MAHATMA GANDHI INSTITUTE OF TECHNOLOGY (Autonomous)
M.Tech. in Digital Electronics and Communication Engineering
Scheme of Instruction and Examination
(Choice Based Credit System)

With effect from the academic year 2022-23

I Semester

S.No.	Course Code	Course Title	Instruction			Examination			Credits
			Hours Per Week			Max. Marks		Duration of SEE in Hours	
			L	T	P/D	CIE	SEE		
1	EC101PC	Advanced Digital System Design	3	0	0	40	60	3	3
2	EC102PC	Wireless Communications and Networks	3	0	0	40	60	3	3
3	EC11XPE	**Professional Elective – I**	3	0	0	40	60	3	3
4	EC11XPE	**Professional Elective – II**	3	0	0	40	60	3	3
5	EC101MC	Research Methodology & Intellectual Property Rights	2	0	0	40	60	3	2
6	AC10XHS	Audit Course – I	2	0	0	40	60	3	0
7	EC151PC	Digital System Design Lab	0	0	4	40	60	3	2
8	EC152PC	Wireless Communications and Networks Lab	0	0	4	40	60	3	2
Total Hours/Marks/Credits			**16**	**0**	**8**	**320**	**480**		**18**

II Semester

S.No.	Course Code	Course Title	Instruction			Examination			Credits
			Hours Per Week			Max. Marks		Duration of SEE in Hours	
			L	T	P/D	CIE	SEE		
1	EC201PC	Network Security and Cryptography	3	0	0	40	60	3	3
2	EC202PC	Advanced Communications and Networks	3	0	0	40	60	3	3
3	EC21XPE	**Professional Elective – III**	3	0	0	40	60	3	3
4	EC21XPE	**Professional Elective – IV**	3	0	0	40	60	3	3
5	AC20XHS	Audit Course – II	2	0	0	40	60	3	0
6	EC251PC	Network Security and Cryptography Lab	0	0	4	40	60	3	2
7	EC252PC	Advanced Communications and Networks Lab	0	0	4	40	60	3	2
8	EC253PC	Mini project with Seminar	0	0	4	100	-	-	2
Total Hours/Marks/Credits			**14**	**0**	**12**	**380**	**420**		**18**

L: Lecture **T**: Tutorial **D**: Drawing **P**: Practical **CIE** - Continuous Internal Evaluation **SEE** - Semester End Examination

MR-22 M.Tech. DECE **MGIT (Autonomous), Hyderabad**

III Semester

S.No.	Course Code	Course Title	Instruction Hours Per Week			Examination Max. Marks		Examination Duration of SEE in Hours	Credits
			L	T	P/D	CIE	SEE		
1	EC31XPE	**Professional Elective – V**	3	0	0	40	60	3	3
2	EC32XOE	**Open Elective**	3	0	0	40	60	3	3
3	EC351PC	Dissertation Work Review- I	0	0	12	50+50	-	-	6
Total Hours/Marks/Credits			**6**	**0**	**12**	**180**	**120**		**12**

IV Semester

S.No.	Course Code	Course Title	Instruction Hours Per Week			Examination Max. Marks		Examination Duration of SEE in Hours	Credits
			L	T	P	CIE	SEE		
1	EC451PC	Dissertation Work Review- II	0	0	12	50+ 50	--	-	6
2	EC452PC	Dissertation VIVA VOCE	0	0	28	--	100	-	14
Total Hours/Marks/Credits			**0**	**0**	**40**	**100**	**100**		**20**

L: Lecture **T**: Tutorial **D**: Drawing **P**: Practical **CIE** - Continuous Internal Evaluation **SEE** - Semester End Examination

Grand Total of Credits

Semester	I	II	III	IV	Total Credits
Credits	**18**	**18**	**12**	**20**	**68**

List of Professional Electives

Professional Elective – I
EC111PE: Design of Fault Tolerant Systems
EC112PE: VLSI Technology and Design
EC113PE: System on Chip Architecture

Professional Elective – II
EC114PE: Coding Theory and Techniques
EC115PE: Optical Communications and Networks
EC116PE: Wireless MIMO Communications

Professional Elective – III
EC211PE: Embedded System Design
EC212PE: Embedded Real Time Operating Systems
EC213PE: Embedded Networks

Professional Elective – IV
EC214PE: Cognitive Radio
EC215PE: Pattern Recognition and Machine Learning
EC216PE: Ad-hoc & Wireless Sensor Networks

Professional Elective-V
EC311PE: Voice and Data Networks
EC312PE: IoT and Its Applications
EC313PE: Deep Learning

Audit Courses

Audit Course-I
AC101HS**:** English for Research Paper Writing
AC102HS: Disaster Management
AC103HS: Sanskrit for Technical Knowledge
AC104HS: Value Education

Audit Course-II
AC201HS: Constitution of India
AC202HS: Pedagogy Studies
AC203HS: Stress Management by Yoga
AC204HS: Personality Development through Life Enlightenment Skills

List of Open Electives offered by Department of Electronics and Communication Engineering to other branches:

Open Elective
EC321OE: System on Chip Architecture
EC322OE: Cognitive Radio
EC323OE: IoT and Its Applications

L	T	P	C
3	0	0	3

M.Tech. in Digital Electronics and Communication Engineering
I Semester Syllabus
EC101PC: Advanced Digital System Design

Course Objectives

The objectives of this course are to make the student
- To study Processor Arithmetic Operations
- To study the Combinational circuits and Sequential circuits
- To study Subsystem Design using Functional Blocks such as ALU, 4-bit combinational multiplier, Barrel shifter etc.

Course Outcomes

At the end of this course, students will be able to
- Understand working of different Combinational circuits and Sequential circuits
- Understand the design (including Timing Analysis) of different logical blocks of varying complexities involving mostly combinational circuits
- Understand the design, (including Timing Analysis) of different logical blocks of different complexities involving mostly sequential circuits

Unit - I

Processor Arithmetic: Two's Complement Number System - Arithmetic Operations; Fixed point Number System; Floating Point Number system - IEEE 754 format, Basic binary codes.

Unit - II

Combinational circuits: CMOS logic design, Static and dynamic analysis of Combinational circuits, timing hazards. Functional blocks: Decoders, Encoders, Three-state devices, Multiplexers, Parity circuits, Comparators, Adders, Subtractors, Carry look-ahead adder – timing analysis, Combinational multiplier structures.

Unit - III

Sequential Logic: Latches and Flip-Flops, Sequential logic circuits - timing analysis (Set up and hold times), State machines - Mealy & Moore machines, Analysis, FSM design using D Flip-Flops, FSM optimization and partitioning; Synchronizers and metastability. FSM Design examples: Vending machine, Traffic light controller, Washing machine.

Unit - IV

Subsystem Design using Functional Blocks (1): Design (including Timing Analysis) of different logical blocks of varying complexities involving mostly combinational circuits:
- ALU
- 4-bit combinational multiplier
- Barrel shifter
- Simple fixed point to floating point encoder
- Dual Priority encoder
- Cascading comparators

Unit - V

Subsystem Design using Functional Blocks (2): Design, (including Timing Analysis) of different logical blocks of different complexities involving mostly sequential circuits:

- Pattern (sequence) detector
- Programmable Up-down counter
- Round robin arbiter with 3 requesters
- Process Controller
- FIFO

Suggested Readings:

1. John F. Wakerly, "Digital Design", Prentice Hall, 3rd Edition, 2002.

Reference Books:

1. Chartrand, "Advanced Digital Systems: Experiments & Concepts With CPLDs", Cengage Learning (2015).

*Note 1: VHDL and ABEL are not part of this course.

*Note 2: SSI & MSI ICs listed in data books are not part of this course.

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3	0	0	3

M.Tech. in Digital Electronics and Communication Engineering
I Semester Syllabus
EC102PC: Wireless Communications and Networks

Course Objectives

The objectives of this course are to make the student
- To study the Channel planning for Wireless Systems
- To study the Mobile Radio Propagation
- To study the Equalization and Diversity
- To study the Wireless Networks

Course Outcomes

At the end of this course, students will be able to
- Understand Cellular communication concepts
- Study the mobile radio propagation
- Study the wireless network different type of MAC protocols

Unit - I

The Cellular Concept-System Design Fundamentals: Introduction, Frequency Reuse, Channel Assignment Strategies, Handoff Strategies- Prioritizing Handoffs, Practical Handoff Considerations, Interference and system capacity – Co channel Interference and system capacity, Channel planning for Wireless Systems, Adjacent Channel interference, Power Control for Reducing interference, Trunking and Grade of Service, Improving Coverage & Capacity in Cellular Systems- Cell Splitting, Sectoring.

Unit - II

Mobile Radio Propagation: Large-Scale Path Loss: Introduction to Radio Wave Propagation, Free Space Propagation Model, Relating Power to Electric Field, The Three Basic Propagation Mechanisms, Reflection-Reflection from Dielectrics, Brewster Angle, Reflection from prefect conductors, Ground Reflection (Two-Ray) Model, Diffraction-Fresnel Zone Geometry, Knife-edge Diffraction Model, Multiple knife-edge Diffraction, Scattering, Outdoor Propagation Models- Longley- Ryce Model, Okumura Model, Hata Model, PCS Extension to Hata Model, Walfisch and Bertoni Model, Wideband PCS Microcell Model, Indoor Propagation Models-Partition losses (Same Floor), Partition losses between Floors, Log-distance path loss model, Ericsson Multiple Breakpoint Model, Attenuation Factor Model, Signal penetration into buildings, Ray Tracing and Site Specific Modeling.

Unit - III

Mobile Radio Propagation: Small –Scale Fading and Multipath: Small Scale Multipath propagation- Factors influencing small scale fading, Doppler shift, Impulse Response Model of a multipath channel- Relationship between Bandwidth and Received power, Small-Scale Multipath Measurements-Direct RF Pulse System, Spread Spectrum Sliding Correlator Channel Sounding, Frequency Domain Channels Sounding, Parameters of Mobile Multipath Channels-Time Dispersion Parameters, Coherence Bandwidth, Doppler Spread and Coherence Time, Types of Small-Scale Fading-Fading effects Due to Multipath Time Delay Spread, Flat fading, Frequency selective fading, Fading effects Due to Doppler Spread-Fast fading, slow fading, Statistical Models for multipath Fading Channels- Clarke's model for flat fading, spectral shape due to Doppler spread in Clarke's model, Simulation of Clarke and Gans Fading Model, Level crossing and fading statistics, Two-ray Rayleigh Fading Model.

Unit - IV

Equalization and Diversity: Introduction, Fundamentals of Equalization, Training A Generic Adaptive Equalizer, Equalizers in a communication Receiver, Linear Equalizers, Non-linear Equalization-Decision Feedback Equalization (DFE), Maximum Likelihood Sequence Estimation (MLSE) Equalizer, Algorithms for adaptive equalization-Zero Forcing Algorithm, Least Mean Square Algorithm, Recursive least squares algorithm. Diversity Techniques-Derivation of selection Diversity improvement, Derivation of Maximal Ratio Combining improvement, Practical Space Diversity Consideration-Selection Diversity, Feedback or Scanning Diversity, Maximal Ratio Combining, Equal Gain Combining, Polarization Diversity, Frequency Diversity, Time Diversity, RAKE Receiver.

Unit - V

Wireless Networks: Introduction to wireless Networks, Advantages and disadvantages of Wireless Local Area Networks, WLAN Topologies, WLAN Standard IEEE 802.11, IEEE 802.11 Medium Access Control, Comparison of IEEE 802.11 a,b,g and n standards, IEEE 802.16 and its enhancements, Wireless PANs, Hiper Lan, WLL.

Suggested Readings:

1. Theodore, S. Rappaport, Wireless Communications, Principles, Practice, PHI, 2nd Ed., 2002.
2. Andrea Goldsmith, Wireless Communications, Cambridge University Press, 2005.
3. Kaveh Pah Laven and P. Krishna Murthy, Principles of Wireless Networks, PE, 2002.
4. Gottapu Sasibhushana Rao, Mobile Cellular Communication, Pearson Education, 2012.

Reference Books:

1. Kamilo Feher, Wireless Digital Communications, 1999, PHI.
2. William Stallings, Wireless Communication and Networking, PHI, 2003.

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M.Tech. in Digital Electronics and Communication Engineering
I Semester Syllabus
Professional Elective – I
EC111PE: Design of Fault Tolerant Systems

Course Objectives

The objectives of this course are to make the student
- To provide broad understanding of fault diagnosis and tolerant design approach.
- To illustrate the framework of test pattern generation using semi and full automatic approach

Course Outcomes

- To acquire the knowledge of fundamental concepts in fault tolerant design.
- To acquire the knowledge of design requirements of self-check in circuits.
- To acquire the knowledge of test pattern generation using LFSR.
- To acquire the knowledge of design for testability rules and techniques for combinational circuits.
- To acquire the knowledge of scan architectures.
- To acquire the knowledge of design of built-in-self test.

Unit - I

Fault Tolerant Design: Basic concepts: Reliability concepts, Failures & faults, Reliability and Failure rate, Relation between reliability and mean time between failure, maintainability and availability, reliability of series, parallel and parallel-series combinational circuits. Fault Tolerant Design: Basic concepts-static, dynamic, hybrid, triple modular redundant system (TMR), 5MR reconfiguration techniques, Data redundancy, Time redundancy and software Redundancy concepts.

Unit - II

Self Checking circuits & Fail safe Design: Self-Checking Circuits: Basic concepts of self-checking circuits, Design of Totally self-checking checker, Checkers using m out of n codes, Berger code, Low cost residue code.
Fail Safe Design: Strongly fault secure circuits, fail safe design of sequential circuits using partition theory and Berger code, totally self-checking PLA design.

Unit - III

Design for Testability: Design for testability for combinational circuits: Basic concepts of Testability, Controllability and observability, The Reed Muller's expansion technique, use of control and syndrome testable designs.
Design for testability by means of scan: Making circuits Testable, Testability Insertion, Full scan DFT technique- Full scan insertion, flip-flop Structures, Full scan design and Test, Scan Architectures- full scan design, Shadow register DFT, Partial scan methods, multiple scan design, other scan designs.

Unit - IV

Logic Built-in-self-test: BIST Basics-Memory-based BIST,BIST effectiveness, BIST types, Designing a BIST, Test Pattern Generation-Engaging TPGs, exhaustive counters, ring counters, twisted ring counter, Linear feedback shift register, Output Response Analysis-Engaging ORA's, One's counter, transition counter, parity checking, Serial LFSRs, Parallel Signature analysis, BIST architectures-BIST related terminologies, A centralized and separate Board-level BIST architecture, Built-in evaluation and self-test (BEST), Random Test socket (RTS), LSSD On-chip self-test, Self – testing using MISR and SRSG, Concurrent BIST, BILBO, Enhancing

coverage, RT level BIST design- CUT design, simulation and synthesis, RTS BIST insertion, Configuring the RTS BIST, incorporating configurations in BIST, Design of STUMPS, RTS and STUMPS results.

Unit - V

Standard IEEE Test Access Methods: Boundary Scan Basics, Boundary scan architecture- Test access port, Boundary scan registers, TAP controller, the decoder Unit, select and other Units, Boundary scan Test Instructions-Mandatory instructions, Board level scan chain structure-One serial scan chain, multiple-scan chain with one control test port, multiple-scan chains with one TDI,TDO but multiple TMS, Multiple-scan chain, multiple access port, RT Level boundary scan-inserting boundary scan test hardware for CUT, Two module test case, virtual boundary scan tester, Boundary Scan Description language.

Suggested Readings:

1. Parag K. Lala, "Fault Tolerant & Fault Testable Hardware Design", PHI, 1984.
2. Zainalabedin Navabi, "Digital System Test and Testable Design using HDL models and Architectures", Springer International Edition.

Reference Books:

1. Miron Abramovici, Melvin A. Breuer and Arthur D. Friedman, "Digital Systems Testing and Testable
2. Design", Jaico Books
3. Bushnell & Vishwani D. Agarwal, "Essentials of Electronic Testing", Springer.
4. Alfred L. Crouch, "Design for Test for Digital IC's and Embedded Core Systems", Pearson Education, 2008.

L	T	P	C
3	0	0	3

M.Tech. in Digital Electronics and Communication Engineering
I Semester Syllabus
Professional Elective – I
EC112PE: VLSI Technology and Design

Course Objectives

Students from other engineering background to get familiarize with large scale integration technology.

- To expose fabrication methods, layout and design rules.
- Learn methods to improve Digital VLSI system's performance.
- To know about VLSI Design constraints.
- Visualize CMOS Digital Chip Design..

Course Outcomes

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

- Review of FET fundamentals for VLSI design.
- To acquires knowledge about stick diagrams and layouts.
- Enable to design the subsystems based on VLSI concepts.

Unit - I

Review of Microelectronics and Introduction to MOS Technologies: MOS, CMOS, Bi-CMOS Technology. Basic Electrical Properties of MOS, CMOS & Bi-CMOS Circuits: Ids – V_{ds} relationships, Threshold Voltage V_T, G_m, G_{ds} and ω_o, Pass Transistor, MOS, CMOS & Bi-CMOS Inverters, Z_{pu}/Z_{pd}, MOS Transistor circuit model, Latch-up in CMOS circuits.

Unit - II

Layout Design and Tools: Transistor structures, Wires and Vias, Scalable Design rules, Layout Design tools.
Logic Gates & Layouts: Static Complementary Gates, Switch Logic, Alternative Gate circuits, Low power gates, Resistive and Inductive interconnect delays.

Unit - III

Combinational Logic Networks: Layouts, Simulation, Network delay, Interconnect design, Power optimization, Switch logic networks, Gate and Network testing.

Unit IV

Sequential Systems: Memory cells and Arrays, Clocking disciplines, Design, Power optimization, Design validation and testing.

Unit - V

Floor Planning: Floor planning methods, Global Interconnect, Floor Plan Design, Off-chip connections.

Suggested Readings:

1. Essentials of VLSI Circuits and Systems, K. Eshraghian Eshraghian. D, A. Pucknell, 2005, PHI.
2. Modern VLSI Design – Wayne Wolf, 3rd Ed., 1997, Pearson Education.

Reference Books:

1. Introduction to VLSI Systems: A Logic, Circuit and System Perspective – Ming-BO Lin, CRC Press, 2011.
2. Principals of CMOS VLSI Design – N.H. E Weste, K. Eshraghian, 2nd Ed., Addison Wesley.

L	T	P	C
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M.Tech. in Digital Electronics and Communication Engineering
I Semester Syllabus
Professional Elective – I
EC113PE: System on Chip Architecture

Course Objectives

The objectives of this course are to make the student
- To design, optimize, and program a modern System-on-a-Chip.
- To (i) analyze a computational task, (ii) characterize its computational requirements, (iii) identify performance bottlenecks, (iv) identify, explore, and evaluate a rich design space of solutions, and (v) select and implement a design that meets engineering requirements.

Course Outcomes

By the end of the course, the students will be able to:
- Decompose the task into parallel components that cooperate to solve the problem.
- Characterize and develop real-time solutions.
- Implement both hardware and software solutions, formulate hardware/software tradeoffs, and perform hardware/software code sign.
- Understand the system on a chip from gates to application software, including on-chip memories and communication networks, I/O interfacing, RTL design of accelerators, processors, firmware and OS/infrastructure software.
- Understand and estimate key design metrics and requirements including area, latency, throughput, energy, power, predictability, and reliability.

Unit - I

Introduction to the System Approach: System Architecture, Components of the system, Hardware & Software, Processor architectures, Memory and Addressing. System level interconnection, An approach for SOC Design, System Architecture and Complexity.

Unit - II

Processors: Introduction, Processor Selection for SOC, Basic concepts in Processor Architecture, Basic concepts in Processor Micro Architecture, Basic elements in Instruction handling. Buffers: minimizing Pipeline Delays, Branches, More Robust Processors, Vector Processors and Vector Instructions extensions, VLIW Processors, Superscalar Processors.

Unit - III

Memory Design for SOC: Overview of SOC external memory, Internal Memory, Size, Scratchpads and Cache memory, Cache Organization, Cache data, Write Policies, Strategies for line replacement at miss time, Types of Cache, Split – I, and D – Caches, Multilevel Caches, Virtual to real translation, SOC Memory System, Models of Simple Processor – memory interaction.

Unit - IV

Interconnect Customization and Configuration: Inter Connect Architectures, Bus: Basic Architectures, SOC Standard Buses, Analytic Bus Models, Using the Bus model, Effects of Bus transactions and contention time. SOC Customization: An overview, Customizing Instruction Processor, Reconfiguration Technologies, Mapping design onto Reconfigurable devices, Instance- Specific design, Customizable Soft Processor, Reconfiguration - overhead analysis and trade-off analysis on reconfigurable Parallelism.

Unit - V

Application Studies / Case Studies: SOC Design approach, AES algorithms, Design and evaluation, Image compression – JPEG compression.

Suggested Readings:

1. Michael J. Flynn and Wayne Luk, Computer System Design System-on-Chip, Wiely India Pvt. Ltd.
2. Steve Furber, ARM System on Chip Architecture, Addison Wesley Professional. 2nd Ed., 2000

Reference Books:

1. Ricardo Reis, Design of System on a Chip: Devices and Components, 1st Ed.,Springer, 2004.
2. Jason Andrews, Co-Verification of Hardware and Software for ARM System on Chip Design (Embedded Technology), Newnes, BK and CDROM
3. Prakash Rashinkar, Peter Paterson and Leena Singh . L, System on Chip Verification Methodologies and Techniques, Kluwer Academic Publishers, 2001.

L	T	P	C
3	0	0	3

M.Tech. in Digital Electronics and Communication Engineering
I Semester Syllabus
Professional Elective – II
EC114PE: Coding Theory and Techniques

Course Objectives

The objectives of this course are to make the student
- To acquire the knowledge in measurement of information and errors.
- To study the generation of various code methods.
- To study the various application of codes

Course Outcomes

On completion of this course student will be able to
- Learning the measurement of information and errors.
- Obtain knowledge in designing Linear Block Codes and Cyclic codes.
- Construct tree and trellies diagrams for convolution codes
- Design the Turbo codes and Space time codes and also their applications

Unit - I

Coding for Reliable Digital Transmission and storage: Mathematical model of Information, A Logarithmic Measure of Information, Average and Mutual Information and Entropy, Types of Errors, Error Control Strategies.
Linear Block Codes Introduction to Linear Block Codes, Syndrome and Error Detection, Minimum Distance of a Block code, Error-Detecting and Error-correcting Capabilities of a Block code, Standard array and Syndrome Decoding, Probability of an undetected error for Linear Codes over a BSC, Hamming Codes. Applications of Block codes for Error control in data storage system

Unit - II

Cyclic Codes: Description, Generator and Parity-check Matrices, Encoding, Syndrome Computation and Error Detection, Decoding, Cyclic Hamming Codes, Shortened cyclic codes, Error-trapping decoding for cyclic codes, Majority logic decoding for cyclic codes.

Unit - III

Convolutional Codes: Encoding of Convolutional Codes, Structural and Distance Properties, maximum likelihood decoding, Sequential decoding, Majority- logic decoding of Convolution codes. Application of Viterbi Decoding and Sequential Decoding, Applications of Convolutional codes in ARQ system.

Unit - I V

Turbo Codes: LDPC Codes- Codes based on sparse graphs, Decoding for binary erasure channel, Log-likelihood algebra, Brief propagation, Product codes, Iterative decoding of product codes, Concatenated convolutional codes- Parallel concatenation, The UMTS Turbo code, Serial concatenation, Parallel concatenation, Turbo decoding

Unit - V

Space-Time Codes: Introduction, Digital modulation schemes, Diversity, Orthogonal space- Time Block codes, Alamouti's schemes, Extension to more than Two Transmit Antennas, Simulation Results, Spatial Multiplexing: General Concept, Iterative APP Preprocessing and Per-layer Decoding, Linear Multilayer Detection, Original BLAST Detection, QL Decomposition and Interface Cancellation, Performance of Multi – Layer Detection Schemes, Unified Description by Linear Dispersion Codes.

Suggested Readings:

1. Error Control Coding- Fundamentals and Applications –Shu Lin, Daniel J. Costello, Jr, Prentice Hall, Inc.
2. Error Correcting Coding Theory-Man Young Rhee, McGraw-Hill, 1989.

Reference Books:

1. Bernard Sklar, Digital Communications-Fundamental and Application, PE.
2. Proakis John .G, Digital Communications, 5th ed. TMH, 2008.
3. Todd K. Moon, Error Correction Coding – Mathematical Methods and Algorithms, Wiley India, 2006.
4. Ranjan Bose, Information Theory, Coding and Cryptography, 2nd Edition, TMH, 2009.

L	T	P	C
3	0	0	3

M.Tech. in Digital Electronics and Communication Engineering
I Semester Syllabus
Professional Elective – II
EC115PE: Optical Communications and Networks

Course Objectives

The objectives of this course are to make the student
- To learn the basic elements of optical fiber transmission link, fiber modes configurations and structures.
- To understand working of the various optical sources and detectors.
- Familiarize students with digital analog links for optical communications.
- To learn link budget, WDM, solutions and SONET/SDH network.
- To understand how to measure and monitor the optical power in the field.

Course Outcomes

At the end of this course, students will be able to
- Recognize and classify the structure of optical fibers, types and optical sources.
- Understanding the operation of optical detectors and also explore the knowledge in WDM.
- Underline how these analog and digital links play key roles in optical design.
- Review the current optical networking components.
- Apply appropriate techniques for performance measurement and monitoring of optical systems.

Unit - I

Optical Fibers: Structures, wave guiding and Fabrication - Nature of Light, Basic optical laws and definitions, Single mode fibers, Graded index fiber structure, Attenuation, Signal Dispersion in fibers. **Optical Sources**- LEDs, Laser Diodes, Line Coding.

Unit - II

Optical components: Photo detectors-Photo detector Noise, Detector Response Time, Avalanche Multiplication, Noise.
Optical Receiver Operation: Fundamental receiver operation, Digital receiver performance, Eye diagrams.
WDM Concepts and Components: Passive optical Couplers, Isolators and Circulators

Unit - III

Optical Links: Digital Links: Point to point links, power penalties, error control, Coherent detection, Differential Quadrature Phase Shift Keying.
Analog Links: Carrier to noise ration, Multichannel Transmission Techniques, RF over Fiber, Radio over fiber links, Microwave Photonics.

Unit- IV

Optical Networks: Network Concepts, Network Topologies, SONET/SDH, High speed light wave links, Optical add/ Drop Multiplexing, Optical Switching, WDM Network, Passive Optical Networks, IP Over DWDM, Optical Ethernet, Mitigation of Transmission Impairments

Unit- V

Performance Measurement and Monitoring: Measurement standards, Basic Test Equipment, Optical power measurement, Optical fiber characterization, Eye diagram tests, optical time domain reflectometer, optical performance monitoring, optical fiber system performance measurements.

Suggested Readings:

1. Gerd Keiser, Optical Fiber Communications, Mc Graw Hill, 5th Edition.
2. Rajeev Ramaswamy and Kumar N Sivarajan, Optical Networks: A Practical Perspective, Elsevier Morgan Kaufmann Publishers (An imprint of Elsevier), 2nd Ed., 2004.

Reference Books:

1. John. M. Senior, "Optical Fiber Communications: Principles and Practice", PE, 2nd Ed, 2000.
2. Harold Kolimbris, Fiber Optic Communication, PEI, 2nd Ed, 2004.
3. Uyless Black, Optical Networks: Third Generation Transport Systems, PEI, 2nd Ed, 2009.
4. Govind Agarwal, Optical Fiber Communications, TMH, 2nd Ed, 2004.
5. S. C. Gupta, Optical Fiber Communications and its Applications, PHI, 2004.

L	T	P	C
3	0	0	3

M.Tech. in Digital Electronics and Communication Engineering
I Semester Syllabus
Professional Elective – II
EC116PE: Wireless MIMO Communications

Course Objectives

The objectives of this course are to
- Provide comprehensive coverage of coding techniques for MIMO communication systems
- Provide understanding of the fundamental issues pertaining to MIMO systems

Course Outcomes

At the end of this course, students will be able to
- Understand basic MIMO communication algorithms
- Understand space-time block codes, space-time trellis codes
- Understand unitary and differential signaling and spatial multiplexing schemes

Unit - I

Fading Channels and Diversity Techniques: Wireless channels – Error/Outage probability over fading channels – Diversity techniques – Channel coding as a means of time diversity – Multiple antennas in wireless communications.

Unit - II

Capacity and Information Rates of MIMO Channels: Capacity and Information rates of noisy, AWGN and fading channels – Capacity of MIMO channels – Capacity of non-coherent MIMO channels – Constrained signaling for MIMO communications.

Unit - III

Space-Time Block and Trellis Codes: Transmit diversity with two antennas: The Alamouti scheme – Orthogonal. and Quasi-orthogonal space-time block codes – Linear dispersion codes – Generic space-time trellis codes – Basic space-time code design principles – Representation of space-time trellis codes for PSK constellation – Performance analysis for space-time trellis codes – Comparison of space-time block and trellis codes.

Unit - IV

Concatenated Codes and Iterative Decoding: Development of concatenated codes – Concatenated codes for AWGN and MIMO channels – Turbo coded modulation for MIMO channels – Concatenated space-time block coding.

Unit - V

Space-Time Coding for Frequency Selective Fading Channels: MIMO frequency-selective channels – Capacity and Information rates of MIMO FS fading channels – Space-time coding and Channel detection for MIMO FS channels – MIMO OFDM systems.

Suggested Readings:

1. Tolga M. Duman and Ali Ghrayeb, Coding for MIMO Communication systems, John Wiley & Sons, West Sussex, England, 2007.
2. Gershman A.B and Sidiropoulus N.D, Space-time processing for MIMO Communications, Wiley, Hoboken, NJ, USA, 2005.

Reference Books:

1. Larsson E.G. and Stoica .P, Space-time block coding for Wireless communications, Cambridge University Press, 2003.
2. Janakiraman. M, Space-time codes and MIMO systems, Artech House, 2004.
3. Jafarkhani .H, *"*Space-time coding: Theory & Practice*"*, Cambridge University Press, 2005.

L	T	P	C
2	0	0	2

M.Tech. in Digital Electronics and Communication Engineering
I Semester Syllabus
EC101MC: Research Methodology & Intellectual Property Rights

Course Objectives

The objectives of this course are to make the student

- To understand the research problem
- To know the literature studies, plagiarism and ethics
- To get the knowledge about technical writing
- To analyze the nature of intellectual property rights and new developments
- To know the patent rights

Course Outcomes

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

- Understand research problem formulation.
- Analyze research related information
- Follow research ethics
- Understand that today's world is controlled by Computer, Information Technology, but tomorrow world will be ruled by ideas, concept, and creativity.
- Understanding that when IPR would take such important place in growth of individuals & nation, it is needless to emphasis the need of information about Intellectual Property Right to be promoted among students in general & engineering in particular.
- Understand that IPR protection provides an incentive to inventors for further research work and investment in R & D, which leads to creation of new and better products, and in turn brings about, economic growth and social benefits.

Unit - I

Meaning of research problem, Sources of research problem, Criteria Characteristics of a good research problem, Errors in selecting a research problem, Scope and objectives of research problem. Approaches of investigation of solutions for research problem, data collection, analysis, interpretation, Necessary instrumentations

Unit - II

Effective literature studies approaches, analysis, Plagiarism, Research ethics

Unit - III

Effective technical writing, how to write report, Paper Developing a Research Proposal, Format of research proposal, a presentation and assessment by a review committee

Unit - IV

Nature of Intellectual Property: Patents, Designs, Trade and Copyright. Process of Patenting and Development: technological research, innovation, patenting, development. International Scenario: International cooperation on Intellectual Property, Procedure for grants of patents, Patenting under PCT.

Unit - V

Patent Rights: Scope of Patent Rights, Licensing and transfer of technology, Patent information and databases, Geographical Indications, New Developments in IPR: Administration of Patent System, New developments in IPR; IPR of Biological Systems, Computer Software etc. Traditional knowledge Case Studies, IPR and IITs.

Suggested Readings:

1. Stuart Melville and Wayne Goddard, "Research methodology: An Introduction for Science & Engineering Students".
2. Wayne Goddard and Stuart Melville, "Research Methodology: An Introduction".

Reference Books:

1. Ranjit Kumar, "Research Methodology: A Step by Step Guide for beginners", 2nd Edition,
2. Halbert, "Resisting Intellectual Property", Taylor & Francis Ltd, 2007.
3. Mayall, "Industrial Design", McGraw Hill, 1992.
4. Niebel, "Product Design", McGraw Hill, 1974.
5. Asimov, "Introduction to Design", Prentice Hall, 1962.
6. Robert P. Merges, Peter S. Menell, Mark A. Lemley, "Intellectual Property in New Technological Age", 2016.
7. Ramappa .T, "Intellectual Property Rights Under WTO", S. Chand, 2008.

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M.Tech. in Digital Electronics and Communication Engineering
I Semester Syllabus
Audit Course- I
AC101HS: English for Research Paper Writing

Course Objectives

Students will be able to:

- Improve their writing skills and level of readability
- Learn about structure and organization of sections and sub sections
- Develop requisite skills to write the title
- Enhance effective writing skills to publish research papers

Unit-I

Planning and Preparation, Word Order, Breaking up long sentences, Structuring Paragraphs and Sentences, Being Concise and Removing Redundancy, Avoiding Ambiguity and Vagueness

Unit-II

Clarifying, Highlighting Findings, Hedging and Criticizing, Paraphrasing and Plagiarism, Sections of a Paper, Abstract, Introduction

Unit-III

Review of the Literature, Methods, Results, Discussion, Conclusions, the Final Check

Unit-IV

Key Skills for: Writing a title, Writing an abstract, Writing an Introduction, Writing a review of the literature

Unit-V

Key skills for: Writing methods, Writing the results, Writing the discussion, Writing the conclusions.
Useful phrases and mechanics of effective writing to publish research papers.

Suggested Readings:

1. Adrian Wallwork, English for Writing Research Papers, Springer New York Dordrecht Heidelberg London, 2011.

Reference Books:

1. Goldbort R (2006) Writing for Science, Yale University Press(available on Google Books)
2. Day R (2006) How to Write and Publish a Scientific Paper, Cambridge University Press
3. Highman N (1998), Handbook of Writing for the Mathematical Sciences, SIAM. Highman's book.

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M.Tech. in Digital Electronics and Communication Engineering
II Semester Syllabus
Audit Course – I
AC102HS: Disaster Management

Course Objectives

- Learn to demonstrate a critical understanding of key concepts in disaster risk reduction and humanitarian response.
- Critically evaluate disaster risk reduction and humanitarian response policy and practice from multiple perspectives.
- Develop an understanding of standards of humanitarian response and practical relevance in specific types of disasters and conflict situations.
- Critically understand the strengths and weaknesses of disaster management approaches, planning and programming in different countries, particularly their home country or the countries they work in
- Provide knowledge about different disasters tools to handle disasters, methods for disaster management

Course Outcomes

- Understanding disasters, manmade hazards & vulnerabilities
- Understanding disaster management mechanism
- Understanding capacity building
- Understanding concepts
- Understanding planning of disaster management

Unit-I: Introduction & Disaster Prone Areas in India

Disaster: Definition, Factors and Significance; Difference between Hazard and Disaster; Natural and Manmade Disasters: Difference, Nature, Types and Magnitude. Study of Seismic Zones; Areas prone to Floods and Droughts, Landslides and Avalanches; Areas prone to Cyclonic and Coastal Hazards with special reference to Tsunami; Post-Disaster Diseases and Epidemics

Unit-II: Repercussions of Disasters and Hazards

Natural Disasters: Earthquakes, Volcanisms, Cyclones, Tsunamis, Floods, Droughts and Famines, Landslides and Avalanches, Man-made disaster: Nuclear Reactor Meltdown, Industrial Accidents, Oil Slicks and Spills, Outbreaks of Disease and Epidemics, War and Conflicts.

Unit-III: Disaster Preparedness and Management

Preparedness: Monitoring of Phenomena triggering a Disaster or Hazard; Evaluation of Risk: Application of Remote Sensing, Data from Meteorological and other Agencies, Media Reports: Governmental and Community preparedness.

Unit-IV: Risk Assessment

Disaster Risk- Concept and Elements, Disaster Risk Reduction, Global and National Disaster Risk Situation. Techniques of Risk Assessment, Global Co-Operation in Risk Assessment: Risk Assessment and Warning, People's Participation in Risk Assessment. Strategies for Survival.

Unit-V: Disaster Mitigation

Meaning, Concept and Strategies of Disaster Mitigation, Emerging Trends in Mitigation. Structural Mitigation and Non-Structural Mitigation, Programs of Disaster Mitigation in India.

Suggested Readings:

1. Nishith R., Singh A K, "Disaster Management in India: Perspectives, issues and strategies "'New Royal book Company.
2. Sahni, Pardeep et. al.," Disaster Mitigation Experiences and Reflections", Prentice Hall of India, New Delhi.
3. Manual on Disaster Management, National Disaster Management, Agency Govt of India.

Reference Books:

1. Goel S.L., Disaster Administration and Management Text and Case Studies", Deep Publication Pvt. Ltd., New Delhi.
2. Pandharinath N., Rajan CK, Earth and Atmospheric Disasters Management BS Publications 2009.
3. National Disaster Management Plan, Ministry of Home affairs, Government of India (http://www.ndma.gov.in/images/policyplan/dmplan/draftndmp.pdf).

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M.Tech. in Computer Aided Structural Engineering
I Semester Syllabus
Audit Course - I
AC103HS: Sanskrit for Technical Knowledge

Course Objectives

- To get a working knowledge in illustrious Sanskrit, the scientific language in the world
- Learning of Sanskrit to improve brain functioning
- Learning of Sanskrit to develop the logic in mathematics, science & other subjects enhancing the memory power
- The engineering scholars equipped with Sanskrit will be able to explore the huge knowledge from ancient literature

Course Outcomes

- Understanding basic Sanskrit language
- Ancient Sanskrit literature about science & technology can be understood
- Being a logical language will help to develop logic in students

Unit-I
Alphabets in Sanskrit
Unit-II
Past / Present / Future Tense, Simple Sentences

Unit-III
Order, Introduction of roots

Unit-IV
Technical information about Sanskrit Literature

Unit-V
Technical Concepts of Engineering - Electrical, Mechanical, Architecture, Mathematics

Suggested Readings:
1. Prathama Deeksha-Vempati Kutumbshastri "Teach Yourself Sanskrit", Rashtriya Sanskrit Sansthanam, New Delhi Publication

Reference Books:
1. Dr. Vishwas, Samskrita "Abhyaspustakam" -Bharti Publication, New Delhi
2. Suresh Soni "India's Glorious Scientific Tradition", Ocean books (P) Ltd., New Delhi.

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M.Tech. in Digital Electronics and Communication Engineering
II Semester Syllabus
Audit Course – I
AC104HS: Value Education

Course Objectives

- Understand value of education and self-development
- Imbibe good values in students
- Let the should know about the importance of character

Course Outcomes

- Knowledge of self-development
- Learn the importance of Human values
- Developing the overall personality

Unit-I
Values and self-development –Social values and individual attitudes. Work ethics, Indian vision of humanism. Moral and non-moral valuation. Standards and principles. Value judgements

Unit-II
Importance of cultivation of values. Sense of duty. Devotion, Self-reliance. Confidence, Concentration. Truthfulness, Cleanliness. Honesty, Humanity. Power of faith, National Unity. Patriotism. Love for nature, Discipline.

Unit-III
Personality and Behavior Development -Soul and Scientific attitude. Positive Thinking. Integrity and discipline, Punctuality, Love and Kindness.

Unit-IV
Avoid fault Thinking. Free from anger, Dignity of labour. Universal brotherhood and religious tolerance. True friendship. Happiness Vs suffering, love for truth. Aware of self-destructive habits. Association and Cooperation. Doing best for saving nature.

Unit-V
Character and Competence –Holy books vs Blind faith. Self-management and Good health. Science of reincarnation, Equality, Nonviolence, Humility, Role of Women. All religions and same message. Mind your Mind, Self-control. Honesty, Studying effectively.

Suggested Readings:

1. Chakroborty, S.K. “Values and Ethics for organizations Theory and practice”, Oxford University Press, New Delhi.

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M.Tech. in Digital Electronics and Communication Engineering
I Semester Syllabus
EC151PC: Digital System Design Lab

Course Objectives

The objectives of this course are to make the student
- To learn the HDL programming language.
- To learn the simulation of basic gates using the basic programming language.
- To learn the simulation of combinational circuits using programming language.
- To learn the simulation of sequential circuits using programming language.
- To learn the synthesis and layouts of analog and digital CMOS circuits.
- To develop an ability to simulate and synthesize various digital circuits.

Course Outcomes

At the end of the course a student will be able to
- Design of Digital VLSI Circuits, stick diagram of circuits
- Understand the design Rules of VLSI circuits
- Understand and simulate speed and power Considerations, Floor Planning and Layout techniques
- Be able to complete a significant VLSI design project having a set of objective criteria and design constraints.

Part - I

Programming can be done using any complier. Down load the programs on FPGA/CPLD boards and performance testing may be done using pattern generator (32 channels) and logic analyzer apart from verification by simulation with any of the front-end tools.

1. HDL code to realize all the logic gates
2. Design and Simulation of adder, Serial Binary Adder, Multi Precession Adder, Carry
3. Look Ahead Adder.
4. Design of 2-to-4 decoder
5. Design of 8-to-3 encoder (without and with parity)
6. Design of 8-to-1 multiplexer
7. Design of 4 bit binary to gray converter
8. Design of Multiplexer/ De-multiplexer, comparator
9. Design of Full adder using 3 modeling styles
10. Design of flip flops: SR, D, JK, T
11. Design of 4-bit binary, BCD counters (synchronous/ asynchronous reset) or any sequence counter
12. Design of a N- bit Register of Serial- in Serial –out, Serial in parallel out, Parallel in Serial out and
13. Parallel in Parallel Out.
14. Design of Sequence Detector (Finite State Machine- Mealy and Moore Machines).
15. Design of 4- Bit Multiplier, Divider.
16. Design of ALU to Perform – ADD, SUB, AND-OR, 1's and 2's Compliment, Multiplication, and
17. Division.
18. Design of Finite State Machine.
19. Implementing the above designs on Xilinx/Altera/Cypress/equivalent based FPGA/CPLD kits.

Part - II

1. Static and Dynamic Characteristics of CMOS Inverter
2. Implementation of EX-OR gate using complementary CMOS, Psedo-NMOS, Dynamic and domino logic style
3. Implementation of Full Adder using Transmission Gates

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M.Tech. in Digital Electronics and Communication Engineering
I Semester Syllabus
EC152PC: Wireless Communications and Networks Lab

Course Objectives

This course aims to develop

- Understanding on functioning of wireless communication system and evolution of different wireless communication systems and standards.
- An ability to compare recent technologies used for wireless communication.
- An ability to explain the architecture, functioning, protocols, capabilities and application of various wireless communication networks.
- An ability to explain multiple access techniques for Wireless Communication
- An ability to evaluate design challenges, constraints and security issues associated with Ad-hoc wireless networks.

Course Outcomes

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

- Implement the advanced digital modulation techniques.
- Design Convolutional encoder and decoder for error control coding techniques.
- Calculate path loss for Free space, Okumura and Hata models for outdoor propagation.
- Comprehend Cellular concepts of GSM and CDMA networks.
- Simulate RAKE receiver for CDMA with MATLAB.

List of Experiments:

1. FSK Modulation and Demodulation technique.
2. QPSK Modulation and Demodulation technique.
3. DQPSK Modulation and Demodulation technique
4. 8-QAM Modulation and Demodulation technique.
5. Implementation of Convolutional Encoder and Decoder.
6. imulation of the following Outdoor Path loss propagation models using MATLAB.

   a. Free Space Propagation model b. Okumura model c. Hata model
7. Simulation of Adaptive Linear Equalizer using MATLAB software.
8. Measurement of call blocking probability for GSM &CDMA networks using Netsim software.
9. Study of GSM handset for various signaling and fault insertion techniques (Major GSM handset sections: clock, SIM card, charging, LCD module, Keyboard, User interface).
10. Study of transmitter and receiver section in mobile handset and measure frequency band signal and GMSK modulating signal.
11. Simulation of RAKE Receiver for CDMA communication using MATLAB software.
12. Simulate and test various types of PN codes, chip rate, spreading factor and processing gain on performance of DSSS in CDMA.
13. Simulate and test the 3G Network system features using GSM AT Commands. (Features of 3G Communication system: Transmission of voice, video calls, SMS, MMS, TCP/IP, HTTP, GPS)
14. Modeling of communication system using Simulink.

Note: Experiments 1 to 5 need to be simulated using MATLAB and tested on hardware**.**

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M.Tech. in Digital Electronics and Communication Engineering
II Semester Syllabus
EC201PC: Network Security and Cryptography

Course Objectives

Students undergoing this course are expected to
- Learn fundamentals of cryptography and its application to network security.
- Understand network security threats, security services, and countermeasures.
- Acquire background on well known network security protocols such as IPSec, SSL, and WEP.
- Understand vulnerability analysis of network security.
- Acquire background on hash functions; authentication; firewalls; intrusion detection techniques.

Course Outcomes

- Understand various Cryptographic Techniques
- Apply various public key cryptography techniques
- Implement Hashing and Digital Signature techniques
- Understand the various Security Applications
- Implement system level security applications

Unit - I

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

Unit - II

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

Unit - III

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

Unit - IV

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

Unit - V

Authentication and System Security: IP and Web Security Digital Signatures, Digital Signature Standards, Authentication Protocols, Kerberos, IP security Architecture, Encapsulating Security Payload, Key Management, Web Security Considerations, Secure Socket Layer, Secure Electronic Transaction Intruders, Intrusion Detection, Password Management, Worms, viruses, Trojans, Virus Countermeasures, Firewalls, Trusted Systems.

Suggested Readings:

1. William Stallings, "Cryptography and Network Security, Principles and Practices", Pearson Education, 3rd Edition.
2. Charlie Kaufman, Radia Perlman and Mike Speciner, "Network Security, Private Communication in a Public World", Prentice Hall, 2nd Edition.

Reference Books:

1. Christopher M. King, Ertem Osmanoglu, Curtis Dalton, "Security Architecture, Design Deployment and Operations", RSA Pres,
2. Stephen Northcutt, Leny Zeltser, Scott Winters, Karen Kent, and Ronald W. Ritchey, "Inside Network Perimeter Security", Pearson Education, 2nd Edition.
3. Richard Bejtlich, "The Practice of Network Security Monitoring: Understanding Incident Detection and Response", William Pollock Publisher, 2013.

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M.Tech. in Digital Electronics and Communication Engineering
II Semester Syllabus
EC202PC: Advanced Communications and Networks

Course Objectives

The objectives of this course are to make the student

- To acquire the knowledge in Orthogonal Frequency Division Multiplexing and Spread Spectrum Communications.
- To study the MIMO Systems.
- To study the various Wireless LANs and PANs.

Course Outcomes

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

- Understand the concepts of Orthogonal Frequency Division Multiplexing and Spread Spectrum Communications.
- Understand the concepts MIMO Systems
- Acquire the knowledge of different Wireless LANs and PANs

Unit - I

Spread Spectrum Communications: Spreading sequences- Properties of Spreading Sequences, Pseudo- noise sequence, Gold sequences, Kasami sequences, Walsh Sequences, Orthogonal Variable Spreading Factor Sequences, Barker Sequence, Complementary Codes Direct sequence spread spectrum: DS-CDMA Model, Conventional receiver, Rake Receiver, Synchronization in CDMA, Power Control, Soft handoff, Multiuser detection – Optimum multiuser detector, Liner multiuser detection.

Unit - II

Orthogonal Frequency Division Multiplexing: 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, Window in OFDM Signal and Spectrum, Synchronization in OFDM, Pilot Insert in OFDM Transmission and Channel Estimation, Amplitude Limitations in OFDM, FFT Point Selection Constraints in OFDM, CDMA vs OFDM, Hybrid OFDM.

Unit - III

MIMO Systems: Introduction, Space Diversity and 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, MIMO-OFDM

Unit - IV

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 - V

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

Broad Band Wireless MANs/IEEE 802.16x: Introduction to WMAN/IEEE 802.16x Technology, IEEE 802.16 Wireless 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.

Suggested Readings:

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

Reference Books:

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

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M.Tech. in Digital Electronics and Communication Engineering
II Semester Syllabus
Professional Elective-III
EC211PE: Embedded Systems Design

Course Objectives

The objectives of this course are to make the student
- To provide an overview of Design Principles of Embedded System.
- To provide clear understanding about the role of firmware, operating systems in correlation with hardware systems.

Course Outcomes

At the end of this course, students will be able to
- Expected to understand the selection procedure of Processors in the Embedded domain.
- Design Procedure for Embedded Firmware.
- Expected to visualize the role of Real time Operating Systems in Embedded Systems
- Expected to evaluate the Correlation between task synchronization and latency issues

Unit - I

Introduction to Embedded Systems: Definition of Embedded System, Embedded Systems Vs General Computing Systems, History of Embedded Systems, Classification, Major Application Areas, Purpose of Embedded Systems, Characteristics and Quality Attributes of Embedded Systems.

Unit - II

Typical Embedded System: Core of the Embedded System: General Purpose and Domain Specific Processors, ASICs, PLDs, Commercial Off-The-Shelf Components (COTS), Memory: ROM, RAM, Memory according to the type of Interface, Memory Shadowing, Memory selection for Embedded Systems, Sensors and Actuators- Light Dependent Resistor, Thermistor, Photo Transistor, Light Emitting Diode, Relays, Stepper Motor. Communication Interfaces: SPI, I2C, UART, Onboard and External Communication Interfaces: WiFi, Bluetooth, ZigBee, USB

Unit - III

Other System Components of Embedded system: Reset Circuit, Brown-out Protection Circuit, Oscillator Unit, Real Time Clock, Watchdog Timer, Embedded Firmware Design Approaches: Super Loop Based Approach and OS based Approach, Development Languages: Assembly Language and High level Language

Unit - IV

RTOS Based Embedded System Design: Operating System Basics, Types of Operating Systems-GPOS, RTOS, Tasks, Task States, Task Control Block, Process and Threads, Multiprocessing and Multitasking, Task Scheduling-Non-Preemptive Scheduling (FCFS, LCFS, SJF, Priority Based), Preemptive Scheduling(FCFS, LCFS, SJF, Priority Based, Round-Robin).

Unit - V

Task Communication: Shared Memory, Message Passing, Remote Procedure Call and Sockets, Task Communication/Synchronization Issues: Racing, Deadlock, Livelock, Starvation, Task Synchronization Techniques: Mutual exclusion through busy waiting/ Spin lock, Mutual exclusion through Sleep and Wakeup, Semaphores, Device Drivers, Methods to Choose an RTOS.

Suggested Readings:

1. Shibu K.V, Introduction to Embedded Systems, Mc Graw Hill.

Reference Books:

1. Raj Kamal, Embedded Systems, TMH.
2. Frank Vahid, Tony Givargis Embedded Systems Design: A Unified Hardware/Software Introduction, John & Wiley Publications, 2002.
3. Lyla B. Das, Embedded Systems, Pearson, 2013.
4. David E. Simon, An Embedded Software Primer, Pearson Education.

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M.Tech. in Digital Electronics and Communication Engineering
II Semester Syllabus
Professional Elective – III
EC212PE: Embedded Real Time Operating Systems

Course Objectives

The objectives of this course are:
- To provide broad understanding of the requirements of Real Time Operating Systems.
- To make the student understand, applications of these Real Time features using case studies.

Course Outcomes

At the end of this course, students will be able to
- Explain real-time concepts such as preemptive multitasking, task priorities,
- Priority inversions, mutual exclusion, context switching, and synchronization, interrupt latency and response time, and semaphores.
- Describe how a real-time operating system kernel is implemented.
- Explain how tasks are managed.
- Explain how the real-time operating system implements time management.
- Discuss how tasks can communicate using semaphores, mailboxes, and queues.
- Implement a real-time system on an embedded processor.
- Work with real time operating systems like RT Linux, Vx Works, MicroC /OS-II, Tiny OS.

Unit - I

Introduction: Introduction to UNIX/LINUX, Overview of Commands, File I/O, (open, create, close, lseek, read, write), Process Control (fork, vfork, exit, wait, waitpid, exec).

Unit - II

Real Time Operating Systems: Brief History of OS, Defining RTOS, The Scheduler, Objects, Services, Characteristics of RTOS, Defining a Task, asks States and Scheduling, Task Operations, Structure, Synchronization, Communication and Concurrency. Defining Semaphores, Operations and Use, Defining Message Queue, States, Content, Storage, Operations and Use

Unit - III

Objects, Services and I/O: Pipes, Event Registers, Signals, Other Building Blocks, Component Configuration, Basic I/O Concepts, I/O Subsystem

Unit - IV

Exceptions, Interrupts and Timers: Exceptions, Interrupts, Applications, Processing of Exceptions and Spurious Interrupts, Real Time Clocks, Programmable Timers, Timer Interrupt Service Routines (ISR), Soft Timers, Operations.

Unit - V

Case Studies of RTOS: RT Linux, MicroC/OS-II, Vx Works, Embedded Linux and Tiny OS, Case Studies of programming with RTOS-Case Study of Automatic Chocolate Vending Machine using MicroC/OS-II RTOS, Case study of sending application Layer byte Streams on a TCP/IP network, Case Study of an Embedded System for a smart card.

Suggested Readings:

1. Qing Li, Real Time Concepts for Embedded Systems, Elsevier, 2011.

Reference Books:

2. Rajkamal, Embedded Systems- Architecture, Programming and Design, TMH, 2007.
3. Richard Stevens, Advanced UNIX Programming.
4. Dr. Craig Hollabaug, Embedded Linux: Hardware, Software and Interfacing.

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M.Tech. in Digital Electronics and Communication Engineering
II Semester Syllabus
Professional Elective – III
CS213PE: Embedded Networks

Course Objectives

The objectives of this course are to make the student
- To elaborate on the conceptual frame work of physical layer and topological issues of networking in Embedded Systems.
- To emphasis on issues related to guided and unguided media with specific reference to embedded device level connectivity.

Course Outcomes

At the end of this course, students will be able to
- Expected to acquire knowledge on communication protocols of connecting Embedded Systems.
- Expected to master the design level parameters of USB and CAN bus protocols.
- Understand the design issues of Ethernet in Embedded networks.
- Acquire the knowledge of wireless protocols in embedded domain.

Unit –I

Embedded Communication Protocols: Embedded Networking: Introduction – Serial/Parallel Communication – Serial communication protocols -RS232 standard – RS485 – Synchronous Serial Protocols -Serial Peripheral Interface (SPI) – Inter Integrated Circuits (I2C) – PC Parallel port programming - ISA/PCI Bus protocols – Firewire.

Unit –II

USB and CAN Bus: USB bus – Introduction – Speed Identification on the bus – USB States – USB bus communication Packets –Data flow types –Enumeration –Descriptors –PIC 18 Microcontroller USB Interface – C Programs –CAN Bus – Introduction - Frames –Bit stuffing –Types of errors – Nominal Bit Timing – PIC microcontroller CAN Interface –A simple application with CAN.

Unit –III

Ethernet Basics: Elements of a network – Inside Ethernet – Building a Network: Hardware options – Cables, Connections and network speed – Design choices: Selecting components –Ethernet Controllers –Using the internet in local and internet communications – Inside the Internet protocol.

Unit –IV

Embedded Ethernet: Exchanging messages using UDP and TCP – Serving web pages with Dynamic Data – Serving web pages that respond to user Input – Email for Embedded Systems – Using FTP – Keeping Devices and Network secure.

Unit –V

Wireless Embedded Networking: Wireless sensor networks – Introduction – Applications – Network Topology – Localization –Time Synchronization - Energy efficient MAC protocols –SMAC – Energy efficient and robust routing – Data Centric routing.

Suggested Readings:

1. Frank Vahid, Tony Givargis, Embedded Systems Design: A Unified Hardware/Software Introduction, John & Wiley Publications, 2002.
2. Jan Axelson, Parallel Port Complete: Programming, interfacing and using the PCs parallel printer port, Penram Publications, 1996.

Reference Books:

1. Dogan Ibrahim, Advanced PIC microcontroller projects in C: from USB to RTOS with the PIC18F series, Elsevier 2008.
2. Jan Axelson , Embedded Ethernet and Internet Complete, Penram publications, 2003.
3. Bhaskar Krishnamachari, Networking Wireless Sensors, Cambridge press 2005.

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M.Tech. in Digital Electronics and Communication Engineering
II Semester Syllabus
Professional Elective – IV
EC214PE: Cognitive Radio

Course Objectives

The objectives of this course are to make the student
- To provide an overview and Function of Cognitive Radios.
- To provide clear understanding about the Dynamic Spectrum Allocation, Spectrum Access and Management.
- To provide knowledge about the Spectrum Trading.
- To understand the Research Challenges in Cognitive Radio.

Course Outcomes

At the end of this course, students will be able to
- Understand the fundamental concepts of cognitive radio networks.
- Develop the cognitive radio, as well as techniques for spectrum holes detection that cognitive radio takes advantages in order to exploit it.
- Understand technologies to allow an efficient use of TVWS for radio communications based on two spectrum sharing business models/policies.
- Understand fundamental issues regarding dynamic spectrum access, the radio-resource management and trading, as well as a number of optimization techniques for better spectrum exploitation.

Unit - I

Introduction to Cognitive Radios: Digital dividend, cognitive radio (CR) architecture, functions of cognitive radio, dynamic spectrum access (DSA), components of cognitive radio, spectrum sensing, spectrum analysis and decision, potential applications of cognitive radio.

Unit - II

Spectrum Sensing: Spectrum sensing, detection of spectrum holes (TVWS), collaborative sensing, geo-location database and spectrum sharing business models (spectrum of commons, real time secondary spectrum market).

Unit - III

Optimization Techniques of Dynamic Spectrum Allocation: Linear programming, convex programming, non-linear programming, integer programming, dynamic programming, stochastic programming.

Unit - IV

Dynamic Spectrum Access and Management: Spectrum broker, cognitive radio architectures, centralized dynamic spectrum access, distributed dynamic spectrum access, learning algorithms and protocols.

Unit - V

Spectrum Trading: Introduction to spectrum trading, classification to spectrum trading, radio resource pricing, brief discussion on economics theories in DSA (utility, auction theory), and classification of auctions (single auctions, double auctions, concurrent, sequential). Research Challenges in Cognitive Radio: Network layer and transport layer issues, cross layer design for cognitive radio networks.

Suggested Readings:

1. Ekram Hossain, Dusit Niyato, Zhu Han, "Dynamic Spectrum Access and Management in Cognitive Radio Networks", Cambridge University Press, 2009.

Reference Books:

1. Kwang-Cheng Chen, Ramjee Prasad, "Cognitive radio networks", John Wiley & Sons Ltd., 2009.
2. Bruce Fette, "Cognitive radio technology", Elsevier, 2nd edition, 2009.
3. Huseyin Arslan, "Cognitive Radio, Software Defined Radio, and Adaptive Wireless Systems", Springer, 2007.
4. Francisco Rodrigo Porto Cavalcanti, Soren Andersson, "Optimizing Wireless Communication Systems" Springer, 2009.
5. Linda Doyle, "Essentials of Cognitive Radio", Cambridge University Press, 2009.

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M.Tech. in Digital Electronics and Communication Engineering
II Semester Syllabus
Professional Elective – IV
EC215PE: Pattern Recognition and Machine Learning

Course Objectives

The student will be able to understand the mathematical formulation of patterns.

- To study the various linear models.
- Understand the basic classifiers.
- Can able to distinguish different models.

Course Outcomes

On completion of this course student will be able to

- Learn the basics of pattern classes and functionality.
- Construct the various linear models.
- Understand the importance kernel methods.
- Learn the Markov and Mixed models

Unit- I

Introduction to Pattern recognition: Mathematical Formulation and Basic Functional Equation, Reduction of Dimensionality, Experiments in Pattern Classification, Backward Procedure for Both Feature Ordering- and Pattern Classification, Suboptimal Sequential Pattern Recognition, Nonparametric Design of Sequential Pattern Classifiers, Analysis of Optimal Performance and a Multiclass Generalization

Unit-II

Linear Models: Linear Basis Function Models -Maximum likelihood and least squares, Geometry of least squares , Sequential learning, Regularized least squares, Multiple outputs , The Bias-Variance Decomposition, Bayesian Linear Regression -Parameter distribution, Predictive, Equivalent, Bayesian Model Comparison, Probabilistic Generative Models-Continuous inputs , Maximum likelihood solution, Discrete features, Exponential family, Probabilistic Discriminative Models -Fixed basis functions, Logistic regression, Iterative reweighted least squares, Multiclass logistic regression, Probit regression, Canonical link functions

Unit-III

Kernel Methods: Constructing Kernels, Radial Basis Function Networks - Nadaraya-Watson model, Gaussian Processes -Linear regression revisited, Gaussian processes for regression, Learning the hyper parameters, Automatic relevance determination, Gaussian processes for classification, Laplace approximation, Connection to neural networks, Sparse Kernel Machines- Maximum Margin Classifiers, Overlapping class distributions, Relation to logistic regression, Multiclass SVMs, SVMs for regression, Computational learning theory, Relevance Vector Machines- RVM for regression, Analysis of sparsity, RVM for classification

Unit-IV

Graphical Models: Bayesian Networks, Example: Polynomial regression, Generative models, Discrete variables, Linear-Gaussian models, Conditional Independence- Three example graphs, D- separation, Markov Random Fields -Conditional independence properties, Factorization properties, Illustration: Image de-noising, Relation to directed graphs, Inference in Graphical Models- Inference on a chain, Trees, Factor graphs, The sum-product algorithm, The max-sum algorithm, Exact inference in general graphs, Loopy belief propagation, Learning the graph structure.

Unit-V

Mixture Models and EM algorithm: K-means Clustering-Image segmentation and compression, Mixtures of Gaussians-Maximum likelihood, EM for Gaussian mixtures, An Alternative View of EM- Gaussian mixtures revisited, Relation to K-means, Mixtures of Bernoulli distributions, EM for Bayesian linear regression, The EM

Algorithm in General, Combining Models- Tree-based Models, Conditional Mixture Models- Mixtures of linear regression models, Mixtures of logistic models, Mixtures of experts.

Suggested Readings:

1. K. S. Fu, Sequential methods in Pattern Recognition and Machine Learning, Academic Press, volume no.52.
2. Pattern Recognition and Machine Learning- C. Bishop-Springer, 2006.

Reference Books:

1. Richard o. Duda, Peter E. hart, David G. Stork, Pattern Classification, John Wiley& Sons, 2nd Ed., 2001.
2. Trevor Hastie, Robert Tibshirani, Jerome H. Friedman, The elements of Statistical Learning, Springer, 2nd Ed., 2009.

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M.Tech. in Digital Electronics and Communication Engineering
II Semester Syllabus
Professional Elective – IV
EC216PE: Ad-hoc and Wireless Sensor Networks

Course Objectives

The objectives of this course are to make the student
- To study the fundamentals of wireless Ad-Hoc Networks.
- To study the operation and performance of various ad-hoc wireless network protocols.
- To study the architecture and protocols of Wireless sensor networks

Course Outcomes

On completion of this course student will be able to
- Students will be able to understand the basis of Ad-hoc wireless networks.
- Students will be able to understand design, operation and the performance of MAC layer protocols of ad-hoc wireless networks.
- Students will be able to understand design, operation and the performance of routing protocol of ad-hoc wireless network.
- Students will be able to understand design, operation and the performance of transport layer protocol of ad-hoc wireless networks.
- Students will be able to understand sensor network Architecture and will be able to distinguish between protocols used in ad-hoc wireless network and wireless sensor networks.

Unit - I

Wireless LANs and PANs: Introduction, Fundamentals of WLANS, IEEE 802.11 Standards, HIPERLAN Standard, Bluetooth, Home RF.
AD HOC WIRELESS NETWORKS: Introduction, Issues in Ad Hoc Wireless Networks.

Unit - II

MAC Protocols: Introduction, Issues in Designing a MAC protocol for Ad Hoc Wireless Networks, Design goals of a MAC Protocol for Ad Hoc Wireless Networks, Classifications of MAC Protocols, Contention - Based Protocols, Contention - Based Protocols with reservation Mechanisms, Contention – Based MAC Protocols with Scheduling Mechanisms, MAC Protocols that use Directional Antennas, Other MAC Protocols.

Unit - III

Routing Protocols: Introduction, Issues in Designing a Routing Protocol for Ad Hoc Wireless Networks, Classification of Routing Protocols, Table –Driven Routing Protocols, On – Demand Routing Protocols, Hybrid Routing Protocols, Routing Protocols with Efficient Flooding Mechanisms, Hierarchical Routing Protocols, Power – Aware Routing Protocols.

Unit - IV

Transport Layer Protocols: Introduction, Issues in Designing a Transport Layer Protocol for Ad Hoc Wireless Networks, Design Goals of a Transport Layer Protocol for Ad Hoc Wireless Networks, Classification of Transport Layer Solutions, TCP Over Ad Hoc Wireless Networks, Other Transport Layer Protocol for Ad Hoc Wireless Networks.

Unit - V

Wireless Sensor Networks: Introduction, Sensor Network Architecture, Data Dissemination, Data Gathering, MAC Protocols for Sensor Networks, Location Discovery, Quality of a Sensor Network, Evolving Standards, Other Issues.

Suggested Readings:

1. Siva Ram Murthy. C and Manoj B. S, Ad Hoc Wireless Networks: Architectures and Protocols, PHI, 2004.
2. Jagannathan Sarangapani, Wireless Ad- hoc and Sensor Networks: Protocols, Performance and Control, CRC Press.

Reference Books:

1. Toh C. K, Ad-Hoc Mobile Wireless Networks: Protocols & Systems, 1st Ed. Pearson Education.
2. Raghavendra C. S and Krishna M. Sivalingam, Wireless Sensor Networks, Springer, 2004.

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M.Tech. in Digital Electronics and Communication Engineering
II Semester Syllabus
Audit Course - II
AC201HS: Constitution of India

Course Objectives

The objectives of this course are to make the student

- Understand the premises informing the twin themes of liberty and freedom from a civil rights perspective.
- To address the growth of Indian opinion regarding modern Indian intellectuals' constitutional role and entitlement to civil and economic rights as well as the emergence of nationhood in the early years of Indian nationalism.
- To address the role of socialism in India after the commencement of the Bolshevik Revolution in 1917 and its impact on the initial drafting of the Indian Constitution

Course Outcomes

On completion of this course student will be able to

- Discuss the growth of the demand for civil rights in India for the bulk of Indians before the arrival of Gandhi in Indian politics.
- Discuss the intellectual origins of the framework of argument that informed the conceptualization of social reforms leading to revolution in India.
- Discuss the circumstances surrounding the foundation of the Congress Socialist Party [CSP] under the leadership of Jawaharlal Nehru and the eventual failure of the proposal of direct elections through adult suffrage in the Indian Constitution.
- Discuss the passage of the Hindu Code Bill of 1956.

UNIT-I:

History of Making of the Indian Constitution: History Drafting Committee, (Composition & Working),
Philosophy of the Indian Constitution: Preamble**,** Salient Features.

UNIT-II:

Contours of Constitutional Rights & Duties: Fundamental Rights Right to Equality**,** Right to Freedom**,** Right against Exploitation**,** Right to Freedom of Religion**,** Cultural and Educational Rights**,** Right to Constitutional Remedies, Directive Principles of State Policy**,** Fundamental Duties.

UNIT-III:

Organs of Governance: Parliament**,** Composition**,** Qualifications and Disqualifications**,** Powers and Functions**,** Executive**,** President**,** Governor**,** Council of Ministers, Judiciary, Appointment and Transfer of Judges, Qualification, Powers and Functions.

UNIT-IV:

Local Administration: District's Administration head: Role and Importance, Municipalities: Introduction, Mayor and role of Elected Representative, CEO of Municipal Corporation. Pachayati raj: Introduction, PRI: Zila Pachayat. Elected officials and their roles, CEO Zila Pachayat: Position and role. Block level: Organizational Hierarchy (Different departments), Village level: Role of Elected and Appointed officials, Importance of grass root democracy.

UNIT-V:

Election Commission: Election Commission: Role and Functioning. Chief Election Commissioner and Election Commissioners. State Election Commission: Role and Functioning. Institute and Bodies for the welfare of SC/ST/OBC and women.

Suggested Readings/ References:

1. The Constitution of India, 1950 (Bare Act), Government Publication.
2. Dr. S. N. Busi, Dr. B. R. Ambedkar framing of Indian Constitution, 1st Edition, 2015.
3. M. P. Jain, Indian Constitution Law, 7th Edn., Lexis Nexis, 2014.
4. D.D. Basu, Introduction to the Constitution of India, Lexis Nexis, 2015.

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M.Tech. in Digital Electronics and Communication Engineering
II Semester Syllabus
Audit Course – II
AC202HS: Pedagogy Studies

Course Objectives

- Review existing evidence on the review topic to inform programme design and policy making undertaken by the DfID, other agencies and researchers.
- Identify critical evidence gaps to guide the development.

Course Outcomes

- What pedagogical practices are being used by teachers in formal and informal classrooms in developing countries?
- What is the evidence on the effectiveness of these pedagogical practices, in what conditions, and with what population of learners?
- How can teacher education (curriculum and practicum) and the school curriculum and guidance materials best support effective pedagogy?

Unit-I
Introduction and Methodology: Aims and rationale, Policy background, Conceptual framework and terminology, Theories of learning, Curriculum, Teacher education. Conceptual framework, Research questions. Overview of methodology and Searching.

Unit-II
Thematic overview: Pedagogical practices are being used by teachers in formal and informal classrooms in developing countries. Curriculum, Teacher education.

Unit-III
Evidence on the effectiveness of pedagogical practices, Methodology for the indepth stage: quality assessment of included studies. How can teacher education (curriculum and practicum) and the scho curriculum and guidance materials best support effective pedagogy? Theory of change. Strength and nature of the body of evidence for effective pedagogical practices. Pedagogic theory and pedagogical approaches. Teachers' attitudes and beliefs and Pedagogic strategies.

Unit-IV
Professional development: alignment with classroom practices and follow-up support, Peer support, Support from the head teacher and the community. Curriculum and assessment, Barriers to learning: limited resources and large class sizes.

Unit-V
Research gaps and future directions: Research design, Contexts, Pedagogy, Teacher education, Curriculum and assessment, Dissemination and research impact.

Suggested Readings:

1. Ackers J, Hardman F (2001) Classroom interaction in Kenyan primary schools, Compare, 31 (2): 245-261.
2. Agrawal M (2004) Curricular reform in schools: The importance of evaluation, Journal of Curriculum Studies, 36 (3): 361-379.
3. Alexander RJ (2001) Culture and pedagogy: International comparisons in primary education. Oxford and Boston: Blackwell.
4. Chavan M (2003) Read India: A mass scale, rapid, 'learning to read' campaign.

Reference Books:

1. Akyeampong K (2003) Teacher training in Ghana -does it count? Multi-site teacher education research project (MUSTER) country report 1. London: DFID.
2. Akyeampong K, Lussier K, Pryor J, WestbrookJ (2013) Improving teaching and learning of basic maths and reading in Africa: Does teacher preparation count? International Journal Educational Development, 33 (3): 272–282.
3. www.pratham.org/images/resource%20working%20paper%202.pdf.

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M.Tech. in Digital Electronics and Communication Engineering
II Semester Syllabus
Audit Course - II
AC203HS: Stress Management by Yoga

Course Objectives

To achieve overall health of body and mind
To overcome stress

Course Outcomes

Develop healthy mind in a healthy body thus improving social health also Improve efficiency

Unit-I
Definitions of Eight parts of yog. (Ashtanga)

Unit-II
Yam and Niyam.

Unit-III
Do's and Don't's in life.
i) Ahinsa, satya, astheya, bramhacharya and aparigraha
ii) Shaucha, santosh, tapa, swadhyay, ishwarpranidhan

Unit-IV
Asan and Pranayam

Unit-V
i) Various yoga poses and their benefits for mind & body
ii) Regularization of breathing techniques and its effects-Types of pranayam

Suggested Readings:
1. 'Yogic Asanas for Group Tarining-Part-I": Janardan Swami Yogabhyasi Mandal, Nagpur

Reference Books:
1. "Rajayoga or conquering the Internal Nature" by Swami Vivekananda, Advaita Ashrama (Publication Department), Kolkata

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M.Tech. in Computer Aided Structural Engineering
II Semester Syllabus
Audit Course-II
AC204HS: Personality Development Through Life Enlightenment Skills

Course Objectives

- To learn to achieve the highest goal happily
- To become a person with stable mind, pleasing personality and determination
- To awaken wisdom in students

Course Outcomes

- Study of Shrimad-Bhagwad-Geeta will help the student in developing his personality and achieve the highest goal in life
- The person who has studied Geeta will lead the nation and mankind to peace and prosperity
- Study of Neetishatakam will help in developing versatile personality of students

Unit-I
Neetisatakam-Holistic development of personality

- Verses-19, 20, 21, 22 (wisdom)
- Verses-29, 31, 32 (pride & heroism)
- Verses-26, 28, 63, 65 (virtue)

Unit-II
Neetisatakam-Holistic development of personality

- Verses-52, 53, 59 (dont's)
- Verses-71, 73,75,78 (do's)

Unit-III
Approach to day to day work and duties.

- Shrimad Bhagwad Geeta: Chapter 2-Verses 41, 47, 48,
- Chapter 3-Verses 13, 21, 27, 35, Chapter 6-Verses 5, 13, 17, 23, 35,
- Chapter 18-Verses 45, 46, 48.

Unit-IV
Statements of basic knowledge.

- Shrimad Bhagwad Geeta: Chapter2-Verses 56, 62, 68
- Chapter 12 -Verses 13, 14, 15, 16, 17, 18
- Personality of Role model. Shrimad Bhagwad Geeta:

Unit-V

- Chapter2-Verses 17, Chapter 3-Verses 36, 37, 42,
- Chapter 4-Verses 18, 38, 39
- Chapter18 –Verses 37, 38, 63

Suggested Readings:

1. "Srimad Bhagavad Gita" by Swami Swarupananda Advaita Ashram (Publication Department), Kolkata.
2. Bhartrihari's Three Satakam (Niti-sringar-vairagya) by P.Gopinath, Rashtriya Sanskrit Sansthanam, New Delhi.

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M.Tech. in Digital Electronics and Communication Engineering
II Semester Syllabus
EC251PC: Network Security and Cryptography Lab

Course Objectives

Students undergoing this course are expected to
- Learn fundamentals of cryptography and its application to network security.
- Understand network security threats, security services, and countermeasures.
- Acquire background on well known network security protocols such as IPSec, SSL, and WEP.
- Understand vulnerability analysis of network security.
- Acquire background on hash functions; authentication; firewalls; intrusion detection techniques.

Course Outcomes

- Understand various Cryptographic Techniques
- Apply various public key cryptography techniques
- Implement Hashing and Digital Signature techniques
- Understand the various Security Applications
- Implement system level security applications.

Note:

I. Below experiment perform using C/C++/JAVA.
II. Minimum 10 experiments must perform.

List of Experiments:

1. Write a program to perform encryption and decryption using substitution and transposition cipher.
2. Write a program to implement DES algorithm logic
3. Write a program for evaluation of AES
4. Write a program for evaluation Triple DES
5. Write a program to implement Blowfish algorithm logic
6. Write a program to implement RSA algorithm logic
7. Implement Diffie-Hellman key exchange mechanism using html
8. Write a program to implement Euclid algorithm
9. Calculate the message digest of a text using SHA-1 algorithm
10. Implement the signature scheme digital signature standard
11. Implement electronic mail security
12. Case study on web security requirement.

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M.Tech. in Digital Electronics and Communication Engineering
II Semester Syllabus
EC252PC: Advanced Communications and Networks Lab

Course Objectives

The objectives of this course are to make the student
- To acquire the knowledge in Orthogonal Frequency Division Multiplexing and Spread Spectrum Communications.
- To study the MIMO Systems.
- To study the various Wireless LANs and PANs.

Course Outcomes

At the end of this course students will be able to
- Understand the concepts of Orthogonal Frequency Division Multiplexing and Spread Spectrum Communications.
- Understand the concepts MIMO Systems
- Acquire the knowledge of different Wireless LANs and PANs.

Note: Below experiment perform using MATLAB

List of Experiments:

1. Implementation of Matched Filters.
2. Optimum receiver for the AWGN channel.
3. Design FIR (LP/HP/BP) filter using Window method.
4. Measurement of effect of Inter Symbol Interference.
5. Generation of constant envelope PSK signal wave form for different values of M.
6. Simulation of PSK system with M=4
7. Simulation of DPSK system with M=4
8. Design of FSK system
9. Simulation of correlation type demodulation for FSK signal
10. BPSK Modulation and Demodulation techniques
11. QPSK Modulation and Demodulation techniques
12. DQPSK Modulation and Demodulation techniques
13. 8-QAM Modulation and Demodulation techniques
14. DQAM Modulation and Demodulation techniques
15. Verification of Decimation and Interpolation of a given signal
16. Power spectrum estimation using AR models

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M.Tech. in Digital Electronics and Communication Engineering
III Semester Syllabus
Professional Elective-V
EC311PE: Voice and Data Networks

Course Objectives

The main objectives of the course are to:

- Acquire the computer networking knowledge as well as the existing connectivity technologies and the required infrastructure which comprises the key steps involved in the communication process.
- Identify the key issues for the realization of the LAN/WAN/MAN network architectures and the hybridized existing form in the business environment and enterprise.
- Establish a solid knowledge of the layered approach that makes design, implementation and operation of extensive networks possible. To learn the 7-layer OSI network model (each layer and its responsibilities) and understand the TCP/IP suite of protocols and the networked applications supported by it.
- Establish a solid knowledge of the layered approach that makes design, implementation, and operation of extensive networks possible.
- Acquire the knowledge of the basic protocols involved in wired/wireless communication process. These include the characteristics of the required infrastructure for Local Area Networks (MAC CSMA-CD/Ethernet, Token Ring, FDDI, and others) as well as the Wide Area Networks using the TCP/IP (visualizing TCP/IP mechanisms and variations), and UDP/IP. Additionally, the Voice over IP (VoIP) technology in the business communications world will be examined. •Link different network performance concepts and traffic issues for Quality of Service (QoS) in broadband communication as well as the network economics of the enterprise.

Course Outcomes

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

- Protocol, algorithms, trade-offs rationale.
- Routing, transport, DNS resolutions
- Network extensions and next generation architectures.

Unit - I

Network Design Issues, Network Performance Issues, Network Terminology, centralized and distributed approaches for networks design, Issues in design of voice and data networks.

Unit - II

Layered and Layer less Communication, Cross layer design of Networks, Voice Networks (wired and wireless) and Switching, Circuit Switching and Packet Switching, Statistical Multiplexing.

Unit - III

Data Networks and their Design, Link layer design- Link adaptation, Link Layer Protocols, Retransmission. Mechanisms (ARQ), Hybrid ARQ (HARQ), Go Back N, Selective Repeat protocols and their analysis.

Unit - IV

Queuing Models of Networks, Traffic Models, Little's Theorem, Markov chains, M/M/1 and other Markov systems, Multiple Access Protocols, Aloha System, Carrier Sensing, Examples of Local area networks

Unit - V

Inter-networking, Bridging, Global Internet, IP protocol and addressing, Sub netting, Classless Inter domain Routing (CIDR), IP address lookup, Routing in Internet. End to End Protocols, TCP and UDP. Congestion Control, Additive Increase/Multiplicative Decrease, Slow Start, Fast Retransmit/ Fast Recovery: Congestion avoidance, RED TCP Throughput Analysis, Quality of Service in Packet Networks. Network Calculus, Packet Scheduling Algorithms.

Suggested Readings:

1. Bertsekas. D and Gallager. R, "Data Networks", 2nd Edition, Prentice Hall, 1992.
2. Peterson .L and Davie B. S, "Computer Networks: A Systems Approach",5th Edition, Morgan Kaufman, 2011.

Reference Books:

1. Kumar, Manjunath. D and Kuri. J, "Communication Networking: An analytical approach", 1st Edition, Morgan Kaufman, 2004.
2. Walrand, "Communications Network: A First Course", 2nd Edition, McGraw Hill, 2002.
3. Leonard Kleinrock, "Queueing Systems, Volume I: Theory", 1st Edition, John Wiley and Sons, 1975.

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M.Tech. in Digital Electronics and Communication Engineering
III Semester Syllabus
Professional Elective-V
EC313PE: Deep Learning

Course Objectives

Introduce to the basic concepts of neural networks.
- Identify and analyze the various types of neural networks and models of neuron and apply accordingly.
- Introduce the concept of deep learning and its types.
- Explore the concepts of applications of deep learning.

Course Outcomes

Upon completing this course students will be able to:
- Analyze and apply the basic the concepts of neural networks
- Analyze various types of neural networks and use various activation functions to solve complex problems.
- Relate the concept of deep learning and its architecture.
- Design and carry out empirical analysis for various types of applications of deep learning systems.

Unit - I

Introduction to Neural networks: Characteristics of Neural Networks, Historical Development of Neural Networks Principles, Artificial Neural Networks: Terminology, Models of Neuron, Topology, Basic Learning Laws, Pattern Recognition Problem, Basic Functional Units, Pattern Recognition Tasks by the Functional Units: Introduction, Analysis of pattern Association Networks, Analysis of Pattern Classification Networks, Analysis of pattern storage Networks, Analysis of Pattern Mapping Networks.

Unit - II

Feedback Neural Networks: Introduction, Analysis of Linear Auto associative FF Networks, Analysis of Pattern Storage Networks, Competitive Learning Neural Networks & Complex pattern Recognition Introduction, Analysis of Pattern Clustering Networks, Analysis of Feature Mapping Networks, Associative Memory.

Unit - III

Fundamentals of Deep Learning: Defining Deep Learning, Common architectural principles of Deep Networks, Building Blocks of Deep Networks, and Major architectures of Deep Networks: Unsupervised Pre-trained Networks, Convolution Neural Networks (CNNs), Recurrent Neural Networks.

Unit - IV

Convolution Neural Networks: The convolution operation, motivation, pooling, Convolution and Pooling as an Infinitely Strong Prior, Applications of deep learning: Large scale deep learning, Computer vision, Speech Recognition, Natural Processing, other applications.

Unit - V

Sequential Modelling: Recurrent neural networks: Recursive neural networks, The long short–term Memory, explicit memory, Auto encoders: Under complete, regularized, Stochastic Encoders and Decoders, Denoising Auto encoders

Suggested Readings:

1. Yagna Narayana. B, Artificial Neural Networks, PHI.(Chapter 1,2 and 3)
2. Patterson Josh, Gibson Adam, Deep Learning: A Practitioner's Approach.
3. Bengio, Yoshua, Ian J. Goodfellow, and Aaron Courville. "Deep learning." An MIT Press book in preparation. (2015)-http://www.deeplearningbook.org/

Reference Books:

1. Simon Haykin, Neural Networks, PHI
2. Ian Good Fellow, Yoshua Bengio, Aran Courville, Deep learning (Adaptive computation & Machine learning).
3. Fausett**,** Fundamentals of Neural Networks: Architectures, Algorithms and Applications.

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Department of Electronics and Communication Engineering
III Semester Syllabus
Open Elective
EC321OE: System on Chip Architecture

Course Objectives

The objectives of this course are to make the student
- To design, optimize, and program a modern System-on-a-Chip.
- To (i) analyze a computational task, (ii) characterize its computational requirements, (iii) identify performance bottlenecks, (iv) identify, explore, and evaluate a rich design space of solutions, and (v) select and implement a design that meets engineering requirements.

Course Outcomes

By the end of the course, the students will be able to:
- Decompose the task into parallel components that cooperate to solve the problem.
- Characterize and develop real-time solutions.
- Implement both hardware and software solutions, formulate hardware/software tradeoffs, and perform hardware/software code sign.
- Understand the system on a chip from gates to application software, including on-chip memories and communication networks, I/O interfacing, RTL design of accelerators, processors, firmware and OS/infrastructure software.
- Understand and estimate key design metrics and requirements including area, latency, throughput, energy, power, predictability, and reliability.

Unit - I

Introduction to the System Approach: System Architecture, Components of the system, Hardware & Software, Processor architectures, Memory and Addressing, System level interconnection, An approach for SOC Design, System Architecture and Complexity.

Unit - II

Processors: Introduction, Processor Selection for SOC, Basic concepts in Processor Architecture, Basic concepts in Processor Micro Architecture, Basic elements in Instruction handling. Buffers: minimizing Pipeline Delays, Branches, More Robust Processors, Vector Processors and Vector Instructions extensions, VLIW Processors, Superscalar Processors.

Unit - III

Memory Design for SOC: Overview of SOC external memory, Internal Memory, Size, Scratchpads and Cache memory, Cache Organization, Cache data, Write Policies, Strategies for line replacement at miss time, Types of Cache, Split – I, and D – Caches, Multilevel Caches, Virtual to real translation, SOC Memory System, Models of Simple Processor – memory interaction.

Unit - IV

Interconnect Customization and Configuration: Inter Connect Architectures, Bus: Basic Architectures, SOC Standard Buses, Analytic Bus Models, Using the Bus model, Effects of Bus transactions and contention time. SOC Customization: An overview, Customizing Instruction Processor, Reconfiguration Technologies, Mapping design onto Reconfigurable devices, Instance- Specific design, Customizable Soft Processor, Reconfiguration - overhead analysis and trade-off analysis on reconfigurable Parallelism.

Unit - V

Application Studies / Case Studies: SOC Design approach, AES algorithms, Design and evaluation, Image compression – JPEG compression.

Suggested Readings:

1. Michael J. Flynn and Wayne Luk, Computer System Design System-on-Chip, Wiely India Pvt. Ltd.
2. Steve Furber, ARM System on Chip Architecture, Addison Wesley Professional. 2nd Eed., 2000

Reference Books:

1. Ricardo Reis, Design of System on a Chip: Devices and Components, 1st Ed.,Springer, 2004.
2. Jason Andrews, Co-Verification of Hardware and Software for ARM System on Chip Design (Embedded Technology) , Newnes, BK and CDROM
3. Prakash Rashinkar, Peter Paterson and Leena Singh L, System on Chip Verification Methodologies and Techniques, Kluwer Academic Publishers, 2001.

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Department of Electronics and Communication Engineering
III Semester Syllabus
Open Elective
EC322OE: Cognitive Radio

Course Objectives

The objectives of this course are to make the student
- To provide an overview and Function of Cognitive Radios.
- To provide clear understanding about the Dynamic Spectrum Allocation, Spectrum Access and Management.
- To provide knowledge about the Spectrum Trading.
- To understand the Research Challenges in Cognitive Radio.

Course Outcomes

At the end of this course, students will be able to Understand the fundamental concepts of cognitive radio networks.
- Develop the cognitive radio, as well as techniques for spectrum holes detection that cognitive radio takes advantages in order to exploit it.
- Understand technologies to allow an efficient use of TVWS for radio communications based on two spectrum sharing business models/policies.
- Understand fundamental issues regarding dynamic spectrum access, the radio-resource management and trading, as well as a number of optimization techniques for better spectrum exploitation.

Unit - I

Introduction to Cognitive Radios: Digital dividend, cognitive radio (CR) architecture, functions of cognitive radio, dynamic spectrum access (DSA), components of cognitive radio, spectrum sensing, spectrum analysis and decision, potential applications of cognitive radio.

Unit - II

Spectrum Sensing: Spectrum sensing, detection of spectrum holes (TVWS), collaborative sensing, geo-location database and spectrum sharing business models (spectrum of commons, real time secondary spectrum market).

Unit - III

Optimization Techniques of Dynamic Spectrum Allocation: Linear programming, convex programming, non-linear programming, integer programming, dynamic programming, stochastic programming.

Unit - IV

Dynamic Spectrum Access and Management: Spectrum broker, cognitive radio architectures, centralized dynamic spectrum access, distributed dynamic spectrum access, learning algorithms and protocols.

Unit - V

Spectrum Trading: Introduction to spectrum trading, classification to spectrum trading, radio resource pricing, brief discussion on economics theories in DSA (utility, auction theory), and classification of auctions (single auctions, double auctions, concurrent, sequential). Research Challenges in Cognitive Radio: Network layer and transport layer issues, cross layer design for cognitive radio networks.

Suggested Readings:

1. Ekram Hossain, Dusit Niyato, Zhu Han, "Dynamic Spectrum Access and Management in Cognitive Radio Networks", Cambridge University Press, 2009.

Reference Books:

1. Kwang-Cheng Chen, Ramjee Prasad, "Cognitive radio networks", John Wiley & Sons Ltd., 2009.
2. Bruce Fette, "Cognitive radio technology", Elsevier, 2nd edition, 2009.
3. Huseyin Arslan, "Cognitive Radio, Software Defined Radio, and Adaptive Wireless Systems", Springer, 2007.
4. Francisco Rodrigo Porto Cavalcanti, Soren Andersson, "Optimizing Wireless Communication Systems" Springer, 2009.
5. Linda Doyle, "Essentials of Cognitive Radio", Cambridge University Press, 2009.

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M.Tech. in Digital Electronics and Communication Engineering
III Semester Syllabus
Professional Elective-V
EC323OE: IOT and its Applications

Course Objectives

The objectives of this course are to make the student
- To study the fundamentals of IOT and M2M.
- To study the reference models of IOT.
- Study the security and privacy issues in IOT.

Course Outcomes

At the end of this course, students will be able to:
- Understand the concept of IOT and M2M
- Study IOT architecture and applications in various fields
- Study the security and privacy issues in IOT

Unit - I

IoT & Web Technology The Internet of Things Today, Time for Convergence, Towards the IoT Universe, Internet of Things Vision, IoT Strategic Research and Innovation Directions, IoT Applications, Future Internet Technologies, Infrastructure, Networks and Communication, Processes, Data Management, Security, Privacy & Trust, Device Level Energy Issues, IoT Related Standardization, Recommendations on Research Topics.

Unit - II

M2M to IoT – A Basic Perspective– Introduction, Some Definitions, M2M Value Chains, IoT Value Chains, An emerging industrial structure for IoT, The international driven global value chain and global information monopolies. M2M to IoT-An Architectural Overview– Building an architecture, Main design principles and needed capabilities, An IoT architecture outline, standards considerations.

Unit - III

IoT Architecture -State of the Art – Introduction, State of the art, Architecture Reference Model- Introduction, Reference Model and architecture, IoT reference Model, IoT Reference Architecture- Introduction, Functional View, Information View, Deployment and Operational View, Other Relevant architectural views.

Unit - IV

IoT Applications for Value Creations Introduction, IoT applications for industry: Future Factory Concepts, Brownfield IoT, Smart Objects, Smart Applications, Four Aspects in your Business to Master IoT, Value Creation from Big Data and Serialization, IoT for Retailing Industry, IoT For Oil and Gas Industry, Opinions on IoT Application and Value for Industry, Home Management, eHealth.

Unit - V

Internet of Things Privacy, Security and Governance Introduction, Overview of Governance, Privacy and Security Issues.

Suggested Readings:

1. Vijay Madisetti and Arshdeep Bahga, "Internet of Things (A Hands-on-Approach)", 1st Edition, VPT, 2014.
2. Francis daCosta, "Rethinking the Internet of Things: A Scalable Approach to Connecting Everything", 1st Edition, Apress Publications, 2013.
3. Cuno Pfister, "Getting Started with the Internet of Things", O Reilly Media, 2011.