – MTI, Delay Line Canceller, Multiple Frequencies, Range-gated Doppler Filters, Non-coherent MTI, Pulse Doppler Radar.

Unit III: Tracking Radar- Sequential lobing, conical scanning, monopulse, phase comparison monopulse, tracking in range, comparison of trackers.

Unit IV: Detection – Introduction, Matched Filter, Detection Criteria, Detector characteristics.

Unit V: Phased Arrays – Basic concepts, feeds, phase shifters, frequency scan arrays, multiple beams, applications, advantages and limitations. Navigational Aids: Direction Finder, VOR, ILS and Loran.

COURSE OUTCOMES:

On successful completion of this course student should be able to:

CO1: Understand the basic operation of pulse and CW radar systems and evaluate the radar performance, tracking systems, detection of signals, and concepts and structure of phased array.-(BL1,BL2)
CO2: Analyze and make selection of suitable tracking radar for a given problem and Select appropriate criterion for detecting a target.-(BL3,BL4)
CO3: Develop and Design tracking radars, and develop radar systems.(BL3,BL6)

TEXT BOOKS& REFERENCES:

- M.I. Skolnik, Introduction Radar Systems, 2nd Edn, Mc Graw Hill Book Co.,1981
- F.E. Terman, Radio Engineering, Mc Graw Hill Book Co. (for Chapter 7 only), 4Th Edn. 1955.
- Simon Kingsley and Shaun Quegan, Understanding RADAR Systems, McGraw Hill Book Co., 1993.

END

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EC – 1872(B) Wavelets

Course Title	Course Code	Credits - 4		
Wavelets	EC 1872(B)	L	T	P
		3	1	-

COURSE OBJECTIVE

The objective of course is to provide student with knowledge of Wavelets and its various applications.

PRE-REQUISITES

Digital Signal Processing

COURSE CONTENTS

Unit I: Introduction Wavelet Transform: Introduction, Continuous-Time Wavelets, Definition of the CWT, CWT as a Correlation, Constant Q-Factor Filtering Interpretation and Time-Frequency Resolution, Inverse CWT.

Unit-II: Introduction to the Discrete Wavelet Transform and Orthogonal Wavelet Decomposition: Introduction, Approximations of Vectors in Nested Linear Vector Subspaces, Example of Approximating Vectors in Nested Subspaces of a Finite & Infinite-Dimensional Linear Vector Space, Bases for the Approximation Subspaces and Haar Scaling Function, Digital Filter Implementation of the Haar Wavelet Decomposition.

Unit-III: MRA, Orthonormal Wavelets, and their Relationship to Filter Banks: Introduction, Formal Definition of an MRA, Construction of a General Orthonormal MRA, Scaling Function and subspaces, A Wavelet Basis for the MRA, Digital Filtering Interpretation, Examples of Orthogonal Basis-Generating Wavelets, Interpreting Orthonormal MRAs for Discrete- Time Signals, Generating Scaling Functions and Wavelets from Filter Coefficients.

Unit-IV: Alternative Wavelet Representations: Introduction, Biorthogonal Wavelet Bases, Filtering Relationship for Biorthogonal Filter, Examples of Biorthogonal Scaling Function and Wavelets, Two-Dimensional Wavelets, Non-separable Multidimensional Wavelets, Wavelet Packet.

UNIT V: Wavelet Transform and its Applications: Introduction, Transform Coding, DTWT for Image and Audio Compression, Wavelet Denoising, Edge Detection and Object Isolation, Image Fusion.

COURSE OUTCOMES:

After completion of the course, the student is able to:

CO1: Gain knowledge about basics of wavelets, its decomposition methods, designing algorithms, representations and various applications.-(BL1, BL2)

CO2: Analyze wavelet based filters filter bank implementations for orthogonality, scaling and other filter coefficients.-(BL3, BL4)

CO3: Design wavelet filter and filter banks with different orthogonality parameters, representations and implement various applications based on wavelet transforms.-(BL3, BL6)

TEXT BOOK & REFERENCES:

- Wavelet Transforms, Introduction to Theory and Applications, R M Rao, A S Bopardikar, Addison Wesley, 1998
- Introduction to wavelet and wavelet transform: A Primer, Burros, Gopinath & Guo, Prentice Hall

END

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EC – 1872(C) Cognitive Radio

Course Title	Course Code	Credits - 4		
Cognitive Radio	EC 1872 (C)	L	T	P
		3	1	-

COURSE OBJECTIVE

The student should be made to:

Know the basics of the software defined radios. Learn the design of the wireless networks based on the cognitive radios. Understand the concepts of wireless networks and next generation networks

COURSE CONTENTS

UNIT I: Introduction To Software Defined Radio: Definitions and potential benefits, software radio architecture evolution, technology tradeoffs and architecture implications.

UNIT II: SDR Architecture: Essential functions of the software radio, basic SDR, hardware architecture, Computational processing resources, software architecture, top level component interfaces, interface topologies among plug and play modules.

UNIT III: Introduction To Cognitive Radios: Marking radio self-aware, cognitive techniques – position awareness, environment awareness in cognitive radios, optimization of radio resources, Artificial Intelligence Techniques.

UNIT IV: Cognitive Radio Architecture: Cognitive Radio – functions, components and design rules, Cognition cycle – orient, plan, decide and act phases, Inference Hierarchy, Architecture maps, Building the Cognitive Radio Architecture on Software defined Radio Architecture.

UNIT V: Next Generation Wireless Networks: The XG Network architecture, spectrum sensing, spectrum management, spectrum mobility, spectrum sharing, upper layer issues, cross – layer design.

COURSE OUTCOMES:

Upon completion of the course, students will be able to:

CO1: Understand the basics of the software defined radios, its architecture, and next generation wireless networks structure of cognitive radios, and next generation wireless networks.-(BL1,BL2)

CO2: Analyze the structure of cognitive radios, and next generation wireless networks.-(BL3,BL4)

CO3: Design and improve cognitive radios.-(BL3,BL6)

END

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TEXT BOOKS & REFERENCES:

- Joseph MitolaIII,"Software Radio Architecture: Object-Oriented Approaches to Wireless System Engineering", John Wiley & Sons Ltd. 2000.
- Thomas W. Rondeau, Charles W. Bostain, "Artificial Intelligence in Wireless communication", ARTECH HOUSE .2009.
- Bruce A. Fette, "Cognitive Radio Technology", Elsevier, 2009.
- Ian F. Akyildiz, Won – Yeol Lee, Mehmet C. Vuran, Shantidev Mohanty, "Next generation / dynamic spectrum access / cognitive radio wireless networks: A Survey" Elsevier Computer Networks, May 2006.
- Simon Haykin, "Cognitive Radio: Brain –Empowered Wireless Communications", IEEE Journal on selected areas in communications, Feb 2005.
- HasariCelebi, Huseyin Arslan, "Enabling Location and Environment Awareness in Cognitive Radios", Elsevier Computer Communications, Jan 2008.
- Markus Dillinger, KambizMadani, Nancy Alonistioti, "Software Defined Radio", John Wiley, 2003.
- Huseyin Arslan, "Cognitive Radio, SDR and Adaptive System", Springer, 2007.
- Alexander M. Wyglinski, Maziarnekovee, Y. Thomas Hu, "Cognitive Radio Communication and Networks", Elsevier, 2010.

END

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EC – 1873(A) Information Theory and Coding

Course Title	Course Code	Credits - 3		
Information Theory and Coding	EC – 1873(A)	L	T	P
		3	-	-

COURSE OBJECTIVE	The Objective Of This Course Is To Make Student Aware Of Concepts Of Information Theory And Coding.
PRE-REQUISITES	• Boolean Algebra • Digital Communication

COURSE CONTENTS

UNIT-I: Definitions, scope and history; limitation of classical and relative-frequency-based definitions. Sets, fields, sample space and events; axiomatic definition of probability. Combinatorics: Probability on finite sample spaces. Joint and conditional probabilities, independence, total probability; Bayes' rule and applications. Definition of random variables, continuous and discrete random variables, cumulative distribution function (cdf) for discrete and continuous random variables; probability mass function (pmf); probability density functions (pdf) and properties.

UNIT-II: Uncertainty, Information and Entropy Information Measures, Characteristics on information Measure, Shannon's concept of information, Shannon's measure of information, Model for source coding theorem, Communication system, Source coding and line/channel coding, channel mutual information capacity (Bandwidth).

UNIT-III: Channel coding, Theorem for discrete memory less channel, Information capacity theorem, Error detecting and error correcting codes, Types of codes, Block codes, Tree codes, Hamming Codes, Description of linear block codes by matrices, Description of linear tree code by matrices, Parity check codes, Parity check polynomials.

UNIT-IV: Compression: Lossless and lossy, Huffman codes, Binary Image compression schemes, Run – length Encoding, CCITT group-3 1D compression, CCITT group-3 2D compression, CCITT group-4 2D compression.

UNIT-V:Cryptography: Encryption, Decryption, Cryptogram (cipher text), Concept of cipher, Cryptanalysis, Keys: Single key (Secret key), Cryptography, two-key (Public key)Cryptograph, Single key cryptography, Ciphers, Block Cipher code, Stream ciphers, Requirements for secrecy, fata Encryption Standard, Public Key Cryptography, Diffie-Hellmann public key distribution, The Rivest- Shamin Adelman(R-S-A) system for public key Cryptography, Digital Signature.

COURSE OUTCOMES:

After completion of the course, the student is able to:

CO1: understand and describe and the channel performance using Information theory.-(BL1,BL2)

CO2: Analyze various error control code properties and compression techniques.-(BL3, BL4)

CO3: Develop/Design cryptography methods for improving security measures of digital systems.-(BL3, BL6)

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TEXT BOOKS& REFERENCES:	• Digital Communication by Das, Mullick & Chatterjee, New Age Pub. • Digital Communication by Proakis, TMH • Digital Image Processing by Gonzales & Woods, Pearson (for Unit – III & IV) • Local Area Network by G. Keiser, TMH (for Unit – V) END

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EC – 1873(B) OFDM& MIMO

Course Title	Course Code	Credits - 3		
		L	T	P
OFDM & MIMO	EC 1873 (B)	3	-	-

COURSE OBJECTIVE

The fundamental concepts and design principles in "multiple-input multiple-output".this course is intended to impart to the students the principles of (MIMO) wireless communications –channel capacity, antenna diversity, space-time the fundamental concepts in "orthogonal frequency-division multiplexing" (OFDM)coding communications – transmission, synchronization, peak-to-average power ratio (PAPR) reduction.

PRE-REQUISITES

- Probability & Stochastic process
- Wireless Communications

COURSE CONTENTS

Unit I: OFDM Basics: Multi-carrier transmission- Data Transmission using Multiple Carriers-Multicarrier Modulation with Overlapping Sub channels, OFDM modulation & demodulation, BER; coded-OFDM; Orthogonal frequency-division multiple-access (OFDMA).

Unit II: OFDM Synchronization: Effect/estimation of symbol-time offset (STO); Effect/estimation of carrier-frequency offset (CFO); Effect/compensation of Sampling-clock offset (SCO), Frequency and Timing Offset Issues.

Unit III: OFDM Issues: Peak-to-Average Power Ratio Reduction (PAPRR): Distribution of OFDM-signal amplitude, PAPR & oversampling; Frequency and Timing Offset Issues -Mitigation methods, SNR performance.

Unit IV: Introduction to MIMO: MIMO Channel Capacity, SVD and Eigen modes of the MIMO Channel, MIMO Spatial Multiplexing. MIMO Diversity Gain: Beam forming Antennas, Diversity: Receive- antenna diversity; Transmit-antenna diversity, MIMO Diversity and applications

Unit V: Space-Time Modulation and Coding: ML detection, rank and determinant criteria, Space-time trellis and block codes, Detection for Spatially Multiplexed MIMO Systems - MIMO - OFDM.

COURSE OUTCOMES:

After completion of the course, the student is able to:

CO1: Describe and understand the channel performance using Information theory issues in OFDM systems, MIMO systems, and Space-Time Modulation and Coding.(BL1, BL2)
CO2: Analyze OFDM & MIMO systems for its performance, issues, and implement various modulation and coding algorithms.(BL3, BL4)
CO3: Design and improve OFDM and MIMO Systems-(BL3, BL6).

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TEXT BOOKS& REFERENCES:	• MIMO-OFDM for LTE, WiFi and WiMAX Li Wang, Ming Jiang, Lajos L. Hanzo, Yosef AkhtmanWeily 2011 • MIMO-OFDM Wireless Communications with MATLAB Yong Soo Cho, Jaekwon Kim, Won Young Yang, Chung G. Kang John Wiley & Sons (2010) • OFDM for Wireless Communications Systems Ramjee Prasad, Artech House Publishers (2004) • MIMO Wireless Communications Ezio Biglieri Robert Calderbank Anthony Constantinides Andrea Goldsmith Arogyaswami Paulraj H. Vincent Cambridge University Press (2007)

END

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EC – 1873(C) Power Electronics

Course Title	Course Code	Credits - 3		
		L	T	P
Power Electronics	EC – 1873(C)	3	-	-

COURSE OBJECTIVE	Study of this subject provides the following Course Objectives: To impart knowledge about various power semiconductor devices. Prepare the students to analyze and design different power converter circuits. Prepare the students to apply power semiconductor devices in different Industrial and Home appliances.
PRE-REQUISITES	• Basic Electrical Engg. • Analog Electronics • Network analysis.
COURSE CONTENTS	**Unit I**: Power, Semiconductor Devices: Classification of Power semiconductor devices, characteristics, construction, application and theory of operation of power diode, power transistor, thyristors. Device specifications and ratings, working of Diac, Triac, IGBT, GTO and other power semiconductor devices. Turn-on / turn-off methods and their circuits. **Unit II**: Rectifiers: Review of uncontrolled rectification an its limitations, controlled rectifiers, half wave, Full wave configurations, multiphase rectification system, use of flywheel diode in controlled rectifier configurations for different types of load. **Unit III**: Inverters and Choppers: Classification of inverters, Transistor inverters, Thyristor inverters, Voltage and Current Communicated inverters, PWM inverters, Principle of Chopper, Chopper classification and their working, Regulators. **Unit IV**: A. C. Voltage Controllers and Cyclo-converters: Classification and operation of a.c. voltage controllers and cycloconverters, their circuit analysis for different types of load. **Unit V**: Industrial Applications: Solid-state switching circuits, Relays, Electronic Timer, Battery charger, Sawtooth generator, Applications in Industrial process control, Motor drive applications, Electronic regulators, etc., Induction heating, Dielectric Heating, Resistance welding and welding cycle.
COURSE OUTCOMES:	**After completion of the course, the student is able to** **CO1:** Acquire fundamental concepts and identify techniques used in power electronics, and develop an understanding about structure and working rectifiers, inverters, choppers, controllers, cyclo-converters and their industrial applications.-(BL1, BL2) **CO2:** Analyze the operation of semiconductor devices like, rectifiers, inverters, choppers, controllers, and , cyclo-converters for their performance.-(BL3, BL4) **CO3:** Design power electronics circuits and devices.-(BL3, BL6)

Sandeep Poddar

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TEXT BOOKS & REFERENCES:	• Power electronics, converters, applications & design - Need Mohan et.al., Wiley • Power Electronics Circuits, devices & applications - M.H. Rashid, PHI. • Power Electronics - P.C.Sen, TMH • Power Electronics: Devices, Circuits & MATLAB Simulations, Alok Jain, Penram Int. Publication. • Semiconductor Power Electronics- CM Pauddar

END

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Samrat Ashok Technological Institute (Engineering College), VIDISHA (M.P.)
(An Autonomous Institute Affiliated to RGPV, Bhopal)
Syllabus: B. Tech –For batch admitted in July 2018
Electronics And Communication Engineering

EC – 1874 (A) CMOS Circuit Design

Course Title	Course Code	Credits - 3		
CMOS Circuit Design	EC 1874 (A)	L	T	P
		3	-	-

COURSE OBJECTIVE	The objective of this course is to enable student to analyze CMOS based circuits and design larger circuits/systems using CMOS amplifier configurations as components.
PRE-REQUISITES	• Electronic Devices and Design • Digital Circuits and Design • Very Large Scale Integration
COURSE CONTENTS	Unit I: Introduction to Analog Design and Basic MOS Physics: General Concepts: Levels of Abstraction, Robust Analog Design. MOSFET Structure and its use as a Switching Device, MOS I/V Characteristics and Second Order Effects. MOS Capacitances & Small Signal Model. Unit II: CMOS Inverter and Logic Gate Design: CMOS Inverter, Voltage Transfer Characteristics, calculation of Voltage equations, Design of CMOS inverters. Transistor sizing, CMOS logic structure, DC analysis of Complementary Logic, BiCMOS logic, Pseudo NMOS, dynamic CMOS logic, Pass transistor, CMOS Domino Logic, NP domino logic, Cascode voltage switch logic, SourceFollowerPullUp logic (SFPL). Unit III: CMOS Amplifier Analysis and Design: Amplification, Analog Design Octagon.Single stage Amplifiers: Common Source Stage, Source Follower, Common Gate and CascodeStage.Differential Amplifiers: Single Ended and Differential Operations, Basic differential pair, qualitative and quantitative analysis, Common mode response, Differential pair with MOS loads, Gilbert Cell, Current Mirror. Unit IV: Frequency Response of Amplifiers & Operation Amplifier: Miller Effect, Association of Poles with Nodes, Common Source Stage, Source Follower, Common Gate and Cascode Stage, Differential Pair. Unit V: Operational Amplifier: General Considerations, One and Two Stage Amplifiers, Gain Boosting Techniques, Common Mode Feedback, Input Range Limitations, Slew Rate, Power Supply Rejection, Noise Analysis.
COURSE OUTCOMES:	**On successful completion of this course student should be able to:** **CO1:** Understand the physics behind MOS structures and models along with the basics of CMOS Analog Design Process, and implementation of various MOS based circuits-(BL1,BL2) **CO2:** Analyze different inverters, amplifier circuits based on their specifications, frequency response and performance parameters.-(BL3,BL4) **CO3:** Design and improve MOS based devices as desired, depending on their specifications, frequency response and performance parameters.-(BL3,BL6)

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TEXT BOOKS& REFERENCES:	• Design of Analog CMOS Integrated Circuits, BehadRazavi, McGraw-Hill Higher Education. • CMOS Digital Integrated Circuits Analysis and Design, Kang and Leblebici, McGraw-Hill Higher Education. • Microelectronic Circuits, 5th Edition, by Adel S. Sedra and Kenneth C. Smith, Oxford University press, 2004 • M.H Rashid, SPICE for Power Electronics and Electric Power, Englewood. Cliffs, N.J. Prentice Hall, 1993.
	END

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EC – 1874 (B) Smart Antenna

Course Title	Course Code	Credits - 3		
Smart Antenna	EC 1874 (B)	L	T	P
		3	-	-

COURSE OBJECTIVE	To gain an understanding and experience with smart antenna environments, algorithms and implementation.
PRE-REQUISITES	• Electromagnetic Theory • Antenna & Wave Propogation
COURSE CONTENTS	Array Antenna Fundamentals: Linear Arrays , Array Weighting, Beam steered Arrays , Circular Arrays ,Fixed Beam and Sectorized Arrays. Sidelobe Cancellors, Retrodirective Arrays. Smart Antennas, benefits of smart antennas, Adaptive Algorithm Basics, Gradient Based Methods, Howells Applebaum Processor, Adaptive Beam forming Elimination of the Effects of Mutual Coupling on Adaptive Antennas. Adaptive Arrays for CDMA , Waveform Diversity Methods, MIMO Examples Angle-of-Arrival Estimation, Array Correlation Matrix ,Bartlett AOA Estimation method ,Capon AOA Estimation method , Spectral Estimation Methods .Channel Characterization ,Channel Impulse Response, Slow Fading; Fast Fading; Fast Fading Modeling ,Spreading , Channel Equalization. Methods for Optimizing the Location of Base Stations for Indoor Wireless Communication, Identification and Elimination of Multipath Effects, Signal Enhancement in Multiuser Communication.
COURSE OUTCOMES:	**On successful completion of this course student should be able to:** **CO1:** Be acquainted with fundamentals and terminology of antenna array, and familiarize with working of smart arrays.-(BL1,BL2) **CO2:** Analyze the implementations for different communication technologies and standards, antennas and arrays.-(BL3,BL4) **CO3:** Design different antennas, antenna arrays, and use various estimation and optimization methods for improving the performance and communication systems.-(BL3,BL6)
TEXT BOOKS & REFERENCES:	• Smart Antennas for Wireless Communications By Frank Gross, McGraw hill • Smart Antennas, Tapan A. Sarkar ,M. C. Wicks, M. Salazar-Palma, R. J. Bonneau , Wiley • Introduction to Smart Antennas , Balanis, Constantine A. , Morgan & Claypool

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EC – 1874 (C) Broadband Communication

Course Title	Course Code	Credits - 3		
Broadband Communication	EC 1874 (C)	L	T	P
		3	-	-

COURSE OBJECTIVE	To expose the students to understand mobile radio communication principles and to study the recent trends adopted in cellular systems and wireless standards.
PRE-REQUISITES	• Electromagnetic Theory • Antenna & Wave Propagation
COURSE CONTENTS	Satellite Communication Systems Orbital aspects of satellite communication, Attitude and orbit control system, Telemetry tracking and command system (TTC), Power subsystems, Antennas, Reliability Satellite link design, System noise temperature, G/T ratio, Down link design, Uplink design, Link for specified (C/N) base-band noise signal. Digital Satellite Links, Frequencies and channel allocations, Modulation techniques, QPSK, QAM, BER analysis, medium access methods for satellite communication. Multicarrier communication systems: DMT, OFDM, MIMO systems, space-time coding, WiFi, WiMax, UWB systems
COURSE OUTCOMES:	**On successful completion of this course student should be able to:** **CO1:** Acquire knowledge orbital aspects of satellite communication and understand the parameters used to analyze the satellite network.-(BL1,BL2) **CO2:** Analyze satellite link systems and communication system.-(BL3,BL4) **CO3:** Design/Develop codes for modulation techniques for satellite link design and communication systems.-(BL3,BL6)
TEXT BOOKS& REFERENCES:	• Timothy Pratt, Charles Bostian, Jeremy Allnut ,"Satellite communication" John Willey and Sons Inc. Second edition • W. L. Pritchard, H.G. Suyderhoud, R.A. Nelson, "Satellite Communication Systems Engineering" Pearson Education Second edition • Wayne Tomasi "Advanced Electronic communications" PHI Learning, Fifth edition • Frank.R. Dungan," Electronic Communication Systems" International Thomson Publishing Company Third edition • J. Proakis, "Digital Communication" 4e, TMH 6. Simon Haykin, "Communication Systems", 4e, John Wiley

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EC – 1875(A) Digital Image Processing

Course Title	Course Code	Credits - 3		
		L	T	P
Digital Image Processing	EC 1875(A)	3	-	-

COURSE OBJECTIVE

The objective of this course is to provide fundamental knowledge of Image Processing Techniques.

PRE-REQUISITES

- Mathematics
- Signal & Systems
- Communication Systems

COURSE CONTENTS

Unit I: Digital Image Processing (DIP): Introduction, Examples of fields that use DIP, fundamental steps in DIP, components of an image processing system. Digital Image Fundamentals: elements of visual perception, image sensing and acquisition, Image Digitization Process, Image sampling and quantization, Matrix Representation, Basic relationships between pixels, Neighborhood, Distance Measures.

Unit-II: Image Transforms: Two-dimensional (2D) impulse and its shifting properties, 2D continuous Fourier Transform pair, 2D sampling and sampling theorem, 2D Discrete Fourier Transform (DFT), Aliasing, Lloyd max Quantizer, Properties of 2D DFT. Other transforms and their properties: Cosine transform, Sine transform, Walsh transform, Hadamard transform, Performance Comparison of 2D FT, DCT, WT etc.

Unit-III: Image Enhancement: Spatial domain methods: Image Enhancement using point processing techniques, basic intensity transformation functions, Negative Transformation, Contrast Stretching, Gray Level Slicing, Histogram based processing-Equalization-specification, Image Subtraction, Image Averaging, Mask Processing Techniques, Fundamentals of spatial filtering, smoothing spatial filters (linear and non-linear), sharpening spatial filters Frequency domain methods: basics of filtering in frequency domain, image smoothing filters (Butterworth and Gaussian low pass filters), image sharpening filters (Butterworth and Gaussian high pass filters)

Unit-IV: Image Restoration: Image degradation/restoration, Image Formation Process, noise models, restoration by spatial filtering, noise reduction by frequency domain filtering, linear position invariant degradations, estimation of degradation function, inverse filtering, Wiener filtering, Constrained Least Square Filter.

Unit-V: Image Compression: Fundamentals of data compression: basic compression methods: Huffman coding, Golomb coding, LZW coding, Run-Length coding, Symbol based coding. Transform coding – Wavelet coding – Basics of Image compression standards: JPEG, MPEG Digital Image Watermarking

COURSE OUTCOMES:

On successful completion of this course student should be able to:

CO1: Understand and describe the fundamentals of digital image processing, image digitization, enhancement restoration process.-(BL1,BL2)
CO2: Analyze the quality parameters of any digital image, and process it for enhancement.(BL3,BL4)
CO5: Design and implement various spatial and frequency domain methods for enhancement, restoration and compression of images.-(BL3,BL6)

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TEXT BOOKS & REFERENCES:	• Gonzalez and Woods: Digital Image Processing, Pearson Education. • Anil Jain: Fundamentals of Digital Image Processing, PHI Learning. • Annadurai: Fundamentals of Digital Image Processing, Pearson Education. • Sonka, Hlavac and Boyle: Digital Image Processing and Computer Vision, Cengage Learning. • Chanda and Majumder: Digital Image Processing and Analysis, PHI Learning. • Jayaraman, Esakkirajan and Veerakumar: Digital Image Processing, TMH. • William K. Pratt, Digital Image Processing, Wiley India. END

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